THE GRAPHIC SIGNS OF INTROVERSION - EXTRAVERSION

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of

INTROVERSION-EXTRAVERSION

by

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CHAPTER I

Historical Survey

Experimental graphology originated in France. Michon (1806-1881), turning away from the mere impressionistic interpretations of his predecessors, collected a vast number of handwriting specimens due to the pen of well-known personages, and comparing those scripts with the character traits of the writers, he evolved his famous "theory of signs", which is still prevalent in popular books on graphology. To a definite sign corresponds a definite quality, and the absence of the sign betokens the absence of the quality.

The countless signs which thus came to be singled out were assembled in eight groups by Crépieux-Jamin, (1) the most widely known of Michon's followers. There were the groups of signs of general intelligence, of will power, of aesthetic sense, etc. All this sounds rather metaphysical, but Crépieux-Jamin handles his table of signs with such virtuosity and insight, that one is tempted to accept its theoretical implications. Both Michon and Crépieux-Jamin had limited themselves to observation and classification, never giving their data a strictly scientific statistical treatment.

Alfred Binet, in his preliminary gropings, which finally led him to the construction of his now famous test, used more scientific methods in his discussion of the claims of graphology. (2) He found that there was some truth in them, although he included no written test in his well-known battery.

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(1) Crépieux-Jamin, J. -"L'Ecriture et le Caractère". Paris. Alcan. No date.
(2) Binet, A. - "Les révélations de l'écriture d'après un contrôle scientifique". Paris, 1906.

Hull and Montgomery (1) invaded the heretofore unviolated sanctum of the graphologists with the usual array of measurements and statistical methods. After comparing a large number of works on graphology, they selected six character traits concerning which there was fair agreement in graphological literature, and which were held to be associated with features of handwriting amenable to objective measurement. Here are some of the character and handwriting traits chosen: ambition with upward sloping lines, bashfulness with lateral narrowness of m's and n's, forcefulness with heavy bars on t's. Their results were disastrous, and, published as they were in the Psychological Review, they became the stock answer of academic psychologists to whoever dared to claim for graphology an honorable status as a science. All the correlations between handwriting and character traits were found to be very low or even negative. A further study by Brown, mentioned in Hull's "Aptitude Testing" (p.149) made the case even worse for graphology. Some of her results contradicted the few significant correlations obtained by Hull and Montgomery, and none but two very much battered tendencies, viz., neatness and individuality, remained among the ruins. Had not Hull and Montgomery's conclusions fallen upon very ready ears, there might have been a further chance for graphologists to obtain a hearing. For instance, they could have pointed out, by way of criticism, that all three experimenters had worked with a very limited number of subjects (17 in the first case and 30 in the second), and they should have also referred to some more strictly experimental work reported by Crépieux-Jamin in his " Les Bases

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(1) Hull, C.L., and Montgomery, R.B., - "An Experimental Investigation of Certain Alleged Relations between Character and Handwriting". Psych. Rev., 1919,26, 63-75.

Fondamentales de la Graphologie". (1) There he abstains from any psychological interpretation of handwriting signs, but he establishes beyond a doubt that from the earliest drawing of strokes by the child to the fluent script of the adult, handwriting shows unmistakable individual differences.

In Germany, metaphysical speculations held a large place in graphological literature, but a good deal of experimental research was also carried on and published. Klages (2) laid down the fundamental theory that every writing movement is composed of three main phases - speed, expanse and pressure. Of these three, the third one was the most thoroughly studied, because Kraepelin had devised a "pressure scale" which made it possible to measure the point pressure in grams. The apparatus consisted essentially in a writing board resting on one of the plates of a scale. The other end of the lever would set a marker into motion, either mechanically or pneumatically. The marker would make a trace on a regular kymograph record, and the deviations from the base line were translated in terms of weight.

Kraepelin, Gross (3), Meumann (4), George Meyer (5), Hirt (6) and Schneickert (7), made use of the pressure scale.

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(1) Crépieux-Jamin, J. - "Les Bases Fondamentales de la Graphologie et de l'Expertise en Ecriture". Paris, 1926.
(2) See Saudek, R., - "The Psychology of Handwriting", 1925, P. 28.
(3) Gross, Adolf, - "Untersuchungen uber die Schrift Gesunder und Geisteskranken", Psych. Arbeiten, 1899,2, 450-468.
(4) Meumann, Ernst, - "Vorlesungen zur Einfuhrung in die Experimentelle Padagogik". 1922, Vol. 3, chap. 18.
(5) Meyer, Georg, - "Die wissenschaftliche Grundlagen der Graphologie". Zweite Auflage von Dr. H. Schneickert, Jena, 1925.
(6) Hirt, Eduard, - "Untersuchungen uber das Schreiben und die Schrift". Psych. Arbeiten, 1914,5, 531-664.
(7) Meyer, G., - Op. cit.

Gross limited himself to the study of very simple strokes or of small organized wholes, such as digits, m's, etc. His conclusion was that there is a greater difference between individuals in the complex than in the simpler strokes, and in pathological cases the differences due to education and skill tend to disappear.

Meumann experimented on pressure with Kraepelin's scale and on speed with Edison's electric pencil. His work on pressure was limited to separate letters. But from his observations of the process of learning how to write, he inferred the important distinction between the single impulse (einzelimpulse) of the beginners who draw a stroke at a time, and the total impulse (gesamtimpulse) of the mature writers who write a word, a line or a sentence as an organized whole.

In the first edition of his "Die wissenschaftiche Grundlagen die Graphologie", published in 1901, G. Meyer manifests a great enthusiasm for the pressure-curves as a graphometric method of classifying individuals. Experimenting with three subjects, who were required to write simple letters or digits, he found that each one of them had a very characteristic pressure-curve. "Every person has his definite curve-type", he concludes, (1). "There is surely no experiment which establishes more firmly the fact that handwriting bears an individual stamp which does not vary".

Schneickert followed the suggestion and studied the pressure curves of 1,000 subjects. He obtained one curve from each of them, and after a certain time he secured a second curve from the same subjects under the same conditions. He tried to match the samples by pairs, and found to his great dismay that the matching was impossible. "In experimenting with three subjects, the things is easy", writes Schneickert (2),

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(1) Op. cit. 2nd edition, p. 28.
(2) Ibid, p. 29.

"but with a thousand or more, it is well-nigh impossible. And so falls the value of the definite curve-type. There is no evidence of a permanent individual graphometric rhythm".

In a study published in 1914, Eduard Hurt concludes that writing pressure is not due to the psychophysical makeup of the writer, but to his graphic rhythm or to the meaning he wants to convey.

Drever (1) devised two different stylusses, one to record grip pressure, and one to record vertical pressure. He was the first to measure grip-pressure. He found that it was rhythmical, and that the amplitude of its variations diminishes with speed. In the study of vertical pressure, he neither improved on, nor corrected the findings of the German psychologists who had used the Kraepelin scale.

In America, the early experimenters in handwriting were less concerned with the graphological diagnosis of the writer's personality than with the improvement of the methods of teaching how to write. Their studies were studies of the writing movement and of its relative ease and speed. They were mass experiments, quantitative as well as qualitative. Some of them have a special bearing on graphology.

McAllister (2) made investigations to ascertain the angle of writing which enables us to write most conveniently and rapidly. The result of this experiment is demonstrated in figure I, which shows a circle divided by radii into four parts. The angles of writing inside

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(1) Drever, J. - "The Analytical Study of the Mechanism of Writing". Proceedings of the R. Soc. of Edinburgh, 1913-14, 34, 230-240.
(2) McAllister, Cloyd N., - "Researches on Movements Used in Writing". Yale Psych. Lab. Studies, 1900, 8, 21-63.

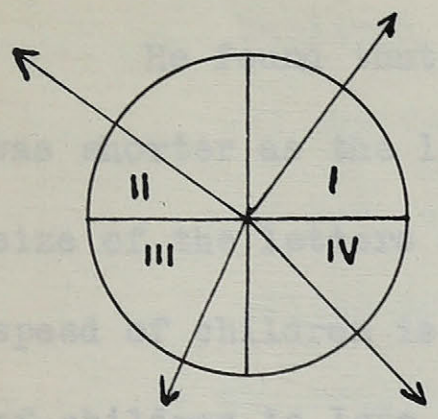

Fig. I

quadrant I are those of slant writing; in quadrant II, those of backhand writing; in quadrant III, those of the lower projections of long letters in slant writing; those of quadrant IV, the lower projections of the same letters in backhand writing.

If we regard the motion of the pen in quadrant I as normal, then the experiment shows:-

(a) - that the movements in quadrant III require 10% less time;

(b) - that the movements in quadrant II require 30% more time;

(c) - that the movements in quadrant IV require 25% more time;

The experiment also shows that finger and wrist movements are slower than full arm movements.

Freeman (1) first studied pressure and speed in simple writing movements, such as the drawing of a single vertical stroke upwards and downwards. He established that introspection is fallible in analysing writing movements. In a second study (2), he began by the following statement (which reminds us of Meumann's previous conclusions, and agrees with those of Hirt, published in the same year 1914): "Writing psychologically is not a succession of separate acts, but is an organised process in which individual elements have their place in the larger units of letters, words, or groups of words".

With a clever and complicated apparatus which recorded time, pressure, speed and direction, he studied those factors in their relations

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(1) Freeman, F.N. - "Preliminary Experiments on Writing Reactions", Mon. Supp. Psych. Rev., 1907,34, 301-333.
(2) Freeman, F.N. - "Experimental Analysis of the Writing Movement", Psych. Rev. Mon., 1914, XVII, 1 - 54.

to each other.

He found that the time in sigmas per millimeter of tracing was shorter as the letters grew larger, the correlation between the size of the letters and the speed per millimeter being r = .85 The speed of children is markedly less than that of adults. The writing of children is less broken up into distinct strokes, but it is less organised into wholes (words or groups of words).

In a third series of experiments conducted under Freeman's guidance (1), a motion picture camera was used in order to follow as accurately as possible the movements of the hand and fingers in the act of writing. The intervals between the exposures were 1/25 of a second, and by counting the number of exposures necessary to cover the drawing of a line, or a dot, the time required for this operation could be figured very accurately. Nine phenomena were found to recur constantly:-

1. In every fresh application of the pen, that is, in every fresh graphic impulse, the pen is obliged to pause before it begins the movement.
2. The speed is always less at the beginning and end of a movement than in the middle.
3. Every angle results in a pause of several 1/25's of a second.
4. Every alteration of the direction of movement results in a retardation of speed, but

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(1) Freeman, F.N., - "The Handwriting Movement", Univ. of Chicago Press.

5. This retardation is not by any means specific and habitual to the individual writer, but is conditioned by the forms of the preceding and following letters, or by the fact that the letter stands at the beginning or at the end of the word.
6. Any mechanical impediment will substantially retard the speed.
7. More time is required to make an accurate dot than for writing an accent or a comma.
8. The movement is retarded the moment the writing pressure is increased.
9. The execution of so-called covering strokes retards the movement.

Saudek (1) set himself the task of accepting none of the graphological doctrines hitherto accepted which cannot be proved either by systematic experiment, or by statistical inquiry. He made use of all the methods of psychological analysis of handwriting described above, and although there is some truth in the criticisms levelled at him in opposite directions, - in America because of his "vague speculations", in Germany because of his excessive reliance on statistics, - he seems to have taken a middle course which gives very promising results. Of his two outstanding theories, the first one concerning the standard class of a script, and the second concerning relative speed, we shall limit ourselves to his discussion of the latter.

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(1) Saudek, R., - "The Psychology of Handwriting", London, 1925.
Saudek, R., - "Experiments with Handwriting", New York, 1929.

This theory of speed and slowness is the cardinal tenet of Saudek's graphological creed. Brook's (1) very advisedly gives it the greatest importance in his popular resumé of Saudek's ponderous volumes. But others have criticized Saudek because he "does not seem to have proved that his judgments ..... actually correlate with the measured rapidity of writing.(2)"

The criticism seems unjust to us, because Saudek took pains to state explicitly that by measuring relative speed, he did not mean "that he will attempt to say how many letters the writer produces, on an average, in a minute". (3) Relative speed is not such a simple concept as speed. Without venturing to suggest a better name for it, I should think that such expressions as "fluency", "lack of inhibition", would convey the meaning better.

A rapid handwriting is one in which the normal tendency to the right is very little interfered with, either by psychological or physical factors; a slow handwriting is one in which this tendency is held in check by the same factors. A fluent hand may write fewer letters in a second than a jerky one, but its relative speed will be greater. In popular parlance we may say that "it is always on the go".

The signs of speed are primary, secondary, or equivocal. A careful perusal of the table reproduced here will show that they are nothing but a repetition of the conclusions reached by McAllister and Freeman. The primary signs are valid in 100% of cases, the secondary may vary to a

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(1) Brooks, H., - "Your character from your Handwriting". 1930.
(2) Allport & Vernon, -"Studies in Exp. Movement", p. 191 - footnote.
(3) Saudek, R., - "Experiments with Handwriting", p. 56.

great extent in the various performances of the same individual.

As to the equivocal signs, they are rather psychological interpretations of the previous ones than strictly independent features.

They are not listed here.

Primary Plus Signs (Speed)(1)	Primary Minus Signs (Slowness)
1. Smooth and unbroken strokes and rounded forms.	1. Wavering forms and broken strokes.
2. Frequent signs of "tendency to the right" all through the manuscript, alternating with "tendency to the left" at the ends of lines where the end of the sentence occurs in one of the following lines.	2. Frequent signs of "tendency to the left".
3. Great uncertainty of aim after temporary interruptions of the act of writing, that is, after syllable - or word-impulses.	3. Conspicuous certainty of aim with scarcely perceptible deviations from the intended direction of motion.
4. Increased continuity of execution; for example, the connection of diacritical signs with the following letter, the joining together of words, the joining together of numerals, in the same group of figures, etc.	4. Frequent pauses during execution recognizable by meaningless blobs, blobs due to readjustment, angles, divided letters and unrhythmical separations within the word itself (English script excepted) and "touching up" of letters.
5. Letters curtailed and degenerated almost to illegibility towards the end of words.	5. Careful execution of significant details of letter-forms and amplification of strokes towards the end of words.
6. "Primarily wide" script (especially in the case of cuneiform characters).	6. "Primarily narrow" script (especially in slanting handwriting).
7. Great difference of emphasis between upstrokes and downstrokes.	7. Hardly any difference in strength of upstrokes and downstrokes; writing produced with very little pressure, or "pasty" writing.
8. Widening of the left-hand margin as the writing proceeds.	8. Ornamental or flourishing connections.

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(1) Saudek, R., "Experiments with Handwriting", p.81.

Secondary Plus Signs (Speed) (1)	Secondary Minus Signs (Slowness)
1. (a) Increasing obliquity as compared with normal angle of school copy. (b) Increasing tendency to reversed angle (over 90 per cent.) when the school copy was vertical and to a lateral grip of the pen.	1. Downstrokes parallel almost as in school copy.
2. "Secondary wide" handwriting (especially if the script is at the same time "primarily narrow").	2. "Secondary narrow" handwriting (especially if the script is at the same time "primarily wide").
3. Rising lines with paper and pen at normal angles.	3. Sinking of the lines (well marked from the beginning of the line, not only during the course of the line).
4. Infrequent changes of angle of writing.	4. Frequent changes of angle of writing.

Saudek also classified the initial and the end adjustments according to the distribution of easy and difficult strokes in McAllister's four quadrants. A reproduction of a table of adjustments is given here (Chart I, p. 12) taken from the supplement to "Experiments in Handwriting". In the present investigation initial adjustments a, b, c, and d, in table 12 and adjustments a, b and c in table 13 were neglected, because they belong to the easiest quadrant.

Saudek's investigation in the graphic signs of dishonesty is undoubtedly his most successful attempt to conform with the recognized scientific standards of diagnosis. By dishonesty he means (2) "a lack of normal power of resistance, allied with criminal tendencies". His experimental group consisted of 141 manuscripts from as many individuals

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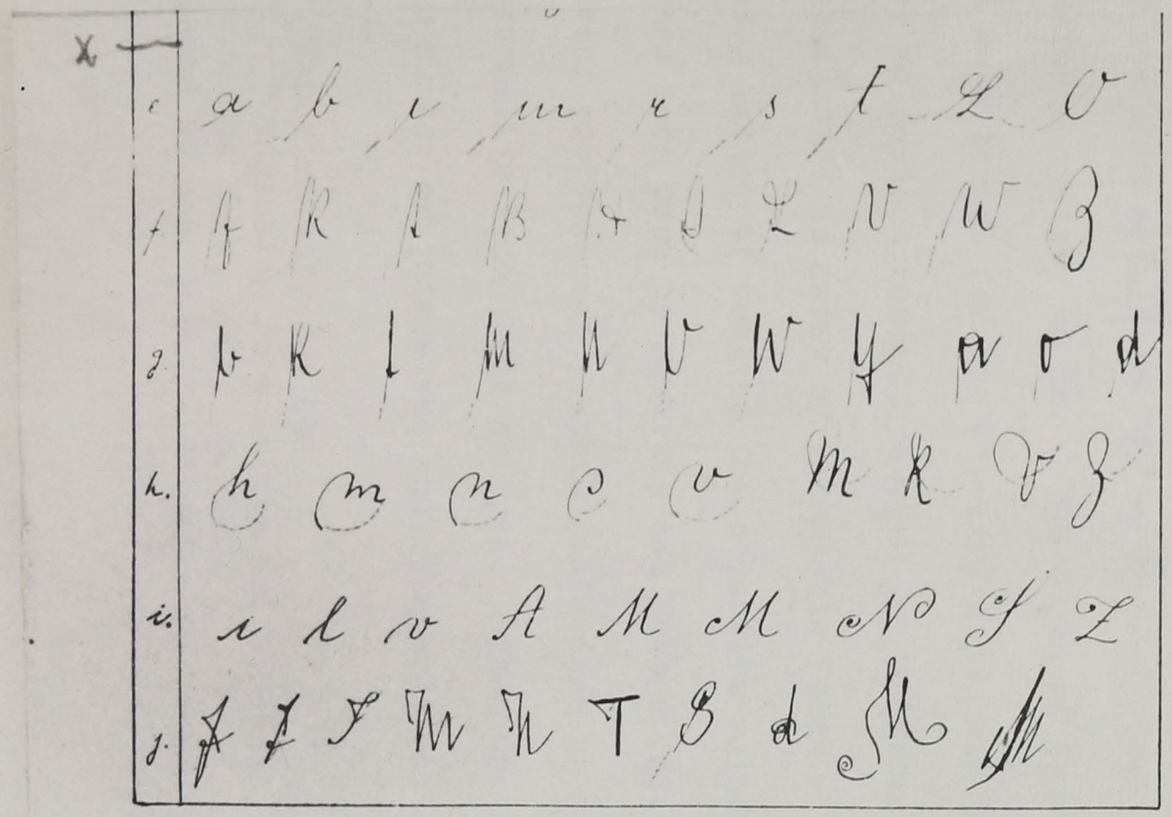
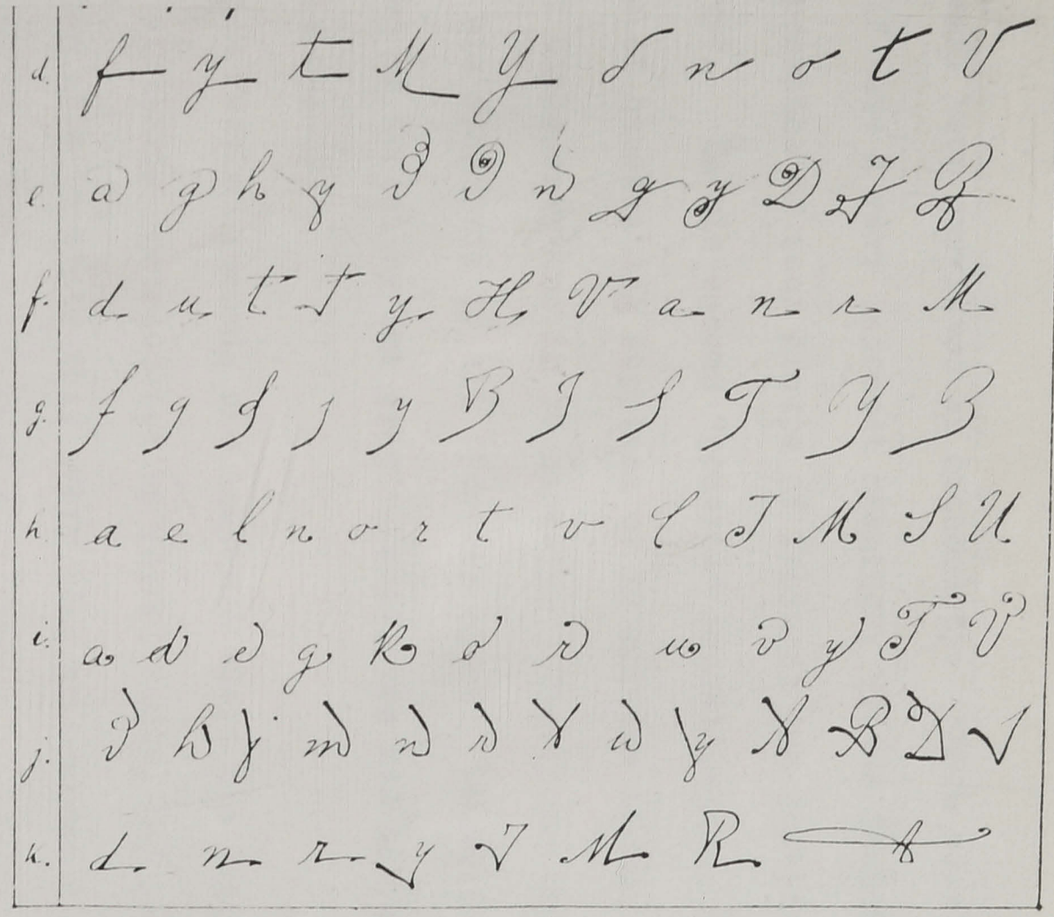
(1) Saudek, R., - Ibid, p. 107.
(2) Meloun, Jan., - "Objektive Kontrollmethoden in der Schriftpsychologie", Arch. f. d. ges. Psych., 1929, 71, p.367 foot-note.



12.

Initial Adjustments



13.

End Adjustments

Chart 1

From Saudek, R., Supplement to "Experiments in Handwriting", Chart VIII

who had already been convicted of dishonesty. "Each single feature may in itself have a very innocent meaning", writes Saudek (1), "and only the appearance of four groups of features can justify a diagnosis of dishonesty". In his second "control" investigation, Saudek studied 73 specimens of handwriting supplied by 19 British firms. In 14 cases he diagnosed dishonesty and in 59 honesty. The firms confirmed the accuracy of his diagnosis in all fourteen cases. However, out of the 59 recognized as honest by the graphologist, one had already been convicted of dishonesty.

Saudek further records one instance where his diagnosis of honesty was similarly contradicted by actual facts, but he is justly proud of being able to state that every time he branded a person as dishonest, his diagnosis was proven to be true.

That such evidence should be "quite unconvincing" (2) to certain psychologists remains a mystery to me. The logic of Saudek's argument may well be taken as a target for the die-hard objectors to the claims of graphology, but no serious research worker is justified in shoving aside as mere rubbish such an array of undeniable facts.

The matching method of testing the objective value of graphological analysis has been used by Robertag and Powers (3). It consists essentially in having professional graphologists draw up a sketch of some subjects' personality from their scripts. Then the sketches are given to a certain number of judges who know the writers. Their judgments

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(1) Saudek, R., - "Experiments", p. 280.
(2) Symonds, P.M., - "Diagnosing Personality and Conduct", The Century Co., New York, 1931, p. 526.
(3) Allport, G.W., and Vernon, P.E., - "Studies in Expressive Movement", New York, 1933 - p. 200 ff.

are tabulated and their correctness above chance is calculated. In Robertag's and Powers' investigations the matchings gave most satisfactory results, but it remains that such a technique, if amenable to an impressive statistical treatment, is nevertheless beset with numerous shortcomings and does not go beyond a mere justification of graphological methods in general. The time is past when such evidence was necessary to bring the attention of psychologists upon the possibilities of graphology. What we want now is to find out how graphology can measure a definite personality trait already rated according to accepted standards.

The late Professor Downey showed great interest in expressive movement in general and graphology in particular. Of all her observations and experiments in that field, one deserves a special mention (1) because it lines up graphology ratings alongside with standardized criteria accepted in psychological research. Twenty-three subjects answered a few questionnaires, such as Neymann-Kohlstedt Introversion-Extraversion, took intelligence, ascendance-submission, and other tests, and they gave also a sample of their handwriting to be analyzed by Dr. Downey. She then selected (on the basis of her graphological analysis), the four, five or even more subjects whom she expected to stand at the top or bottom of the rank orders for several of these measures. Here follows a list of some of the tests and scales used, together with the average rank of her choices:-

Introversion scores on the N.K. test	4.1
Extraversion " " " " "	11.0
Submission scores on the A.S.test	7.74
Ascendance " " " " "	12.4
High scores on Meier Seashore Art Judgment Test	12.4

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(1) Allport & Vernon, - op cit., p. 233.

Assuming that a mere chance agreement between the ratings and the graphologist's choice would have given 12 as rank, we may conclude that, in at least two cases - introversion and submission - the experiment had some success. But, if such a result is not without value in a preliminary investigation, it is far from being sufficient to put the graphological diagnosis of those traits on a par with the questionnaire and test scores already in use. This unsatisfactoriness of the results may explain why neither Downey nor Powers, at whose requests the matchings were made, gave a list of the graphic signs used by the analyst in her diagnosis.

For the sake of being complete, let us mention Harvey's study (1). Desirous of being impartial as regards both the claims of the graphologists and the criticisms of the psychologists, he starts afresh the whole investigation. He adopts a most complex method of measuring the length of letters, the size of angles, the spacing, etc. He calculates ratios of every description between some of his raw scores, and he throws big heaps of figures into the magic caldron of statistical witchery. His method is justly criticized by Jan Meloun (2) on the ground that it is based on the false notion that there is a special virtue in starting to measure without any previous thinking as to what is worth while measuring. In spite of that self-imposed handicap, Harvey obtained results which do not contradict the findings of Freeman and Saudek.

In their "Study of Constitutional Types", Klineberg, Ash and Block (3) quote the following passage from an article of S.G.Jislin,

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(1) Harvey, O.L., "The Measurement of Handwriting considered as a Form of Expressive Movement". Character and Personality, 1934, p.310-321.
(2) Meloun, Jan, - "Handwriting Measurements and Personality Tests", Character and Personality, 1934, 2, 322-330.
(3) Klineberg, Ash and Block, - "Study of Constitutional Types", Genetic Psych. Monog., 1934, 16, 145-221.

in "Zeitschrift fur die gesamte Neurologie and Psychiatrie", 1925, 28, 518-523. "Pyknics write a flowing hand, the letters connected, the writing straight and of medium height, the letters very similar to each other; there is similarity in the writing of most pyknics. The writing of leptosomes is usually angular, with uniform pressure, the letters often separated, the writing frequently infantile and uncertain, with many stereotyped curves and figures".

As the original article was not available to the experimenter, this quotation is merely documentary and affords no opportunity for discussion, nor for comparison with the results of the present research.

Cantril, Rand and Allport (1) made a step in the right direction when they correlated the scores obtained by psychological and graphological methods applied to the personality traits established in Vernon and Allport's "Study of Values". But there again, as in Downey's choices, the procedure followed by the graphologist remains clouded in mystery. How can another graphologist compare his results with theirs, or improve their methods, when he is left to guess what features of handwriting were taken into account, and what norms were used for their measurement?

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(1) Cantril, H., Rand, H.A., and Allport, G.W., - "The Determination of Personal Interests by Psychological and Graphological Methods". Character and Personality, 1933, 2, 134-143.

CHAPTER II

EXPERIMENTS ON WRITING PRESSURE

The curves obtained by Meumann, Meyer, Schneickert, Drever, Freeman and Hirt, gave us valuable information concerning pressure. A clear-cut difference was demonstrated between the various impulses which animate the writer according as to whether he writes a stroke, a letter, a word, or a sentence as an organized whole. The normal writing rhythm was discovered and its lack of constant correlation with mere physical strength was established. The variations in rhythm due to psychological factors were also brought into relief.

But, on the other hand, those same studies have convinced us that pressure is only one feature of handwriting. No full diagnosis of even a single personality trait has yet been sucessfully grounded on pressure alone. By singling out a constellation of signs indicating dishonesty, Saudek (1) has shown us that, instead of taking over-nice measurements of one single feature of a script, we should rather group in various patterns features which experiments have proven to be significant, recognizable and ratable to some degree. Of all these, pressure, whether exerted on the point of the pen, or on the pen holder, remains a very important one.

But the use of the scale, or of the stylus, is necessarily restricted to the laboratory. Even if some progress is made in the technique of recording pressure in such experimental settings, the problem

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(1) Saudek, R., - "Experiments with Handwriting", p. 277.

will always remain as to how we shall recognize pressure and rate it in an ordinary sample of handwriting. Saudek writes (1): "Pressure is revealed, not in the thickness of the stroke, but exclusively in the difference between up-strokes and down-strokes". Elsewhere (2) he gives as the sign of pressure "the difference in shading which exists between up-strokes and down-strokes .... when the hold of the pen is normal, and between down-strokes and lateral strokes when the lateral hold of the pen is adopted." He duly warns us that the difference between the strokes may be apparently reduced to a minimum, owing to the use of a stylograph or a non-resilient pen. But in such cases a careful inspection of the variations in the friction of the pen against the paper may disclose the pressure rhythm.

As no instance is known where these general directions have been checked up against the curves obtained with the scale or the stylus, a preliminary experiment was made where, amongst other features not directly related to the present investigation, normal pressure rhythm was studied both on the kymograph records and on the ordinary script of the subjects.

The stylus used was one devised by P.E.Vernon (3). Fig. 2, (p.19), shows it in longitudinal section, with two cross sections below.

"The solid, non-moving portion of the instrument consists of a metal tube 7/16 in. in diameter in its upper part AB, and at its extreme lower part CD, but with an intermediate narrow

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(1) "Psychology of Handwriting", p. 29.
(2) Ibid, p. 100.
(3) Vernon, P.E., - "An instrument for Recording Handwriting Pressure". British Journal of Ed. Psychology, 1934, 4, 310-316.

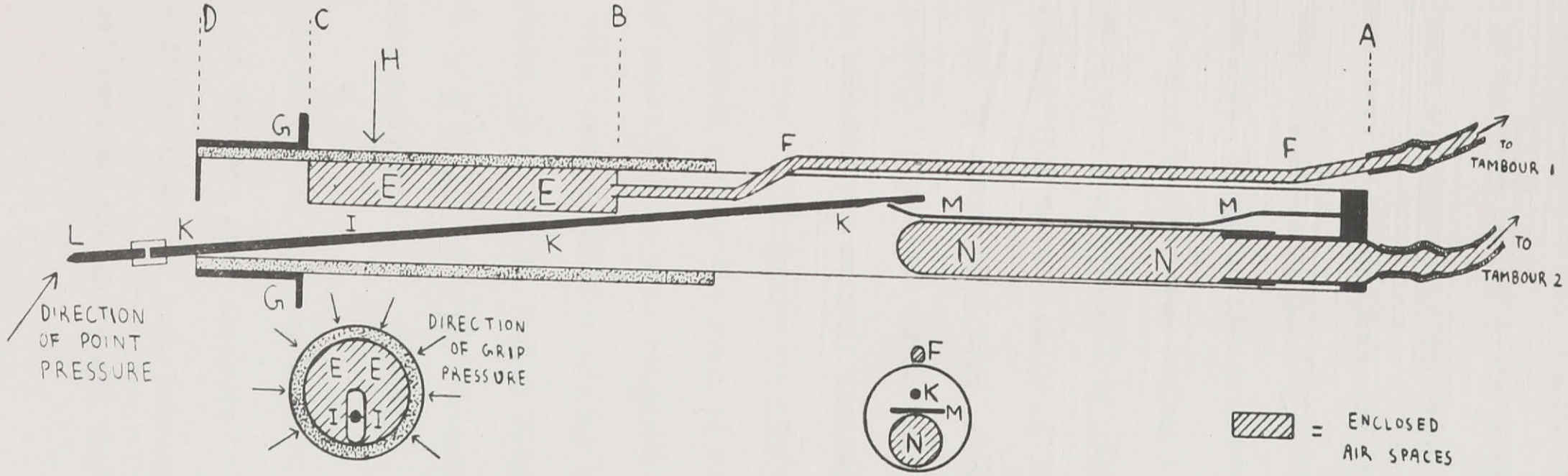


FIG. 2.

LONGITUDINAL AND CROSS SECTIONS OF STYLUS FOR RECORDING HAND-WRITING PRESSURE.

oval section BC, measuring ¼ in. by 1/8 in. A rubber tube whose inner bore is also about 7/16 in. is fixed with airtight joints just above B and below C, so that an enclosed air space EE is left outside the oval tube. This space connects through a separate narrow metal tube FF, and through flexible rubber tubing, to one of two tambours. Owing to the presence of a metal collar GG, the Subject is forced to hold the stylus with his fingers at about the point H, and the strength of his grip is therefore recorded on a smoked drum by the lever of the first tambour. The writing lead L is fixed to a long, straight rod KK (3/32 in. in diameter) which is pivoted on an axis at I within the oval tube. Thus when the Subject writes, the lead is pressed up, and the upper end of the rod moves downwards against a metal tongue or spring MM; this spring causes the lead to return to its original position when the point pressure is released. The same spring presses against a thin rubber bladder NN, of the type used in self-filling fountain pens. It is filled with air, and its upper end is connected by a metal tube, and thence by flexible rubber tubing, to the second tambour."

The tambour levers magnified the height of the tracings 23 times for the vertical pressure and 26 times for the grip-pressure. The variation in pressure was measured as the difference in ½ m.m. between the height from the base line of the highest peak on the curve and that of the lowest hollow.

There were 18 subjects in all. Each subject was first required to write with his own pen, on a sheet of unruled paper, a text of fifteen

lines dictated at a speed consistent with his normal rate of writing. This specimen was afterwards studied by the experimenter by the ordinary methods of observation available to graphologists, viz: with the naked eye or with lenses of various magnifying power, up to 5 or 6 diameters. The subject was thus given a rank in the whole group. This ranking is called ranking determined by "observed pressure". As no method is available to give such a ranking for grip-pressure, the observations recorded here below are necessarily limited to point pressure.

The subject was also required to write with the pressure pencil on a sheet of unruled paper resting on a non resilient surface - glass in this case - the following sentence: "I could write faster, but I should like to do well". The variations of the kymograph curve were measured as explained above, and the ranks determined by "measured pressure" were confronted with those of "observed pressure".

Table 1, (p.22) gives the results.

The next step was to group the specimens into three classes of "observed pressure", and choose from each class two, or more, scripts which could be used to establish a qualitative scale. The first group would include scripts of light or no pressure; the second, those of medium pressure; and the third, those of heavy pressure. By pressure we mean rhythmical pressure, or cyclical variation not easily explained by merely mechanical factors, such as unevenness of the writing surface, bad condition of the pen, and the like. Again, we are less concerned with the absolute pressure than with the range of intraindividual variation, and we are not trying to determine whether the observed variation is due to permanent factors or to transient impulses.

TABLE I

Subject No.	POINT PRESSURE Highest peak	Lowest Hollow	Diff.	GRIP PRESSURE Highest Peak	Lowest Hollow	Diff.	RANKS Measured point pressure	Observed point pressure
1	11	4	7	6	1	5	8	4
2	8	1	7	6	1	5	8	9
5	0	0	0	1	0	1	16	15
7	3	3	0	2	0	2	16	16
8	0	0	0	1	0	1	16	17
9	17	2	15	10	0	10	1	1
10	18	8	10	13	0	13	6	2
11	15	2	13	2	0	2	2	10
12	10	3	7	2	0	2	8	3
13	0	0	0	2	0	2	16	12
14	5	1	4	2	0	2	12.5	14
15	12	0	12	2	0	2	4	7
16	0	0	0	1	0	1	16	18
17	20	8	12	1	0	1	4	5
18	15	3	12	7	0	7	4	6
19	10	4	6	3	0	3	10.5	8
20	6	2	4	1	0	1	12.5	13
21	8	2	6	0	0	0	10.5	11

The rank correlation is 0.8318, which gives (1)

$r = .845$, P.E. $= \pm .048$.

(1) Garrett, H.E., "Statistics in Psychology and Education", p. 192.

Here are the signs of each group:

1. No-pressure scripts, (a) no difference in the width of the down-strokes and up-strokes, or (in the case of lateral hold of the pen) of side-strokes and down-strokes; (b) no evidence of rhythmical scratching of the paper (this cannot be determined from a photostat copy, and it requires the use of a good lens).

2. Medium pressure scripts present either one of the two following features: (a) difference in the width of down-strokes and up-strokes, or side-strokes and down-strokes, or (b) recurrent scratching of the writing surface not adscribable to physical or mechanical impediments.

3. Heavy pressure scripts present simultaneously both features described here above.

Samples of the first group are No. 16 and No. 7 in Chart 2, (24); of the second, Nos. 13, 2 and 17; of the third Nos. 1 and 9. In Chart 3, (p.25) the seven same types of handwriting are reproduced, enlarged four times. Of the 18 specimens studied, 3 were placed in the first category, 9 in the second, and 6 in the third.

They were also distributed in three groups according to the variation of pressure recorded on the kymograph. Group I included the scripts of 0 to 3 half-millimeters of difference; Group II, those of 4 to 9 half-millimeters; Group III, those of 10 half-millimeters and more, 10 to 15 in the present case. The range of the first group seems unduly short, but when one has found that a pressure 0 half-millimeters on the kymograph records may be obtained by a variety of light scripts, the range seems justifiable. This slowness of the marker to start registering above the base line may be due to an imperfection of the apparatus which might be eventually remedied. The first group of

No. 16 phenomena have of parapsychic
to the extent at least that the
is much too long for review here.

No. 7 least that the history of their studies
review here. But it is difficult to find
among them or to point to any conside

No. 13 ychologists have frequently in the past
heculiar phenomena of paraschycic
the extent at least that the history of

No. 2 uld not have acquired by the
ever, a still greater number

No. 17 to any considerable progress
standing of the nature of the
these several able psychologists

No. 1 et least that the history of
much too long for review here
cult to find much general a
them or to point to any consi
made toward an understan
given some information

No. 9 that they could not
by the recognized

No. 16 of psychologists

No. 7 psychologists

No. 13 of psychologists

No. 2 psychologists

No. 17 of psychologists

No. 1 psychologists

No. 9 psychologists

Chart 3

measured pressure included 5 cases; the second 7; and the third 6.

The number of cases is so small that it was not considered worth while to calculate the coefficient of correlation. In its place, and in order to have some measure of comparison, the following table was drawn up and the coefficient of contingency, together with the correction for broad grouping (1), was calculated. For three categories the coefficient of contingency cannot exceed .816 (2).

TABLE 2

Observed Pressure	Slight	Medium	Heavy	f y
Measured pressure in ½ m.m.				
10 - 15		2	4	6
4 - 9		5	2	7
0 - 3	3	2		5
fx	3	9	6	

$$C = .641$$

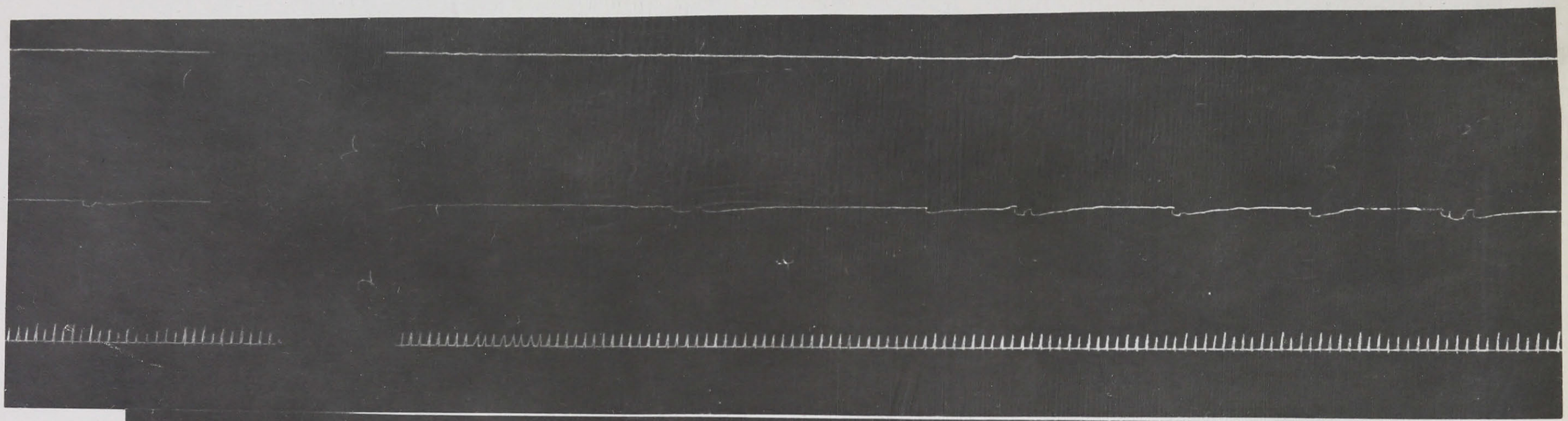
$$_cC = .8002$$

In the kymograph records reproduced in Charts 4 & 5,(p.27 & 28) the top line gives the point pressure; the middle line, the grip-pressure; the bottom line is the time-record. A mere inspection of these graphs shows that specimens No. 9 and No. 17, belonging respectively to the "heavy" and the "medium" groups of observed pressure, present curves which are

(1) Holzinger, K.J., - "Statistical Methods in Education", p. 273.

(2) Ibid, p. 277.

No. 13



No. 17

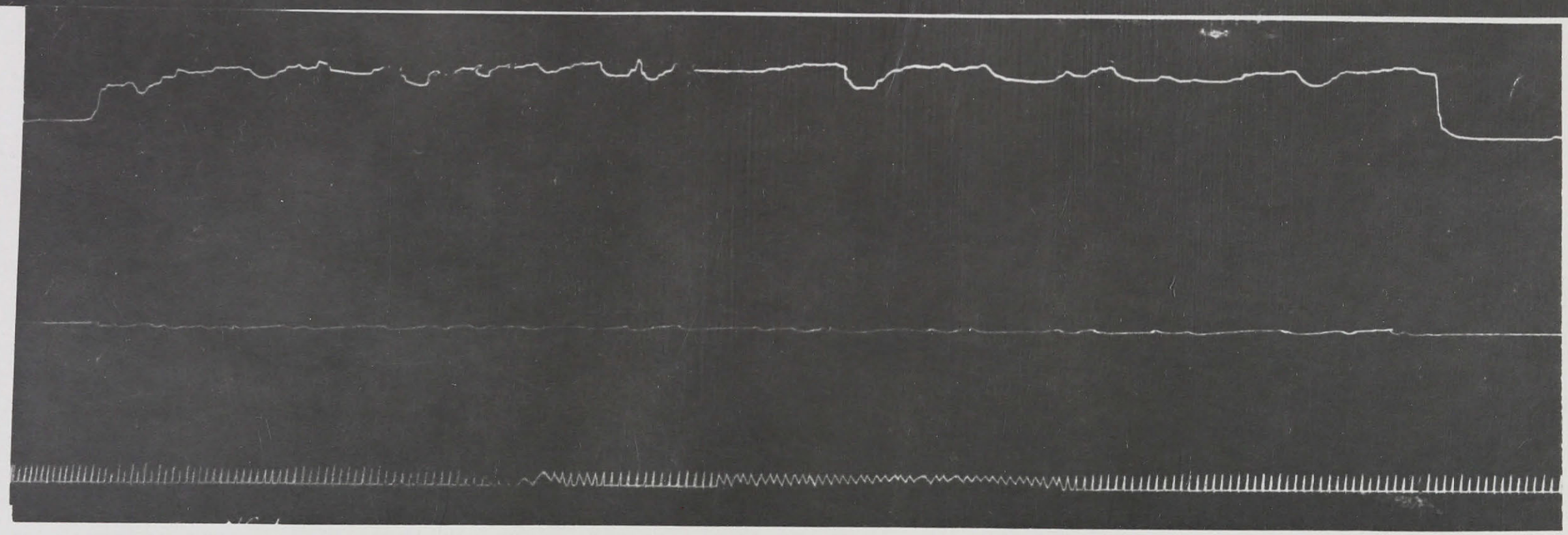
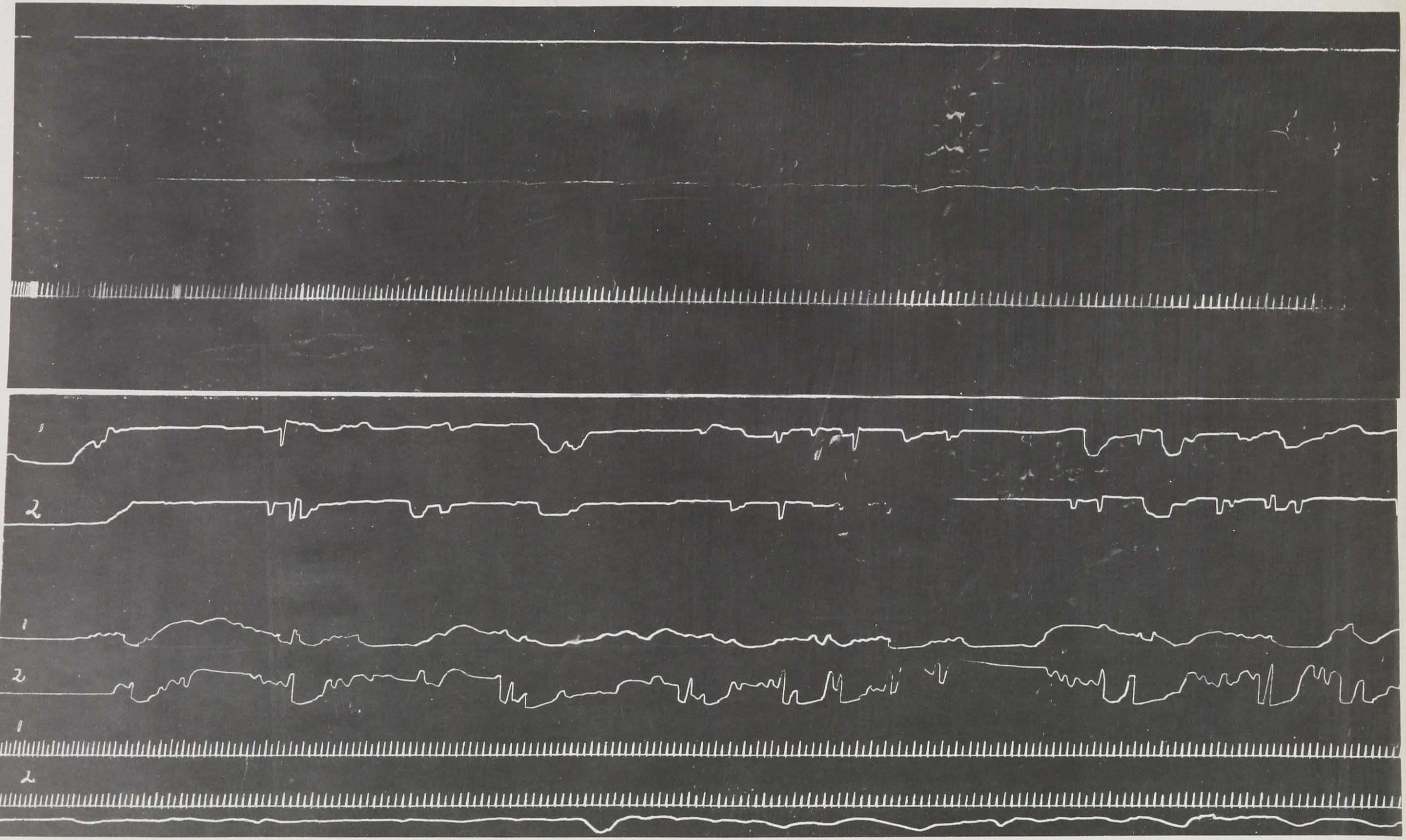


Chart 4

No. 16

Chart 5



No. 9

well characterized and easily measured. If we study the corresponding scripts in Charts 2 and 3, we see that if No. 9 can easily be recognized as a case of typical pressure, No. 17 is more puzzling.

The trained graphologist will not be misled, however. On the original copy he will detect numerous and recurrent scratchings which will mean to him the same thing as a widening of the strokes, unobtainable in this case because the pen was non-resilient.

Graphs No. 16 and No. 13 (Charts 5 and 4) present a different problem. They both show a practically even record of point-pressure. Yet the observed pressure seems to differ in a sufficient degree to warrant the placing of script No. 16 in the no-pressure, and script No.13 in the medium-pressure group. This divergence in rating undoubtedly accounts to some degree for the lack of point-to-point correlation between the two methods of valuation of pressure, and it deserves some discussion.

If we examine closely specimen No.13 in its normal size (Chart 2), we do observe variations of pressure in many instances. For example, see in the first line "h" of "have", "f" and "l" of "Frequently", "h" in "the"; in the second line, "h" in "phenomena" and "parapsychic"; in the third line, "h" in "the", "that", and "history", "l" in "least", in its enlarged reproduction, (Chart 3), "f", "y", "h", "l", "i", etc.

Now, which criterion shall we accept, the kymograph record which shows no pressure, or the enlarged copy of the script which shows noticeable variations in the width of the strokes?

It must be remembered here that the pressure pencil is responsive to one form of rhythm only, that of the flexor muscles which move the

pen from what we may call zero pressure downwards. It does not reveal anything of the rhythm of the extensor muscles which move the pen from that zero point (or mere weight of the pen) upwards. In such a case of a rhythm produced exclusively,or almost exclusively, by the extensor muscles, the pen will have a tendency to leave the paper. If it is fine-pointed and somewhat stiff, it will actually leave the paper (see the fine breaks in the loops of "l"and "g", in specimen No. 2, Chart 3. If it is broad and resilient, it will not leave the paper entirely, except when a small physical obstacle makes it jump, (see stroke between "t" and "s" in No. 13, Chart 3), and it will merely leave a lighter and thinner trace, as in "h" and "l" (No. 13, Chart 3).

That such a rhythm proves to be more exerting for the hand and requires the abuttal of some grip-pressure is evidenced in graph. No.13, Chart 4, where we see that the middle curve presents well-marked variations towards the end of the sentence. In other words, if we are looking for rhythm in the writing movement, we must not forget that it may be present in a light hand as well as in a heavy hand. And for the measurement of the former, the apparatuses already devised are still inadequate.

However, we may let the matter rest until some more refined investigation has settled the issue. And even with the lack of perfect correlation between the ratings of pressure obtained by the two methods considered here, we may conclude that for general purposes, pressure is validly measured when observed and rated according to the rules set above for the three qualitative groups. The chances of error accruing from the apparent coarseness of the method will not be very great.

Moreover, if we remember that, in the constellations of graphic signs actually used to diagnose a personality trait, pressure counts only for one among many, we shall not lament so much the loss of the too often deceiving accuracy provided by quantitative methods that have not been probed sufficiently.

CHAPTER III

EXPERIMENTS WITH DISORDERED SUBJECTS

If we go over the psychological descriptions of patients suffering from functional psychoses, we find in them personality traits which tend to group themselves into two fairly definite constellations, one having for its central unit schizophrenia, the other centering around manic-depressive insanity.

The same traits are to be found in normal people, and there they are distributed according to a normal frequency curve, irrespective of intelligence level, age, or social standing. The extreme cases in the distribution were given different names by various psychologists, but it seems that Jung's denotation of introverts and extraverts has been more generally accepted.

In the present experiment the correlation between schizophrenia and introversion, as well as between manic-depressive insanity and extraversion, was accepted as a fundamental assumption.

The experimenter was given all facilities to go over the full records of as many patients as he wanted. He observed the patients themselves for periods extending from two months up to two years. He confronted his own conclusions as to their psychological make-up with the diagnostic of the psychiatrists. Two mental hospitals gave him this opportunity to secure at leisure first-hand information about disordered subjects, the Verdun Protestant Hospital, which accommodates over 1,200 inmates, and the St. Jean de Dieu Hospital, where the patients number over 4,500. From more than 100 patients he secured samples of

handwriting. Out of them only 26 were eventually used for the present investigation, because only they were found to measure up to the requirements, namely: (a) completeness of personal history, (b) sufficient period of observation in the hospital, (c) perfect agreement between the psychologist and the psychiatrist as regards their constitutional type, (d) spontaneity (inasmuch as we may speak of such a thing with certain patients) in the writing of the specimen to be used in the investigation. Special care was also taken to include scripts which presented much similarity at first inspection, but were, nevertheless, due to the pen of subjects belonging to contrasting groups.

Here are two case histories taken at random in the collection, and considerably abbreviated.

No. 4 R.T. Male, 29 years (1935). Father alcoholic. Education: school progress poor, reached 6th grade at 16 years. Obstinate, ill-tempered, and stubborn as a child. First commitment at 21 years (July 1927). The trouble had been in progress ever since he had left school. Delusions: Patient claims he has neither miction nor defecation. Emotionally rigid. Discharged on Dec. 31st, 1928. Readmitted in a state of agitation on July 1st, 1932. Manifests auditory hallucinations, ideas of guilt and of persecution. Becomes quiet after two weeks and assumes the behaviour of the typical schizophrenic "lifer". Specimen given in January, 1935.

No. 20 A.F. Male, 29 years (1935). Family history: Aunt and cousin have been mental cases for years. Little schooling and low I.Q. First attack at 19 years. Symptoms: patient was confused, presented delusions of persecution, was destructive and threatened his mother. One month after admission he became agitated and very restless, had flight of ideas and was over-elated. Was let out on trial three times and eventually discharged after two years of treatment. Was readmitted within less than a month. Since then he has been in and out on trial, sometimes coming back of himself when he feels a relapse is impending, sometimes having to be coaxed back. The length of his trials has varied from one to eight months. When well he is perfectly conscious of his sad condition, but he does not worry about it. The specimen was taken during a period of

> remission (May, 1934), a few weeks after a stay in the cell. The handwriting lacks fluency because of physical impediments: the patient had hurt his thumb and little finger a few days before, and his hand was rather stiff. Diagnostic: manic-depressive.

The specimens of handwriting were studied as to their showing the signs of relative speed or slowness, and the initial and final adjustments demonstrated in Saudek's works. The purpose of the investigation was to find out whether, and to what extent, schizophrenic and manic-depressive patients could be differentiated by the presence of those signs.

Chart 6 (p.35) gives the results in detail.

The first column contains the serial number of the patient and his initials. On each row are marked by an X the graphic features present in his handwriting. When the graphic feature is very prominent, two X's are entered in the cell, (for instance, subject 10, Primary Slowness 4; Subject 17, Final adjustment "d"). Chart 7 (p.36) and 8 (p.37) reproduce in slightly reduced size a short sample of the script of every subject. Some of the graphic signs listed above (p. 10 and 11) may not be noticeable in these samples, but they are to be found elsewhere in the specimens obtained from the subject.

A mere glance at Chart 6 shows that the handwriting of schizophrenic patients manifests more signs of primary slowness and more initial adjustments. The manic-depressive subjects write faster, on the whole, but their greater speed is better manifested in the signs of secondary than of primary speed. Of all the adjustments, final "d"

Chart 6

Subjects.	Speed (Primary)								Slowness (Primary)								Speed (Secondary)				Slowness (Secondary)				Initial Adjustments						Final Adjustments.							
Schizos.:	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	1	2	3	4	e	f	g	h	i	j	d	e	f	g	h	i	j	k
No. 1. H.N.									X		X	X	X	X	X			X			X	X			X			X	X										
No. 2. L.F.			X		X	X			X	X		X	X		X			X						X	X			X		X		X						
No. 3. F.K.L.			X				X		X		X	X	X				X								X				X			X						
No. 4. R.T.									X		X	X	X	X										X	X				X									
No. 5. H.R.							X		X		X	X	X											X		X	X	X										
No. 6. H.S.									X		X	X	X	X	X						X			X	X				X	X	X			X				
No. 7. R.de L.C.			X						X		X	X	X		X									X				X	X					X	X			
No. 8. A.L.									X		X	X	X	X	X		X				X							X	X		X	X			X			
No. 9. N.R.									X		X	X	X		X													X	X		X	X						
No. 10. A.B.			X			X			X	X		X	X		X									X					X			X						
No. 11. J.A.		X	X				X		X		X	X	X												X				X									
No. 12. E.H.	X		X							X	X		X	X							X				X			X				X						
No. 13. A.R.	X									X	X		X	X											X				X	X		X						
No. 14. R.C.									X	X	X	X			X		X												X	X		X						
No. 15. B.P.			X						X	X		X	X				X											X	X	X		X	X					
No. 16. M.L.		X			X				X		X	X	X	X	X		X								X	X		X	X	X								
Man.-Dep.:																																						
No. 17. Y.D.	X		X				X					X	X				X		X	X	X				X					X	X							
No. 18. M.G.	X		X		X							X	X	X			X	X	X	X				X	X				X		X	X						
No. 19. D.F.P.	X		X								X		X				X	X							X					X								
No. 20. A.F.	X	X				X	X										X			X									X									
No. 21. R.L.		X	X		X	X			X			X	X	X	X		X	X	X						X													
No. 22. M.A.G.		X	X			X			X			X	X																X									
No. 23. R. Lac.	X	X	X		X	X						X					X	X		X																		
No. 24. A.G.D.	X	X	X			X						X	X	X	X			X																					
No. 25. M.L.	X		X	X	X					X			X		X		X	X		X									X									
No. 26. J.N.	X	X	X		X	X		X					X		X				X	X										X								

1. ction materials, when
be made of unbleached
thumb & forefingers aff-
directions of line, not
writing. In this position
2.

and other secondary
ith small sticks or
ther color. The block
3. nly, and it is printed

The drawings should
I The blocking in and
2. a finished drawin
4.

unbleached muslin,
and when gingham and
5. unexpected wash, we

Please examine this hand
6. possible and report to Doctor

J'écris quelques lignes po
7 hopital St Jean de Dieu
année Les pommes qui
pas aussi bonnes que ce
9 achetées

j'ai une demande en grâce de
lay moi immédiatement. Je
très reconnaissante si vous m'ac-
8
Obligez, en plus, moi
la famille Royale Englai
10 dont j'ai droit. Entén

faire désespéré et j'en
Confiante en votre esprit
13 solidaire pour demeure

The rabbi is not always
רבי לא תמיד
Table — שלחן
11 book — ספר

religieuses
14a

guerrier
14c

religieuses
14b

Marguerite
16c

Don't you know seven
despise myself this
way. Must be
12 forced to carry such

Marguerite
16a

La rendonnée que j'ai demandée
les amis mis de votre Seigneur
15 b

Chart 7. Handwriting specimens of schizophrenic patients slightly reduced.

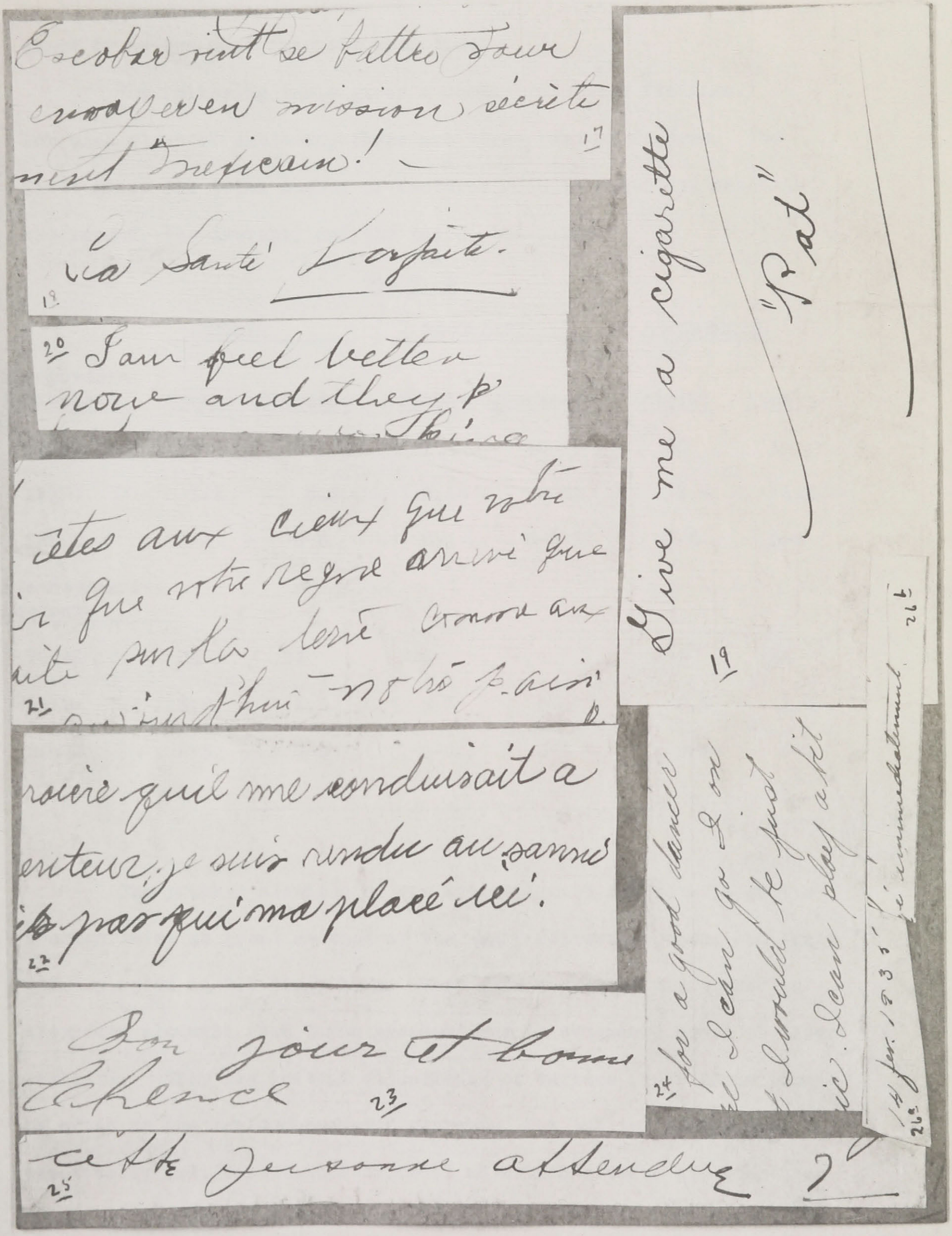


Chart 8. Handwriting specimens of manic-depressive patients. Actual size.

seems to be the most frequent with them.

The following table gives a summary of these findings. For each class of subjects, there are three rows of figures. The first gives the total number of features grouped under six headings; the second, the average; and the third, the range.

TABLE 3

	PRIMARY		SECONDARY		ADJUSTMENTS	
Schizophrenic Patients	Speed	Slowness	Speed	Slowness	Initial	Final
TOTAL	18	83	7	12	38	18
AVER.	1.1	5.2	0.44	0.75	2.4	1.1
RANGE	0-3	4-6	0-1	0-2	1-3	0-3
Manic-depressive Patients						
TOTAL	38	26	23	1	8	14
AVER.	3.8	2.6	2.3	0.1	0.8	1.4
RANGE	2-6	0-5	0-4	0-1	0-2	0-4

The primary slowness of the schizophrenic subjects is on the average twice as great as that of the manic-depressive ones, and their primary speed is 3.5 times less. They show a greater difference in secondary slowness (7.5 times greater) and in secondary speed (5 times smaller). They use initial adjustments of various kinds three times as often as the manic-depressive patients, but the two groups are practically indifferentiated by final adjustments taken all together.

If we consider the overlapping in the range, we see that no single group of graphic features is sufficient to differentiate a schizophrenic from a manic-depressive. The number of subjects being insufficient to warrant the drawing of percentile curves, we may content ourselves with the tables of accumulated frequencies for each group of graphic features (see page 40) The first column gives the number of signs of each group found in a single specimen; the second and the third, the number of schizophrenic or manic-depressive subjects who have that many signs or more.

Looking over the tables, one sees that all groups of signs overlap. Therefore, none of them is a valid criterion to differentiate schizophrenia from manic-depressive insanity. Primary slowness (see table 7, p.40) shows so little overlapping, only three schizophrenic and two manic-depressive subjects having equally 4 signs, that one may be tempted to consider this feature as a valid criterion. But we must remember that, according to our basic assumption, the two mental disorders under study are taken as extremes in the distribution of introversion and extraversion. If these extremes cannot be set farther apart, we must conclude either that our assumption is false or that the graphic signs chosen are not significant.

Saudek follows a slightly different procedure (1). He gives a positive value to each sign of speed (primary or secondary) and a negative value to each sign of slowness. The algebraic sum of the signs discovered in a specimen determines whether it must be classed as fast or slow. On the other hand, he does not give a double weight to any

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(1) "Experiments with Handwriting", p. 108 ff.

Table 4

Primary Speed.		
No. of signs	Schizo.	M.-D.
6		1
5		2
4		6
3	2	9
2	6	10
1	10	
0	16	

Table 5

Secondary Speed.		
No. of Signs	Schizo.	M.-D.
4		1
3		5
2		8
1	7	9
0	16	10

Table 6

Initial Adjustments.		
No. of signs	Schizo.	M.-D.
3	6	
2	15	1
1	16	7
0		10

Table 7

Primary Slowness.		
No. of Signs	Schizo.	M.-D.
6	6	
5	13	
4	16	2
3		4
2		8
1		9
0		10

Table 8

Secondary Slowness.		
No. of Signs	Schizo.	M.-D.
2	3	
1	10	1
0	16	10

Table 9

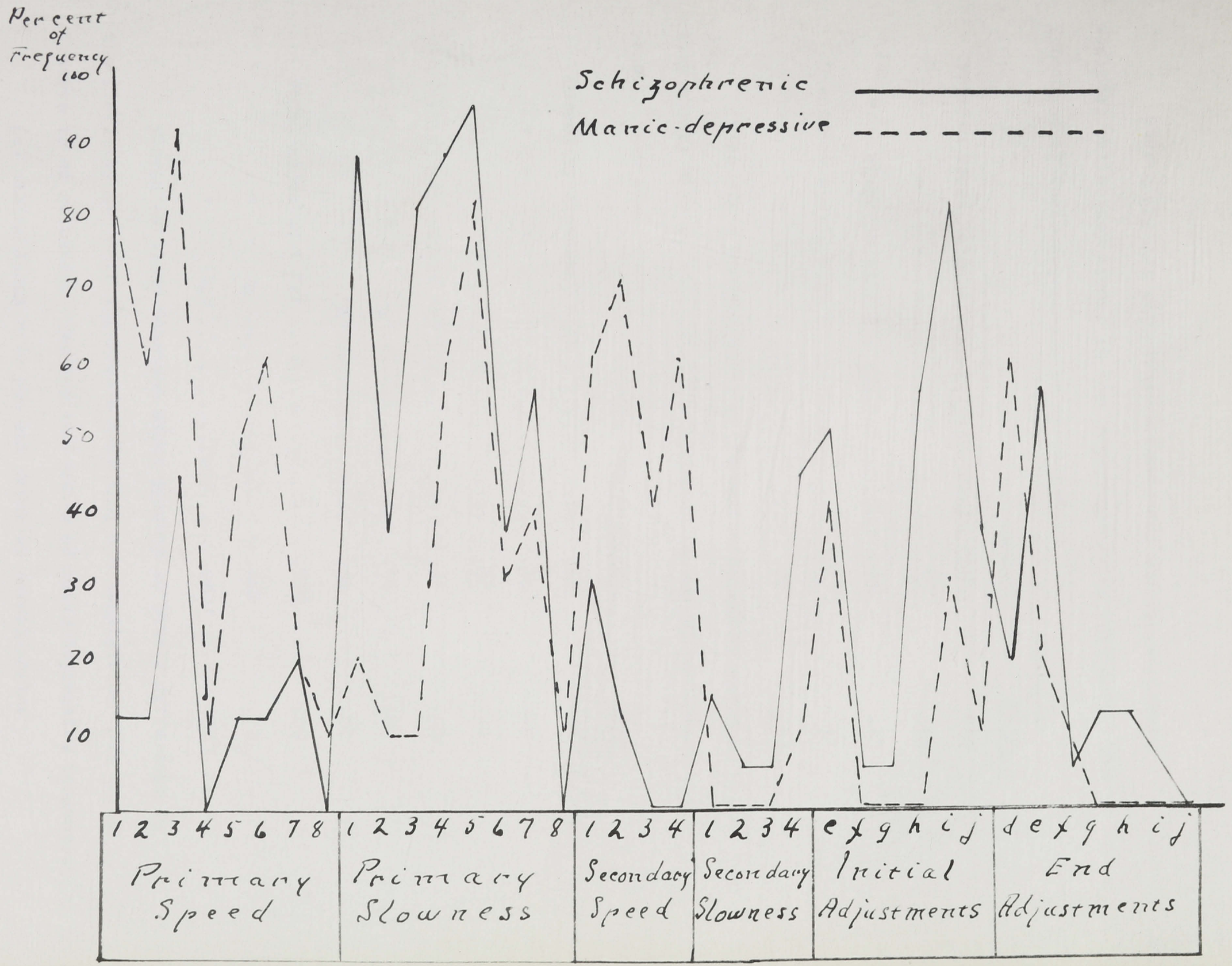
Final Adjustments.		
No. of signs	Schizo.	M.-D.
4		1
3	1	2
2	6	5
1	11	6
0	16	10

any sign, as we have done here in four instances (see Chart 6,p.35 , specimens 4, 10, and 15).

Let us follow the same procedure, doing away with weights and lumping together all signs of primary and secondary speed or slowness. The results are somewhat more encouraging. The schizophrenic have an average score of - 4.25, and the manic-depressive have one of + 3.7. The range of the first group is from -1 to -8, that of the second is from 0 to +7. There is no overlapping, it is true. Relative speed or slowness is definitely a distinguishing feature of schizophrenic or manic-depressive handwriting. But the cases under study form a highly selected group, and the ranges, if they do not overlap, are still too closely adjacent to warrant the use of speed and slowness as the only criterion in diagnosing either psychosis in an unselected group of disordered subjects. In diagnosing introversion and extraversion from the scripts of an unselected group of normal individuals, it is even less reasonable to content oneself with such an inadequate sign.

The next step was to study each sign separately and find out which one, if any, was a valid indication of the psychoses. To render comparison possible, the frequency of the appearance of each sign was expressed in percentages. For instance, sign 1 of primary speed appearing on two schizophrenic specimens, it was rated .125 (2/16); sign 2 was also rated .125; sign 3, .44, etc. Two curves were drawn (Chart 9, p.42) on coordinates where y was the percentage of the frequencies of the signs for either group, and x was the actual list of the signs themselves, (speed, slowness, adjustments).

Chart 6


Percent of Frequency
100
90
80
70
60
50
40
30
20
10
Schizophrenic
Manic-depressive
1 2 3 4 5 6 7 8
Primary Speed
1 2 3 4 5 6 7 8
Primary Slowness
1 2 3 4
Secondary Speed
1 2 3 4
Secondary Slowness
e f g h i j
Initial Adjustments
d e f g h i j
End Adjustments

Five signs are altogether absent from the schizophrenic scripts, while they appear in the manic-depressive specimens. The frequency of their appearance is as follows:

	Schizo.	M.-D.
Primary speed, sign 4	.00	.10
" " " 8	.00	.10
" slowness sign 8	.00	.10
Secondary speed, sign 3	.00	.40
" " " 4	.00	.60

Nine signs are absent from the manic-depressive scripts, while they appear with various rates of frequency in the schizophrenic specimens. They are:

	Schizo.	M.-D.
Secondary slowness, sign 1	.19	.00
" " " 2	.06	.00
" " " 3	.06	.00
Initial adjustment "f"	.06	.00
" " "g"	.06	.00
" " "h"	.56	.00
Final adjustment "g"	.125	.00
" " "h"	.125	.00
" " "i"	.06	.00

Eleven of these fourteen signs present so little difference in the frequency of their appearance that they are negligible. But three deserve to be retained. Two are indicative of manic-depressive tendencies:

(a) rising lines with pen and paper at normal angles (secondary speed 3);

(b) infrequent changes of angle of writing

(secondary speed 4);

One is indicative of schizoid dispositions:

(c) initial adjustment "h", (see Chart 1, p.12).

It belongs to McAllister's most difficult quadrants (II and IV, see above, p. 6).

Two signs of primary speed (nos. 1 and 3) are also significant if we contrast them with their opposite signs of slowness. The first, - smooth and unbroken strokes, and rounded forms vs. wavering forms and broken strokes, - is more likely to be a pathological sign. It reveals the shortness of the writing impulse of the patient, and I am not ready to accept it as an indication of a constitutional difference. The other, - great uncertainty of aim after temporary interruptions vs. conspicuous certainty of aim in crossing the "t's" and dotting the "i's" may likewise be due to the shortness of the impulse. It remains to find out whether these two features appear in their original or in a slightly modified form in the handwriting of normal introverts or extraverts. In our study of the handwriting of children, (Chapter 6), we shall come back to the first of these two signs, and we shall see that, in such cases of immaturity of handwriting, it has some value.

Before leaving this group of subjects, we must finally look at the curves of Chart 9, (p.42) and notice that these stand apart for the whole length of each group of graphic features, with the only exception of final adjustments. There they cross twice, once very markedly at sign "d", and once, less noticeably, at sign "f". We may take it as an indication that, on the whole, these groups of signs, taken from Saudek's works, are somewhat correlated with the two psychoses under

study, and may also be correlated with the two corresponding psychological type-patterns, introversion and extraversion. Four individual signs stand out in greater prominence as indication of either constitutional make-up. They are: secondary speed 3 and 4, initial adjustment "h", and final adjustment "d". This last one is chosen because of the abrupt and very noticeable crossing of the curves at this point. It consists in club-shaped letter-endings, long "t" bars and paragraphs, (see Chart 1, p. 12)

Conclusions

1. Primary speed and primary slowness are kept as signs of schizoid and cycloid tendencies, and of normal introversion and extraversion.

2. Signs of secondary speed or slowness are not retained as a group, but signs 3 and 4 are taken spearately and accepted also, in their actual or in a slightly modified form, as signs of the same tendencies.

3. Initial adjustments made of extra strokes belonging to McAllister's second and fourth quadrants are indicative of schizoid tendencies.

4. Final adjustments "d", described here above, are indicative of cycloid tendencies.

5. In some cases of graphic immaturity due to illness, illiteracy, or age, signs 1 and 3 of primary speed or slowness deserve further study.

6. None of the signs retained are, taken separately, valid criteria of the presence, or absence, of the constitutional tendencies under consideration.

7. If, according to the fundamental assumption accepted here as a working basis, schizophrenia and manic-depressive insanity are at the extreme ends of a continuum on which are distributed according to the Gaussian curve the frequencies of various degrees of introversion - extraversion in the normal population, we ought to find in the handwriting of normal introverts and extraverts a few more graphic signs which, combined with those already accepted, should definitely set apart the two highly selected groups of disordered subjects whose scripts have been the subject-matter of the present investigation.

N.B. When we have finished our study of the handwriting of normal introverts and extraverts, we shall revert to the present group, and we shall see that this last desideratum has been carried out.

CHAPTER IV

EXPERIMENTS WITH NORMAL SUBJECTS

Our next investigation deals with normal subjects. In order to rate them as regards introversion and extraversion, we requested them to answer two questionnaires, the Neymann-Kohlstedt and the Menzies-Webster. The first one is well known. The second is reproduced in the appendix. It contains 38 questions, 19 intended to measure what the senior author of the test has called "magnification of self", and 19 measuring introversion-extraversion. The answers are distributed on a four-point scale, and weighted according to a key prepared by one of the originators, M.C.Webster. The genesis of the test and its validity were discussed in a previous dissertation. (1)

First experimental group. The subjects were 142 students taking the first course in Psychology at McGill University. There were 63 females and 79 males, of age ranging from 17 to 30 years (mean average = 19.73). The specimen of handwriting they gave for the investigation was a short letter written to the experimenter. It was written in ink, with the subject's own pen, on unruled paper, uniform in size and quality for all subjects. Mention was made by the writer of the width of the pen-point (broad, medium, fine), and of the flexibility of the pen.

As a further illustration of their graphism, the subjects wrote under dictation the following sentence: "Psychology has been defined as

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(1) Bois, J.S.A., "Some objective aspects of temperament", 1934, McGill University Library, p. 49-51.

the science of human behaviour". Then they were told to rewrite it, changing every vowel for its predecessor in the usual list, a, e, i, o, u; that is: writing "a" instead of "e", "e" instead of "i", and so on, and "u" instead of "a". The vowels were written on the blackboard in their normal sequence, with full directions as to the change to be made. The subjects were allowed to write the list of vowels on their copy and refer to it in order to avoid mistakes, but they were directed not to practice the new spelling before writing down the garbled sentence. This procedure was called "writing in a state of graphic conflict".

On both the Neymann-Kohlstedt and the Menzies-Webster questionnaires the scores usually range from a negative value to a positive one. In the first case a negative score means introversion, in the second it means extraversion. In the results given here, the negative scores were done away with. A constant number was added to the raw scores (22 for the M-W test and 20 for the N-K). The range of the first became 0-39, from extraversion to introversion; that of the second, 0-49, from introversion to extraversion.

The results (from extraversion to introversion in both cases) are given in table 10.

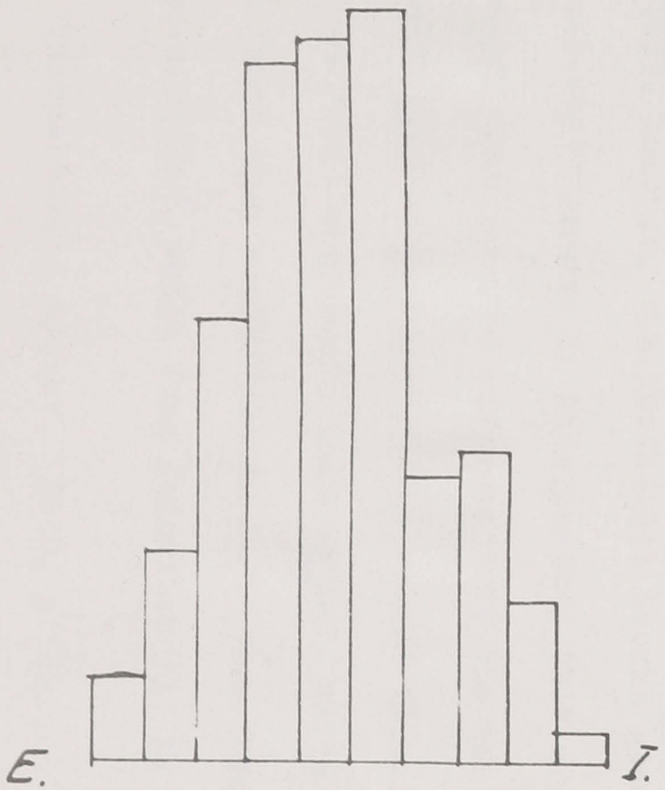
TABLE 10 (142 cases)

Menzies-Webster Test		Neymann-Kohlstedt Test	
SCORES	FREQUENCIES	SCORES	FREQUENCIES
0 - 3	3	49 - 45	1
4 - 7	8	44 - 40	10
8 - 11	17	39 - 35	10
12 - 15	27	34 - 30	12
16 - 19	28	29 - 25	15
20 - 23	29	24 - 20	30
24 - 27	11	19 - 15	27
28 - 31	12	14 - 10	20
32 - 35	6	9 - 5	11
36 - 39	1	4 - 0	6
Mean = 17.9 ± 0.37		Mean = 21.73 ± 0.61	
S.D. = 6.6 ± 0.26		S.D. = 10.8 ± 0.43	

A simple inspection of the histograms No. 1 and No. 3 on Chart 10, (p.50), reveals that the scores on the Menzies-Webster questionnaire assume a much more regular distribution than those on the Neymann-Kohlstedt. If in the former, the skewness is slightly positive, it is decidedly negative in the latter. In other words, the first one tends to group the subjects on the extraversion side, while the second groups them on the introversion side in a marked degree. The total range on the Menzies-Webster is 6 times the standard deviation; in the Neymann-

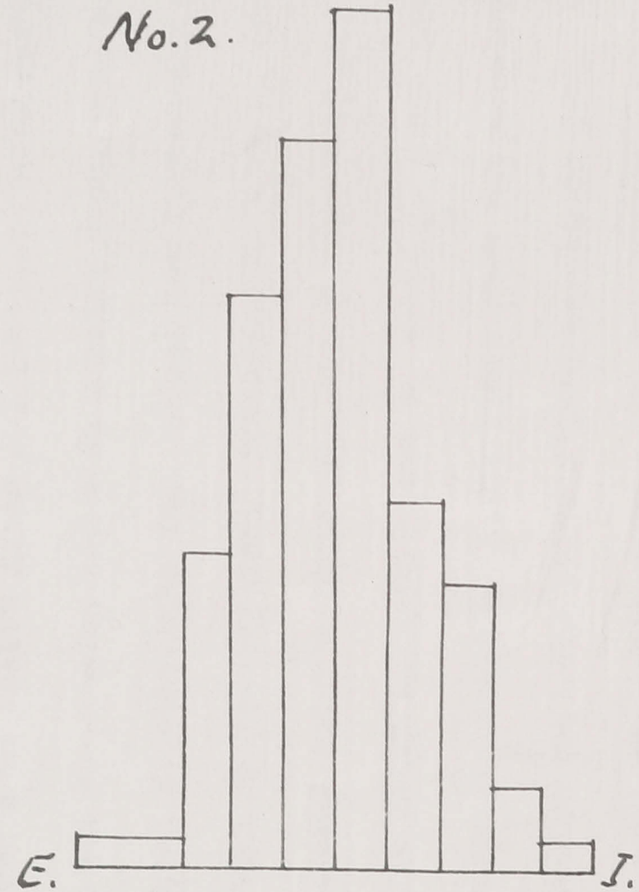
Chart 10

No. 1.



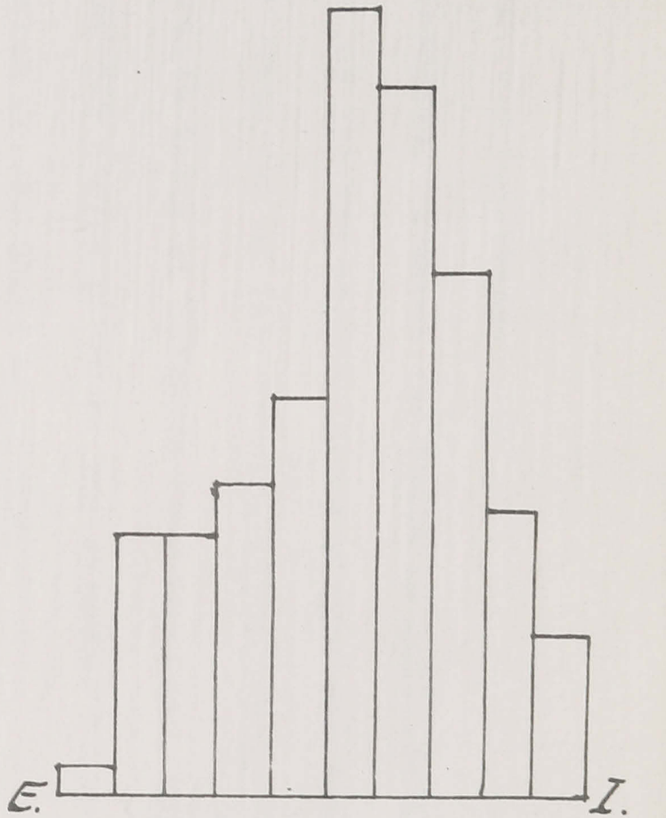
Menzies-Webster Test.
142 cases.
Range: 0 - 39.
Mean: 17.9 ± .37
S.D. : 6.6 ± .26

No. 2.



Average Scores, $\frac{X_{MW} + X_{NK}}{2}$.
126 cases.
Range: 1 - 50.
Mean: 25.30 ± .382
S.D. : 6.35 ± .270

No. 3.



Neymann-Kohlstedt Test.
142 cases.
Range: 49 - 0.
Mean: 21.73 ± .61
S.D. : 10.80 ± .43

Kohlstedt, it is only 4.6 times.

The correlation between the tests is only .3472 ± .0498. In order to combine the two scores into a single one which could be accepted as the criterion of introversion-extraversion, the values were translated into terms of deviates from the mean, and the average of the two transmuted scores given as the eventual score of each subject (See histogram No. 2, Chart 10, p.50).

As I was carrying on this work, I noticed that the difference in percentile ranks from one test to the other was well beyond 50 in a few cases. This seemed so little to be expected of two tests which purport to measure the same trait that I wondered if there was not some permanent cause of error in the directions given with the questionnaires. Of the 16 subjects whose percentile ranks presented a difference of 50 or more, 7 were interviewed. They were given exhaustive verbal explanations concerning the tests. The experimenter read out the questions to them and scored their answers on a new form. On the Menzies-Webster test the results were identical for every answer in 4 cases, and they varied by no more than 1 point on the total score for the 3 others. On the Neymann-Kohlstedt, however, the variations became great as soon as the subjects changed their manner of interpreting this sentence in the directions: "Consider them (the 50 statements of the test) from the viewpoint of personal <u>like</u> or <u>dislike</u>". It seemed that these subjects interpreted "like" as "what they would like <u>to be</u>", while the majority took it as meaning "what they would like <u>to do</u>". The "compensating attitude of the unconscious", which Jung describes (1) is apparently

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(1) Jung, C.E., - "Psychological types", 1923, p. 426.

coming into play here. It causes the extreme extravert to reach out for the traits which will make for his psychic equilibrium. The introvert is likewise reaching out for the opposite features. What he likes to be is then the very opposite of what he is likely to be. As a consequence the score on the test gives us a distorted picture of the type and is not valid.

The same compensating attitude undoubtedly affected the scores of other subjects whose difference in percentile ranks was below 50. As it was impossible to interview all the subjects or to give them the test a second time, the safest course to follow in order not to reduce too much the number of subjects, and still remove the most ambiguous scores, was to take out from the experimental group all those whose percentile rank in one direction was distant by 50 or more points from their rank in the other. There were sixteen (16) of them. When the correlation between the two tests was calculated for the 126 remaining subjects, it had come up 12 points from the previous one, viz: $.4678 \pm .0466$ instead of $.3472 \pm .0498$.

Of these 126 subjects, eleven were chosen who were ranking highest on both tests, 4 at the introversion, and 7 at the extraversion end of the scale. Their handwriting was examined and scored according to the criteria tentatively established with disordered subjects. But no correlation was found between the graphic diagnosis and the rating from the tests. It became evident that the criteria were utterly insufficient. Then I spread the eleven specimens on the table, those of the introverts at one end and those of the extraverts at the other.

For days I tried to discover some graphic features present in the first four and absent from the last seven. No single trait was found to be always identified with one constitutional type and always absent from the script of the opposite, or present under a strikingly different form. At last ten opposite features were selected which were apt to be in either type of handwriting, when taken singly, but which, taken as a group or constellation, would place all the four introverted scripts on one end of the scale and all the extraverted scripts on the other end.

Nine of these "graphic signs of introversion-extraversion" could be identified in ordinary specimens, and one was manifested in the experimental setting of "graphic conflict". They are deviations from the normal, or learned type of handwriting. As all other human traits, they are distributed according to the normal frequency curve (1). Only the extremes are significant here. Each sign has its opposite. The absence of either of them, or the simultaneous presence of the two, is scored 0. The extraversion signs are given a negative value of one point each, the introversion signs are given a similar positive value. The algebraic sum of the signs is the final score.

Here is the list of the graphic signs chosen:

INTROVERSION	EXTRAVERSION
1. Copperplate imitation of school-copy, stilted, stylistic handwriting.	1. Unstilted imitation of school copy.

It is impossible to give any method of measuring this sign. To appreciate its meaning, we must remember that some people use hand-

(1) This is explicitly accepted by E. Meyer, "Wissenschaftiche Grundlagen der Graphologie", 1925, p. 142.

writing as a means to an end. They write to express ideas, to give vent to their feelings, to transact business, etc. Or they take the accepted standard script as a pattern that they neither question nor attempt to imitate too meticulously. The act of writing has no particular importance of its own. For other persons, writing is always an end, not a mere means. The delineative element is always apparent in their script, even if they attempt to write faster. They dont write, they draw strokes. These are introverts, the former are extraverts. See samples E 1 and I 1 On Chart 11, (p.55)

2. Backward-tending originality, i.e. leftward tending strokes and letters not consistent with the general style.	2. Forward-tending originality i.e. simplification of letters or of common groups of letters.

Two instances are given on Chart 11. In the first one, E 2, note the "t" in "short", the connection between "o" and "f" in "of", the absence of the lower loop in "f" of "of", the peculiar formation of "f" in "forming", the group "to". In the second, I 2, note the "d's" which are retained all through the letter, although their shape is not consistent with the general style. In its general appearance, the script resembles the care-free E 1.

3. Pressure constant, i.e. strokes consistently light or pasty without the scratches mentioned in the discussion on pressure. Or pressure irregular, i.e, without any correlation with word or syllable impulse.	3. Pressure rhythmical, as explained in chapter on pressure. Or pressure "final", i.e., increasing towards end of syllable or words.

E. 1 I think it is absolute nonsense, and has no relation whatever to the personality or character of

It is a subject, however, that

P. 1 would need much thought as one might easily draw his conclusions too rapidly.

E. 2 short hand methods of forming letters which will enable me to write quicker, thereby

P. 2 never had my personality analyzed,

E. 3 sometimes I can write better than at-

P. 3 firm seat likes to get a job or actually trying to reflect some

E. 7a. is much value in it as a science.

E. 7b. could be interpreted from graphology.

P 7a. imagination can be discerned by graphology.

P. 7b. good word for the science of gr

The concept of pressure has been enlarged here in order to cover cases which are not properly differentiated in the previous discussion of the topic. A careful examination of script E 3, (Chart 11), will show that, in spite of the lightness of his hand, the writer has kept a certain rhythm in his pressure. The ending of the words "for", "the", "fact", "that", "people", "better", etc., shows a darkening stroke which cannot be explained by the mere flowing back of the ink on the already formed stroke when the pen comes to a stop. A microscopic examination of the original copy would make this point more evident. In specimen I 3 we have a good instance of what I call "irregular" pressure. The pressure shows sometimes at the beginning, sometimes at the end, sometimes in the very middle of the word. See "strokes" and "actually".

4. Initial adjustments belonging to McAllister's second or fourth quadrant; or unusually long initial adjustments in the third and first quadrant.	4. No initial adjustments; adjustments fewer than in school-copy, and in keeping with the general trend of movement.

This requires no further illustration. The McAllister's distribution of strokes in quadrants has been given in chapter one, and the adjustments given in Saudek's table (Chart 1, p. 12) are more than sufficient.

5. T bars short, straight, and accurately placed, or put on the left of the stem and barely reaching it. Short loops in lieu of "t" bars.	5. T bars long or thrown to the right. Paraphs. Punctuation signs large in proportion to the size of the script.

An important remark has its place here. Most teachers of

vertical handwriting train their pupils to put a short "t" bar to the right of the stem. When such a script is examined, the graphologist must not forget to vary his appreciation of sign "5" accordingly.

6. Lines straight with marked slowness.	6. Lines straight with marked speed.

Here I mean perfectly straight, without the use of any device (guide-sheet, etc.) to insure the rigidity of the line. Marked speed or slowness means an excess of at least two clearly recognized primary signs of Saudek's list. (see above, p. 10)

7. Lines irregular, i.e. showing frequent breaks.	7. Lines going up with paper and pen at normal angles or lines stepped with some regularity, or lines sinuous.

In measuring this sign, care must be taken not to over-value the breaks which appear at a normal interruption in the text. A typical instance of an introverted break is given in specimen I 7a, between the words "imagination" and "can". By putting a ruler under each of the words of specimen I 7b, one sees with glaring evidence what I mean by break in the writing line.

The stepped line is not given in the Chart. It is a feature well-known to graphologists. The words are consistently written in an upward or downward direction, each word beginning on a fairly straight line. This gives the handwriting the appearance of series of staircases.

The sinuous line presents noticeable curves of various descriptions. One is shown in E 7b, (Chart 11), "much value in". In E 7b "could be" shows a curve with its concavity turned upwards, the remaining words show a curve turned the opposite way.

8. Slow handwriting.	8. Rapid handwriting

Only primary signs are taken into account, and it suffices of a score of + 1 or - 1 to rank the script in either class.

9. Secondary narrowness.	9. Secondary width.

This is Saudek's secondary sign No.2 (1). "Secondary width means the widening of the intervals between the individual letters of the word, and secondary narrowness means the reduction of these intervals". (2)

The absolute size and the type of the handwriting have to be taken into consideration when this sign is measured. Thus specimen I 1 is narrow, and specimen E 3 is wide.

10. Sixty per cent (60%) or more, of possible adjustments in "graphic conflict".	10. Twenty per cent (20%) or less of possible adjustments in "graphic conflict".

This was measured in the following manner. The number of vowels to be changed (see above page 47) was counted. There were 21 in all, but as two were coming in immediate succession, namely, "e e" in "been", they were counted as one. The number of adjustments of the pen made immediately before or after the writing of the substituted letters was also counted. There was some overlapping in the scores of the 4 introverts and 7 extraverts taken for study, but the average of the first group was significantly higher than that of the second, 12 adjustments as compared to 4.6. The extreme scores, well beyond the overlapping range, were taken as criteria, namely - 12 or more adjustments

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(1) "Experiments with Handwriting", p. 107.
(2) Ibid., p. 267.

for the introverts, and 4 or fewer for the extraverts.

Table 11 gives the scores, from extraversion to introversion, obtained from these graphic signs.

TABLE 11

Distribution of graphic scores of Extraversion-Introversion

(126 cases)

SCORE	FREQUENCIES
- 7	4
- 6	3
- 5	4
- 4	14
- 3	13
- 2	13
- 1	12
0	15
+ 1	14
+ 2	12
+ 3	5
+ 4	6
+ 5	8
+ 6	2
+ 7	1

Mean = $-0.5 \pm .19$
S.D. = $3.21 \pm .13$

Taking the average of the deviates of the scores of the two tests as a criterion ($\frac{x_{MW} \quad x_{NK}}{2}$), we find between it and the graphic signs a correlation of $+ .602 \pm .038$. If, instead of averaging the deviates, we combine the two independent measures of the criterion by using a formula for the correction of attenuation, ($\frac{r_{(oo)1}}{\sqrt{\frac{2\, r_{oo}}{1 + r_{oo}}}}$) (1)

(1) Hull, C.L., - "Aptitude Testing", p. 244.

we find for correlation between the graphic prediction and the true criterion thus obtained: r = + .754 Forecasting efficiency = 0.344.

The same procedure applied to the scores of the total experimental group, including the 16 ambiguous cases discussed above, gives us: $r_{(o+o)1}$ = .5079, r_{oo} = .3472, and $r_{(\text{true criterion})(\text{graphic prediction})}$ = + .707. Forecasting efficiency = 0.293. In both cases we reach a forecasting efficiency of "decided value" (1), beyond the upper limit of that attained by most test batteries actually in use.

With the Menzies-Webster questionnaire taken separately, the graphic signs give a correlation coefficient of + .5485 $\pm$ .0415. With the Neymann-Kohlstedt, r = + .44 $\pm$ .048

These results were so good as to warrant a further statistical treatment. The inter-correlations between the graphic signs were calculated according to Holzinger's formula for qualitative series (2), the signs being grouped as predicting introversion, nothing, or extraversion. Then the mutiple correlation was calculated between the various signs and the criterion. The value of the regression coefficients was obtained by the method of successive approximations (3). The criterion scores were the averages of the deviates on the two tests. The number of cases retained was 126.

The results are given in the following tables:-

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(1) Ibid., p. 276.
(2) Holzinger, K.J., - "Statistical methods", p. 261, formula 119.
(3) Kelly, T.L., - "Statistical Method", 1924, p. 302.

TABLE 12

CORRELATION OF GRAPHIC SIGNS OF INTROVERSION-EXTRAVERSION WITH AVERAGE OF TRANSMUTED SCORES ON M-W and N-K TESTS (CRITERION) AND WITH EACH OTHER.

		GRAPHIC SIGNS									
		1	2	3	4	5	6	7	8	9	10
CRITERION		.374	.276	.249	.172	.155	.116	.289	.292	.065	.213
Graphic Signs:	1		-.015	.140	.037	.066	.132	.141	.167	.142	.097
	2			.070	-.010	.057	.007	.090	.090	-.034	.173
	3				.020	.007	.080	.068	.203	.112	.001
	4					.160	.033	.061	.099	-.059	.065
	5						.036	.034	.030	.027	.135
	6						.030	.230	.035	.025	
	7							.015	-.045	.058	
	8								.138	.046	
	9									.009	
	10										

TABLE 13

WEIGHTS OF GRAPHIC SIGNS OBTAINED BY SUCCESSIVE APPROXIMATIONS OF REGRESSION COEFFICIENTS.

VARIABLES	Weights First Guess	Weights Second Approximation	Weights Third Approximation
Graphic Sign 1	5	.264	.2778
" " 2	4	.211	.2122
" " 3	3	.139	.1448
" " 4	2	.109	.1117
" " 5	2	.081	.0777
" " 6	2	.009	.0149
" " 7	4	.212	.2020
" " 8	4	.156	.1749
" " 9	1	.009	.0136
" " 10	3	.117	.1104
Multiple correlation resulting:	.5936	.6028	.6033

Let us examine table 12 and see if the signs chosen as predictors of introversion-extraversion form a desirable battery. It is generally accepted that, (a) the predictors should each correlate as highly as possible with the criterion, (b) they should correlate with each other as low as possible.

The first condition is fulfilled to a reasonable degree by six of the predictors, viz: 1, 2, 3, 7, 8, 10. Sign No. 10 (adjustments in "graphic conflict") cannot be determined from an ordinary sample of

handwriting, and its use requires a special experimental procedure. Its correlation with the criterion proves that it has some diagnostic value, and the weight it retains in the third approximation (see table 13) is comparatively high. A more complete statistical treatment will be required before we may decide whether one should, or should not, take the trouble of using it in actually determining introversion and extraversion for clinical or vocational purposes.

Of the five signs that remain, none has a correlation of less than .25 with the criterion. If we examine the intercorrelations among these five predictors, we find that they are all sufficiently small to satisfy the second condition. One single exception might be noted: it is the correlation between sign 3 and sign 8 (r. = .203) But since they both happen to correlate very low with other signs, v.g.: $r_{8.2}$ = .09, $r_{3.2}$ = .07, $r_{8.7}$ = .015, $r_{3.7}$ = .068, and since their intercorrelation is still lower than their respective correlations with the criterion, we may keep them. If we go back to the list of signs of introversion-extraversion given above (p.53) we note that sign 3 (rhythmical or final pressure) is very little different from sign 7 of primary speed (rhythmical pressure). Rhythmical pressure being an important prediction of speed-slowness which becomes in its turn sign 8 of introversion-extraversion, it is indeed not very wise to use it again as a separate sign of introversion-extraversion. It is true that in its new capacity it is combined with a form of pressure which had not been differentiated as such heretofore. This new element is "final" pressure. Does it raise or lower the correlation of pressure with speed? I cannot tell. Saudek gives nowhere the correlations of his signs with the speed they determine, and

the present data do no more than raise the question. I must note also that the rating of pressure on a three-point qualitative scale, as demonstrated in Chapter 2, was determined after the present set of data were collected. It is possible that, (in a later investigation), this refinement in appreciating pressure may help to clear the difficulty encountered here.

Of the remaining signs, 4 and 5 present a similar difficulty. Their intercorrelation is not much lower than that of 4 with the criterion, and even higher than that of 5 with the same. This would seem to indicate that the tendency of making long t bars and using paraphs is just as much inconsistent with introversion as it is with initial adjustments. In a recasting of the list of signs of introversion-extraversion, it may be advisable to make it shorter and lump these two signs together. The combined sign could read somewhat like this: initial adjustment vs rightward tending end - adjustments.

Sign 6 (straight lines with marked speed or slowness) has a very low correlation with the criterion, and its predictive value is far from being considerable. This was foreseen in the course of the examination of the scripts. It occurs very seldom, 22 times in all; and even when it does, its determination is too uncertain to be considered as objective. Its only redeeming feature is its comparatively high correlation with sign 8 ($r_{6.8} = .23$).

Sign 9 fares even worse. Its correlation with the criterion is the lowest ($r_{0.9} = .065$) With signs 1 and 8 it correlates somewhat better ($r_{1.9} = .142$, $r_{9.8} = .138$). This is why it was kept, as well

as sign 6, in the approximation of the regression coefficients.

The conclusions we have just reached by inspection and discussion become more evident the minute we note the weights eventually arrived at. If the weight of sign 9 is taken as a unit, the order of increasing importance of the signs is as follows:-

Signs	Weights
9	1
6	1
5	7
4	11
3	14
8	17
7	20
2	21
1	28

In order to find out if sign 10 (percentage of adjustments in "graphic conflict") could be dropped without impairing the forecasting efficiency of the battery, the whole data were given an entirely new statistical treatment.

First, sign 10 was taken off all scores (28 in all) in which it had appeared. Then the product moment correlation was calculated for the whole group (126 cases) between the new scores and the criterion $\left(\frac{x_{MW} \quad x_{NK}}{2} \right)$. The correction for attenuation was also calculated.

As the nine signs now remaining really constituted a new battery where their respective weights were liable to be altered, the regression coefficients were again calculated from the intercorrelations given in table 12, minus, of course, the last column.

The following table gives the comparison between the results thus obtained in the correlation and the forecasting efficiency. Table 15 gives the comparison between the previous weights and the new ones.

TABLE 14

COMPARISON BETWEEN THE RESULTS OBTAINED
(a) with a battery of 10 graphic signs, and
(b) with a battery of 9 graphic signs.

		BATTERY OF 10 SIGNS	BATTERY OF 9 SIGNS
Signs unweighted	Correlation with criterion	.602 ± .038	.586 ± .039
	Correlation corrected for attenuation	.754	.735
	Forecasting efficiency	.34	.32
Signs weighted	Multiple correlation	.603	.593
	Multiple correlation corrected for attenuation	.756	.743
	Forecasting efficiency	.345	.330

TABLE 15

WEIGHTS OF THE GRAPHIC SIGNS (REGRESSION COEFFICIENTS) OBTAINED BY THREE SUCCESSIVE APPROXIMATIONS

	BATTERY OF 10		BATTERY OF 9	
SIGNS	REGRESSION COEFFICIENTS	Weights	REGRESSION COEFFICIENTS	Weights
1	.2778	28	.2712	27
2	.2122	21	.2323	23
3	.1448	14	.1315	13
4	.1117	11	.1156	12
5	.0777	8	.0967	10
6	.0149	1	.0061	1
7	.2020	20	.2161	22
8	.1749	17	.1537	15
9	.0136	1	.0070	1
10	.1104	11	.0000	

From table 14 we see that the difference in forecasting efficiency between the two batteries of unweighted signs is .02. This difference is slightly reduced by the weighting; it is now .015. In other words the dropping of sign 10 reduced the practical value of the test by 4.4%. The cumbersome procedure required to determine that sign may therefore be avoided without impairing the relative accuracy of the diagnosis. In practice it is less trouble to increase the number of specimens than to have the subject give a sample of writing in graphic conflict. If the specimens offered cover a certain range of years, and a variety of emotional moods, the results of their analysis will be as good with the nine-sign battery as with the full ten-sign battery applied to one specimen only.

Second experimental group. The second experimental group was not so considerable as might be desired. But it had over the first the advantage of being less homogeneous, both as to age and as to educational level. It comprised 29 subjects, (13 males, 16 females) of ages varying from 17 to 55 years (M.A. = 28.62 yrs.), and belonging to various occupational levels, from unskilled laborers to students in professional schools.

They were given the Menzies-Webster Test for introversion-extraversion and they submitted to the experimenter a sample of their handwriting. These specimens were of various lengths; some contained nothing but the signature, the address and the mention of the sex, others were full-page letters on unruled paper. Seven were written in pencil, twenty-two were written with pens of various sizes and quality. All in all, they were a fair sampling of the scripts of adults

which the practising graphologists are requested to analyse. It is a well known fact that professional graphologists who are jealous of their reputation will not accept such scanty material. They make it a rule not to undertake an analysis unless the specimen submitted conforms to a minimum of conditions, viz.: length of about 15 lines, text written spontaneously, i.e. not dictated nor copied, written with pen and ink, on unruled paper. But I felt that the diagnosis of the single trait of introversion-extraversion, supposedly imbedded very deeply in the psychological make-up of the subjects, would come out satisfactorily, in spite of the relative inadequacy of the graphic material. From the experience acquired with abnormal subjects, who cannot always use pen and ink, I knew that, in the cases of samples written with pencil, the measurement of certain graphic features had to be altered in a definite direction. For instance, angles are less apparent, and should be appreciated more exactingly. For pressure, one must not forget to take into account the gradual wearing of the pencil point and the various degress of softness of the leads.

Circumstances prevented me from giving to the subjects the second test used for the first group. I had to choose either the Menzies-Webster or the Neymann-Kohlstedt. I took the former because it gave in the first experiment a better correlation with the graphic scores than did the latter, r .55 $\pm$ .042 against .44 $\pm$ .048. It had also the advantage of having only 19 questions, which offer a choice of 76 weighted answers, whilst the Neymann-Kohlstedt has only 50 questions with straight "yes" or "no" answers.

Table 16, (p.70) contains four double columns. The first gives the scores and the frequencies on the questionnaire; the second, the scores and the frequencies on the graphic signs unweighted; the third, the scores and the frequencies for the graphic signs weighted as in the ten-sign battery; the fourth, the same results with signs weighted as in the nine-sign battery.

The coefficients of correlation between the criterion and the graphic scores are:-

Criterion and unweighted signs:	$r = .55 \pm .087$
Criterion and signs weighted in battery of 10:	$r = .62 \pm .077$
Criterion and signs weighted in battery of 9:	$r = .58 \pm .084$

The criterion used with this second group is only part of the one used with the first. This renders impossible a direct comparison of the results. On the other hand it is gratifying to find that the correlation between the Menzies-Webster questionnaire and the unweighted scores is the very same for the two groups of subjects (r. = .55.) The variations in this coefficient due to the weighting of the signs are not very significant. With the weights derived from the analysis of the battery of ten signs we obtained a coefficient higher than with the weights established for the battery of nine signs. I did expect the very opposite. This is another instance of how little it pays to have recourse to weighting in order to improve such a test as this.

Nevertheless, we may conclude, from the fact that the correlation coefficient with the M-W questionnaire and the graphic scores is the same

TABLE 16

RESULTS WITH SECOND EXPERIMENTAL GROUP (29 SUBJECTS)

M-W TEST		GRAPHIC SCORES					
CRITERION		UNWEIGHTED		WEIGHTED 10-sign battery.		WEIGHTED 9-sign battery.	
SCORES	FREQ.	SCORES	FREQ.	SCORES	FREQ.	SCORES	FREQUENCIES
4 - 7	2	0	1	0 - 2	2	1 - 3	1
8 - 11	3	1	0	3 - 5	3	4 - 6	1
12 - 15	2	2	1	6 - 8	8	7 - 9	9
16 - 19	9	3	4	9 - 11	9	10 - 12	6
20 - 23	7	4	4	12 - 14	4	13 - 15	9
24 - 27	4	5	6	15 - 17	3	16 - 18	1
28 - 31	2	6	6			19 - 21	2
		7	3				
		8	2				
		9	0				
		10	1				

In all columns, the low scores mean extraversion.

First column:

Mean = 18.2 $\pm$ .781
S.D. = 6.24 $\pm$ .552

Second column:

Mean = 5.2 $\pm$ .28
S.D. = 2.23 $\pm$ .198

Third column:

Mean = 8.97 $\pm$ .468
S.D. = 3.81 $\pm$ .330

Fourth column:

Mean = 11.31 $\pm$ .314
S.D. = 2.51 $\pm$ .222

with the two groups, that there is a strong indication of the validity of the graphic test.

In research work it is indeed necessary to spread the scores of the tests on a sufficiently long scale. But when the tests are used in actual practice, the whole distribution is cut into a limited number of groups. Witness the Terman-Binet, where a score of from 90 to 110 is classified as "normal", a score below 70 is classified as "definite feeble-mindedness", etc. Witness also the letter ratings of the Army Tests. Why should we not do the same with the ratings on the introversion-extraversion scale? We merely deceive ourselves if we think that so-called accurate measurements are really giving a true picture of some micrometric variations of a psychological "dimension" of personality. Introversion-extraversion is, in the present state of our knowledge, such a dimension. It is a workable hypothesis. But who will maintain that the concept is so clear, the objective trait underlying it so visible, that we may safely attempt to mark with meticulous precision, on a ten or fifteen point scale, the degree of introversion or extraversion possessed by a particular subject? Let us accept as ambiverts the 68% of the cases found in the middle of the normal distribution, ambiverts-introverts, and ambiverts-extraverts the cases included in the area of the curve between 1 S.D. and 2 S.D., and let the remaining extreme cases be straight introverts or extraverts. This five point scale will be sufficient for diagnostic purposes, and it is so modest in its implications that it does not lead the psychologist to deceive himself and take his subtle mathematical distinctions for objective discriminations carefully controlled. Until a more objective method is

found to single out the ultimate elements of human personality, a coarse scale is perhaps more scientific than a finer one.

The fine-point scale groups the 29 subjects now under study in a manner strikingly reminiscent of the normal frequency curve. According to the questionnaire scores, the group includes: -

18 ambiverts.

4 ambivert-extraverts.

4 ambivert-introverts.

2 extraverts.

1 introvert.

The graphic signs give the following distribution:-

17 ambiverts.

4 ambivert-extraverts.

5 ambivert-introverts.

1 extravert.

2 introverts.

The coefficient of correlation (product-moment method) between the two distributions and the coefficient of contingency are identical to the second decimal point. They equal .75

The results may be expressed in the following manner:
Let us suppose two clinical psychologists, one who does not use graphological methods and one who does. They rate the 29 subjects as to introversion-extraversion on a five-point scale, each one according to his method. When they compare their results they find that they are in perfect agreement in 21 cases, within one point in 7 cases, and at a

distance of two points for the last case. This one was rated ambivert-extravert on the strength of his answers, and ambivert-introvert from his graphism. Since the graphologist is able, without any interviewing, to justify his doubts concerning the veracity of the subject, I wonder whose diagnosis would be better confirmed by a thorough personal inventory!

The disordered subjects again.

At the end of the study of the scripts of mental patients, I promised to come back to them and to re-examine them in the light of the criteria obtained in the present investigation. This I must do briefly now.

It suffices to glance at the two following Charts Nos. 12 and 13 (pp.74 & 75) to see that the desiratum expressed in Chapter 3 has been fulfilled within reasonable expectation. In Chart 12 we see the signs clustering in a very definite manner, those of introversion on the side of schizophrenia, and those of extraversion on the side of manic-depressive insanity. Every schizophrenic writer (with the exception of patient No.11) has more introverted than extraverted graphic features. Patient No. 11 has 4 signs of introversion and four of extraversion. Here I must mention that, going over the whole record of this patient, I find that in the course of eight years (Sept. 1926 to May 1934) he was committed to the mental hospital for six different periods. The early onset of his psychosis was taken as an indication of a dementia praecox in its first stages, but there is a cyclic element in the march of the disease which disturbs the diagnostician. At the

Graphic Signs of Introversion-Extraversion appearing in the scripts of psychotic subjects.

	Introversion.									Extraversion.								
Schizophrenic	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
No. 1	x		x		x		x	x	x									x
2		x	x	x			x	x						x				x
3	x						x	x				x		x				
4	x		x		x		x	x										
5		x			x		x	x				x						
6	x		x	x	x		x	x										
7	x		x	x	x		x	x										
8	x		x		x		x	x										
9	x		x		x		x	x					x					
10			x	x			x	x		x				x				
11				x			x	x	x	x		x	x	x				
12		x	x		x		x	x	x									
13		x	x	x			x	x						x				x
14		x	x		x	x		x										
15		x		x	x		x	x				x						
16		x	x	x	x		x	x										
Manic-depressive																		
No. 17		x								x		x	x	x				x
18			x							x				x		x		x
19			x							x			x	x				x
20										x		x	x	x			x	x
21			x										x	x		x		x
22										x						x		
23										x		x	x	x			x	x
24			x							x			x			x		x
25												x		x		x	x	x
26										x		x	x	x		x	x	x

Chart 12

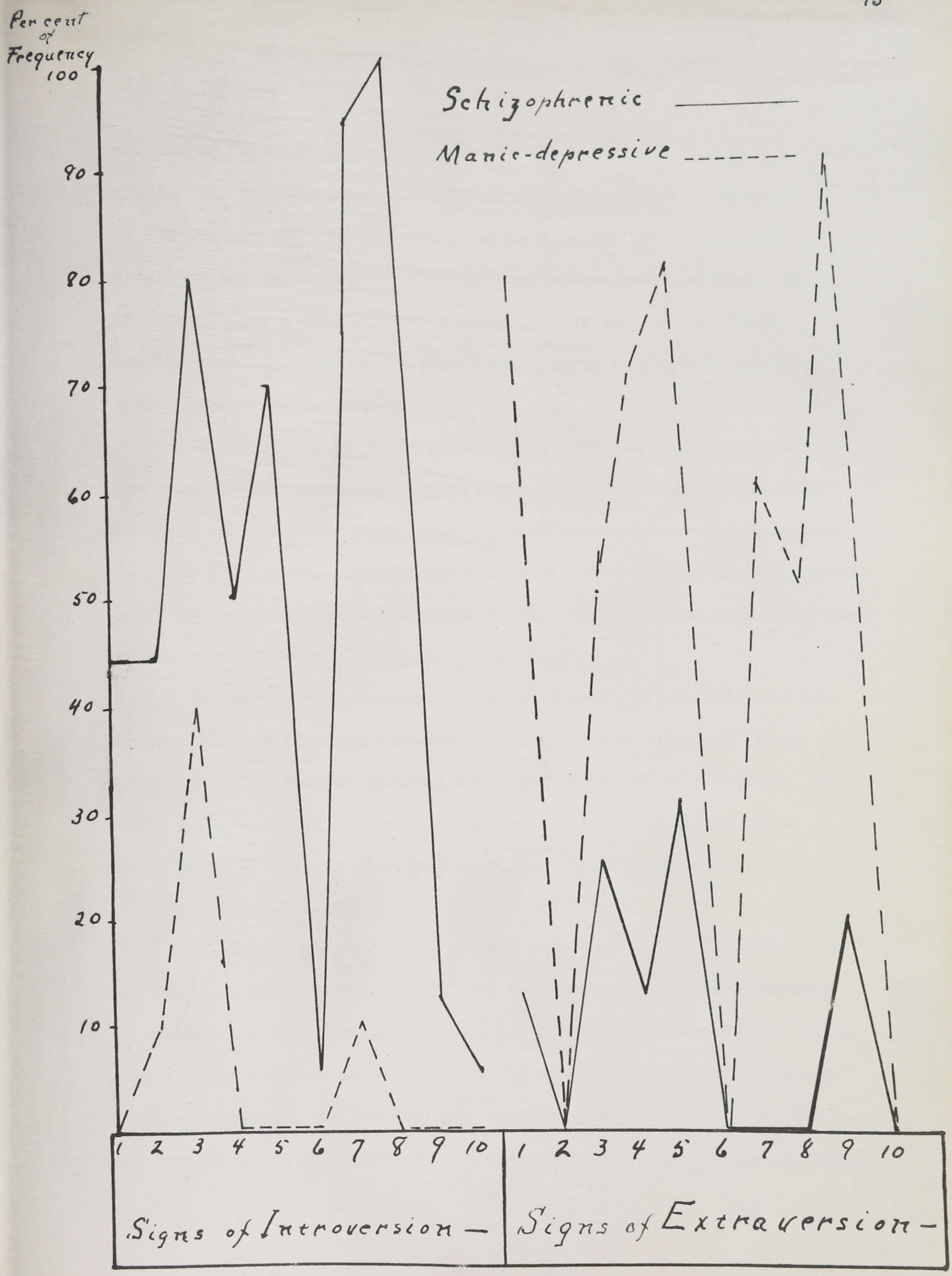
Per cent of Frequency
100
90
80
70
60
50
40
30
20
10
Schizophrenic
Manic-depressive
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
Signs of Introversion —
Signs of Extraversion —

Chart 13

writing of these lines it is impossible for me to secure more abundant information concerning this case. But I deem it my duty to mention the problem it raises. Without rashly giving too much credit to the graphological theories evolved so far, I am inclined to believe that a more searching study of this patient may yield results that may, not only not contradict them, but perhaps confirm them in a spectacular manner.

Whatever may be of this individual case, it remains that the new signs do correlate better with schizophrenia and manic-depressive insanity than did the signs of primary and secondary speed. The graph on Chart 13, (p.75), illustrates this truth. We see that the two curves never cross, and that they are at a greater distance from each other than they were in Chart 9, (see p.42).

We may express the same thing in figures, if we wish. In the sixteen (16) schizophrenic specimens taken together we found eighty (80) signs of introversion and sixteen (16) signs of extraversion. The ratio is 5 to 1. In the ten (10) manic-depressive scripts we have forty-seven (47) signs of extraversion and five (5) of introversion. The ratio is over 9 to 1.

Sign ten (graphic conflict) was neglected in all abnormal cases but two. It was already so difficult to obtain satisfactory specimens of handwriting from the patients, that I did not take the trouble to go through the procedure necessary to bring out this relatively unimportant feature. However, the two patients who tried the changing of the vowels had results which were perfectly consistent with the rest of their graphism.

One was a schizophrenic, the other was a manic in a state of remission. If this proves nothing for our theory, it does not contradict it either.

Sign six (lines perfectly straight with marked slowness or speed) has not much validity in the case of abnormal people. They seem almost all unequal to such an accomplishment.

Sign two (backward or forward originality) is sometimes present in its first form, never in the second. All the subjects seem to have come down to or remained at a level of graphic maturity where such simplification of letters (forward originality) is not apparent. Gross(1) had already noted that acquired skill tends to disappear in pathological cases.

Of the remaining signs, two of the extravert group never appear in the handwriting of schizoids. They are signs 7 and 8. Five signs of the introvert group are entirely absent from the scripts of cycloids. They are signs 1, 4, 5, 8 and 9.

In order to calculate the correlation coefficients between each sign and the psychosis it is related to, I used the tetrachoric method (2). The determination was made with the aid of Thurstone's Computing Diagrams (3). Here are the results:-

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(1) Gross, A., - Op. cit. p. 467.
(2) Kelly, T.L., - "Statistical Method", 1924, p. 253.
(3) Chesire, L., Saffir, M., and Thurstone, L.L., - "Computing Diagrams for the Tetrachoric Correlation Coefficient", University of Chicago Press, 1933.

TABLE 17

TETRACHORIC CORRELATION COEFFICIENTS BETWEEN SCHIZOPHRENIA AND GRAPHIC SIGNS OF INTROVERSION

Sign	1	r	=	.95
"	2	r	=	.63
"	3	r	=	.62
"	4	r	=	.95
"	5	r	=	.97
"	6	r	=	.00
"	7	r	=	.97
"	8	r	=	1.00
"	9	r	=	.00

TABLE 18

TETRACHORIC CORRELATION COEFFICIENTS BETWEEN MANIC-DEPRESSIVE INSANITY AND GRAPHIC SIGNS OF EXTRAVERSION

Sign	1	r	=	.89
"	2	r	=	.00
"	3	r	=	.39
"	4	r	=	.82
"	5	r	=	.72
"	6	r	=	.00
"	7	r	=	.95
"	8	r	=	.95
"	9	r	=	.90

If we compare these tables to the table of the weights of the graphic signs taken from normal scripts (see page 66), we see that sign 6 drops out of the picture entirely. It has the lowest weight in table 15, and here it correlates with neither psychosis. Sign 9 (secondary width or narrowness) had also a very small weight. Here the correlation of secondary narrowness and schizophrenia is .00; that of secondary width with mania is very high: .90. It is because of this

high correlation that I cannot accept to drop sign 9 without further study. Is it merely a pathological sign having no relation to normal introversion-extraversion? Does it manifest some other dimension of the normal personality? Could it be measured more accurately than was done in the present investigation? This last explanation of my failure to make more of it in my study of normal scripts seems the most probable. I may have overlooked the fact that the type of script taught in our schools calls for long connections (1), and I may have taken as of normal length connections which were relatively short. In the writings of maniacs, the secondary width was so conspicuous that I could not help but notice it.

CONCLUSIONS

In spite of its numerous shortcomings, the present investigation has established beyond reasonable criticism, a few facts which may be summed up as follows:-

1. The psychological variable known under the name of introversion-extraversion and measured by such tests as the Neymann-Kohlstedt and the Menzies-Webster may also be measured by calculating the algebraic sum of certain signs found in handwriting.

2. These graphic signs are all well-characterized deviations from the normal school-copy. The deviation may be either in one direction or in the opposite. For instance, letters may be amplified or simplified. Pressure may be more than the average or less than the average, etc. As all deviations from an average, these are taken as positive in one direction

(1) In "The Palmer Method of Business Writing", published by the Educational Book Co., Toronto, the average distance between the letters is at least twice the height of the small letters, and often more.

and negative in the other.

3. Ten (10) signs chosen as valid predictors of introversion-extraversion have all proven to have some value. They are described here above. In computing the scores the signs of introversion are arbitrarily given a positive value, those of extraversion a negative one.

4. They may be scored unweighted or weighted according to the table given on page 66. For a sufficiently large group of subjects the average results remained almost unchanged.

5. None of these signs, taken singly, may be held as sufficient to indicate either introversion or extraversion. Any of them may be found in the script of a subject whom his total score puts very far on the end of the scale opposite to this particular sign. For instance, any sign of introversion may be found in the script of an individual who ranks very high in extraversion, and vice versa. Therefore, there is nothing in common between the conclusions reached here and the defunct "theory of signs".

6. It is possible to reduce the battery to nine, even to eight or seven signs, without altering the results to a great extent.

7. The same battery of graphic signs applied to the scripts of patients suffering from schizophenia or manic-depressive insanity separates them into two well-defined groups.

CHAPTER V

VARIATIONS IN GRAPHIC SCORES OF INTROVERSION-EXTRAVERSION FROM CHILDHOOD TO ADULT AGE

"Introversion and extraversion are not characters at all, but mechanisms, which can, as it were, be inserted or disconnected at will. Only from their habitual predominance do the corresponding characters develop. There is an undoubted predilection depending upon a certain inborn disposition, which, however, is not always absolutely decisive for one or other mechanism. I have frequently found milieu influence to be almost equally important." Thus writes Jung (1), the originator of the theory which we have taken as our fundamental assumption. Again: "Give the introvert a thoroughly congenial, harmonious milieu, and he relaxes and expands to complete extraversion, until one begins to wonder whether one may not be dealing with an extravert. But transfer the extravert into a dark and silent chamber, where every repressed complex can gnaw at him, and he will be reduced to a state of tension, in which the faintest stimulus becomes a poignant realization. The changing situations of life can have a similar effect, momentarily reversing the type; but the preferential attitude is not, as a rule, permanently altered, i.e., in spite of occasional extraversion the introvert remains what he was before, and the extravert likewise". (2)

Is this a preferential attitude which makes the "introvert

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(1) Jung, C.G., - "Psychological Types", p. 354.

(2) Ibid., p. 356.

remain what he was before, and the extravert likewise", apparent in various specimens of handwriting written at different times in a person's life?

In order to find an answer to this question, the experimenter asked all people willing to cooperate in his research, students, acquaintances, and friends, to let him have specimens of their handwriting written at different times of their life. Twenty individuals (9 male, 11 female) presented for examination a total of 96 specimens (average: 4.8 per subject). The ages at which the samples were written varied from 5 to 43. The minimum range of years from the first to the last specimen for one single subject was 5; the maximum 29; the average 13.9 years.

When the present investigation was over, the experimenter found that nine of the specimens could not be scored validly with the signs he was using; their graphism was too immature to warrant a diagnosis. All had been written when the subjects were very young (10 years or below).

This left a total of 87 specimens (range in number of samples from one writer: 2 - 12; average per individual: 4.35). The total range of the ages covered for all subjects was 10 to 43; the average length of time per subject was 11.7 years of his life. 84 samples were written with pen and ink, 3 were in pencil; 50 were on unruled and 37 on ruled paper. Apart from the normal changes in handwriting due to maturation, there were 10 subjects who had passed consciously from a definite type of handwriting to a different one.

All these specimens were examined and scored as to introversion-

extraversion according to the battery of nine signs described in the previous chapter. Their extreme scores ranged from extraversion 6 to introversion 5, with an average of extraversion of 2.3. This difference between the mean of the present group and those of the two experimental groups (first group of 126 subjects: E 0.6, second group of 29 subjects: E 0.8) may seem disturbing at first. But it does not impair the results of the present investigation. This group is a selected one by the fact that no one joined it unless he had a personal interest in the results, or was the type who would cooperate in such a venture. Again, the possibility of securing samples dating five or ten years back was limited in a number of cases where subjects manifested their willingness to present some. Three subjects were thus unable to join who happened to be introverts. Finally, we are not concerned here with the general distribution of the features in the general population, but with the intraindividual variations which may appear as the years go by. And this is fairly well exemplified in the samples under study.

Table 19, (p.84) gives the results. The first column includes the serial number of each subject and his or her sex; the second, the extreme ages at which the specimens were written; the third, the number of specimens; the fourth, the range of the variation in graphic scores of introversion-extraversion.

TABLE 19

SUBJECT NO.	SEX	RANGE of AGE	NUMBER OF SPECIMENS	RANGE OF VARIATION OF GRAPHIC SCORES
1	F.	11 - 20	12	E 5 - 0
2	M.	16 - 20	3	E 4 - E1
3	F.	10 - 35	2	E 3 - E2
4	M.	9 - 24	6	E 4 - E0
5	M.	10 - 16	5	E 5 - E2
6	M.	13 - 18	3	E 4 - E1
7	F.	14 - 18	2	E 6 - E5
8	M.	11 - 22	7	E 5 - E1
9	M.	12 - 33	5	E 2 - 0
10	F.	14 - 24	3	E 2 - E1
11	F.	11 - 19	2	E 2 - E1
12	F.	10 - 17	2	E 2 - E1
13	M.	11 - 26	6	E 5 - I1
14	F.	13 - 18	3	I 2 - I3
15	F.	11 - 18	3	1 2 - I4
16	M.	14 - 35	2	0 - I2
17	F.	12 - 20	4	E 2 - 0
18	F.	14 - 18	2	I 2 - I5
19	M.	15 - 43	6	E 6 - E3
20	F.	12 - 21	9	E 6 - E3

The first experimental group (see chapter 4) had graphic scores extending from E 7 to I 6. The mean average was E 0.6, and the standard deviation was 3.08. If we take the standard deviation as a basis, we may divide the whole group into five sub-groups: ambiverts, whose score lie within one standard deviation to the left or to the right of the mean; ambivert-extraverts and ambi-introverts, between the first and the second standard deviations on either side; and finally extraverts and introverts, beyond the second deviation at either extremes of the distribution. As a consequence, three subjects whose scores would fall on three different points within a standard deviation would be all denoted by the same appel-lation. In the middle of the range, the variation could be as great as six points, and the appellation would remain identical.

If an interindividual variation of up to six points in the middle range, or of three points in the outlying scores, does not materially change the diagnosis, it seems reasonable to accept as a normal fluctuation within a person's life a variation of three points or less in the scores of his several specimens of handwriting given at various age levels.

Let us examine the graphs on Chart 14, p.86. One column gives us the serial number of the subjects. Here they are listed in order of decreasing extraversion. The following column gives the age at which was written the specimen given for examination. The next gives the highest extraversion (or the lowest introversion) score attained in the course of their life. Then two tripartite

Subj. No.	Age.	From	+1σ	+2σ
7.	18	E6		
	14			
19.	43	E6		
	38			
	35			
	30			
	21			
	15			
20.	21	E6		
	20			
	19			
	18			
	17			
	16			
	14			
	12			
1.	20	E5		
	20			
	20			
	19			
	18			
	17			
	16			
	15			
	14			
	13			
	12			
	11			
5.	16	E5		
	15			
	14			
	12			
	10			
8.	22	E5		
	16			
	15			
	14			
	13			
	12			
	11			
13.	26	E5		
	21			
	18			
	16			
	13			
	11			

Subj. No.	Age	From	+1σ	+2σ
2.	20	E4		
	18			
	16			
4.	24	E4		
	16			
	14			
	10			
	9			
	9			
6.	18	E4		
	16			
	13			
3.	35	E3		
	10			
9.	33	E2		
	32			
	24			
	19			
	12			
10.	24	E2		
	22			
	14			
11.	19	E2		
	11			
12.	17	E2		
	10			
17.	20	E2		
	18			
	15			
	12			
16.	35	0		
	14			
14.	18	I2		
	16			
	13			
15.	18	I2		
	15			
	11			
18.	18	I2.		
	14			

columns provide for the variations from this score towards introversion in terms of either actual scores (dotted vertical lines) or standard deviations (continuous vertical lines). The scores attained at various age levels are marked by an X on the corresponding vertical lines. For each subject the various X's are joined by a line which we may call the "curve of fluctuation" in the graphic expression of introversion-extraversion.

In 16 cases out of 20, the curve of fluctuation remains within one standard deviation. In three cases it wanders into the next, and in one case it crosses over the second boundary line (No.13). The average range in years covered by the specimens is 11.8 for the first 16 cases; for the four cases presenting extreme variations, it is 13.5. The first group contains the four longest periods, viz: 22, 22, 26 and 29 years.

The first conclusion which presents itself to the mind of the observer is that the fluctuations in the graphic scores of introversion-extraversion for several specimens written by the same individual at different age levels, at and after graphic maturity, are relatively unimportant in the majority of cases. And the habitual predominance of the introversion or extraversion mechanism, as pointed out by Jung, may be detected by graphological analysis.

But what of the other four cases? Does the life history of the subjects account for their momentary shift beyond the expected fluctuations of their preferential attitude. Yes, it does. In each case we may apply Jung's very words quoted above: The subject was

"reduced to a state of tension in which the faintest stimulus became a poignant realization". The poignancy of the realization admits of degrees, without a doubt. The cause of the transient tension may be endogenous or exogenous, or both. But in every case that presents an unusual fluctuation, we find a definite perturbance which accounts for it. Let us take them separately

Case 1. - Female. A rather precocious child who scored E 3 at the age of her graphic maturation. See a complete display of her specimens on Chart 15, p. 90. They are all but one taken from envelopes addressed to a life-long correspondent. Unfortunately, I was not permitted to cut samples from the text of the letters. As may be expected, it was much more revealing than the addresses. At twelve and at thirteen, the subject shows a slight fluctuation towards introversion, but nothing worth mentioning (12 years: E 2, 13 years: E 2; see corresponding specimens on Chart 15). At fourteen and fifteen the fluctuation curve makes an incursion into the second standard deviation (see Chart 14, p.86). What happened? Oh! nothing outside of the ordinary, I admit. But something sufficient to make an impression on a bright and highly sensitive girl. From the text of her letters we learn that she was then very conscious of how she looked, of what people thought of her. There is mention of a very important affair: her first dance-party, of a very thought-absorbing piece of apparel: her first dance dress. For the whole period covered by these two letters she is very much concerned with her own appearance; she has not found her real self and she is looking around in search of "nice" manners to imitate. See the backward curling of the t bars at

14 years (Chart 15, p.90). At 15 they are a compromise between the curlicue and the forward tending bar; at 16, things have swung to the other extreme (E 5), but not so far beyond the average E 3.

Case 4 - Male. This boy reached his graphic maturity at a very early age. Two specimens, written two months apart, at 8 years of age, present a picture of perfect ambiversion. Then there is a sudden jump to 4 points of extraversion. The habitual score has been E 3 for the last thirteen years, four points from the initial 0 (see Chart 14, No.4). How shall we account for that? This way: an over-maternal mother up to nine years of age, and a stay in a military school from nine to ten. Then the boy went to another boarding school where, as we see from his letters, the lessons were easy and the discipline altogether different. It is true that he was then forced to change from a slanting to a vertical handwriting. But such a trivial imposition did not prevent the release of the previous environmental tensions. That very year the mother found, to her amazement, that her quiet little son suddenly turned to be a lively and turbulent boy. Fourteen years have passed. She has not got over her surprise yet, and she caresses the idea of seeing him back to what she taught him to be. After his graduation, the boy found a good position - away from home! He is doing well. Apparently he never craved for the environment of his younger years. The tension was relieved at 10 years, and it is so good to be without it!

Case 13, Male. This boy presents the greatest amount of fluctuation, (see Chart 14, No.13). From his life-story we also see that his problems were of a serious nature. Twice he came near failure because of lack of self-knowledge. Fortunately, he has qualities which

St. Paul St.
Baltimore
11 yrs.

12 Saint Paul St.
Baltimore
Md.
16 yrs.

The Royalton Apt. 6.
Maryland & North
Baltimore
12 yrs.

6
9, 12 St. Paul St.
Baltimore
Maryland
17 yrs.

3 East Read St.
Baltimore Md.
13 yrs.

Chadford Apts.
Roland Ave
Baltimore
Md
18 yrs.

East Read St.
Baltimore Md.
14 yrs.

Chadford Apts
Roland Ave
Baltimore
Md.
19 yrs.

Saint Paul St.
Baltimore Md.
15 yrs.

Chadford Apts.
Roland Ave.
Baltimore
20 yrs.

Other difficulties arise
20 yrs.

Samples written by one subject, from 11 to 20 yrs. of age.

made up for that deficiency. At 16 years of age, he left High school before the year was over, feeling sure that he was unable to pass his matriculation examinations. (score = I 2, Chart 14, No.13). He became girl-shy, self-conscious, retiring. Says he did not like the teacher. He entered an office as junior clerk. There he was promoted many times in rapid succession, but - to his own surprise - always to positions which put him in more frequent contact with people. He did very well. At eighteen (score E 4, p.84), he was publicity agent for a big concern and was finding it a most natural thing to interview officials of other firms. But he had in his head to become a technician. He resumed his studies, went to college with the purpose of taking engineering. Failed (see score I 1, p.84). He is now taking medicine with special interest in pediatrics and gynaecology. He likes it and does well. His score is back to normal.

Case 8, Male. On one sample, the score is outside the expected column (Chart 14, No. 8, age 15). This specimen was written in September 1929. The following February, the subject was laid up with heart trouble (endocarditis). The conditions at school are reported as badly depressing at the time when the specimen was written. After a few months of illness the subject recovered. He is now in good health and going to college.

Of all the other subjects, two have reported a considerable change, both in their handwriting and in their personality, in the years intervening between the specimens given. They are Case No. 16 and Case No. 18. The first one shows a fluctuation well within the

standard deviation, viz: 2 points only. The curve of fluctuation of the second goes from one side of the tripartite column to the other (see Chart 14, p.86, No.18). The handwriting of this No.18 is reproduced on Chart 16, p.93. Samples 1 and 2 were written at 14 years of age, and sample 3 at 18 years. At simple inspection the two types of script look so different that one may doubt their common origin. And needless to say that in the present investigation we are not concerned with the problem of finding identical traits in these scripts. Nevertheless, the sum total of the signs of introversion found in the first two samples remains within three points of the score for the third. The latter is I 5. From the interview, I conclude that the subject is very introspective, and when she speaks of her achieving purposely a "complete change in her personality", she betrays an increase in her autistic tendencies.

Three more samples are reproduced on Chart 16, p.93. They are from a subject whose script was submitted at the last minute. The case is most interesting, and it may help us in drawing our conclusions.

Until she graduated from Normal School, the writer used the vertical type of script exemplified in specimens 4 and 5 (Chart 16,p.93). Then she secured a position as a teacher in a town where the school board objected to her style of handwriting. She was told that she had to teach the slanting script with free-hand movement. She readily consented, and she quickly acquired the desired fluency in this new style. In order not to spoil her new hand, she carefully avoids returning to the old forms. Specimen 6 was written after two years of

Let ABCD be an equal sided figure in which DB is drawn
It is req. to prove that ① ∠ABD = ∠ADB ② ∠CBD = ∠CDB ③ ∠ABC = ∠ADC 1.
Proof ①

Let st lines yO, xO be int & ext bisectors of ∠BOA.
It is required to prove that ∠s xOA, COy are comp. 2.

And so we find that they take
in the general characteristics, 3.
but upon closer inspection of

parenthesis
Well, sir final exams are over and
the results published and I passed. They were
really awfully stiff and I certainly
expected at least three failures - however 4.
I had "pull" with the markers. (I must have
done!) Now, I am waiting to see if I can

Thanks just heaps for 5.
the pictures of yourself and

My goodness, you
actually wrote a letter 6.
on New Year's Day. You
must be the only one out

practice and teaching of the free-hand movement. The difference in general appearance from specimens 4 and 5 is so great that none but a very experienced handwriting expert could detect the identity of the writer. But the score on the graphic signs of introversion-extraversion has remained exactly the same, viz.: E 3. It seems that the acquisition of a new type of handwriting has not affected the personality at all. Here we have a change in handwriting, but no accompanying personal problems.

In all ten cases (eleven with this one) where a definite change in the style of handwriting is reported, we see no concomitant and important variation of the graphic signs of introversion-extraversion. In those cases where there were both change of style and great fluctuation in the scores, the two phenomena did not coincide.

CONCLUSIONS

The habitual predominance of the mechanisms of either introversion or extraversion all through the life of a person, accepted by Jung as a fact of clinical experience, is also apparent in his graphism, when it is examined according to the rules established in this investigation.

The score based on the graphic signs of introversion-extraversion remains unchanged when the subject passes from one style of script to another, provided, of course, he acquires an equal or almost equal fluency with either style.

The variations to be expected in the handwriting of subjects who present no serious physiological troubles, nor any deep-reaching

psychological maladjustments, are confined to the limits of one standard deviation of the distribution of the scores of a normal group.

When variations occur that shift the score beyond the limits of a standard deviation, in other words, when the scores vary by more than three points on the original scale, we are in the presence of some deep psychological problem or of some physiological trouble.

Such considerable variations have proven, in all the cases studied here, to be of a temporary nature.

They are all at a distance of three points or more from the average of the normal scores of the same individual.

Emotional conflicts of a lesser gravity and alterations in the personal make-up which do not reach the deepest layers of personality are not expected to produce a fluctuation of more than three points in the graphic score of temperament.

When a subject presents two specimens of handwriting written without unusual physical impediments (v.g. very poor writing material , unsteadiness or roughness of the writing surface, etc.), which score at levels distant by more than three points on the graphic introversion-extraversion scale, there are very good reasons to think that we are dealing with a problem case.

In forensic graphology, the present results may have some value. If two specimens of handwriting, written in normal circumstances and nearly at the same date, present some similarities in general appearance, but give a widely different score on the graphic introversion-extraversion

scale, it is more than probable that they are not from the same subject.

Nine specimens offered to the experimenter for the present investigation were left aside because it was impossible to score them with the norms established for adults. In the following chapter, we shall describe the attempts made at scoring the handwriting of immature writers on an introversion-extraversion scale.

CHAPTER VI

EXPERIMENTS WITH THE HANDWRITING OF CHILDREN

In the study of the variations of the graphic signs of introversion-extraversion through the life of the writers, (Chapter V), I had discarded 9 samples written at ten years of age or earlier, because I could not rate them satisfactorily with the signs established for adult writing. It seemed evident that in the case of children the total impulse of the handwriting movement was much more limited in scope than in the case of more mature writers, and, as a consequence, its graphic record could not be studied according to the same norms. Such a conclusion is in perfect keeping with the findings of the neurologists who admit of many stages in the gradual myelinisation of the nervous fibres of the cortex, the last stage taking place from the eighth to the tenth year of the child's life. That is the time when the "fibrae propriae" of the sixth cortical layer (Brodmann) reach their maturity and make possible "the fine coordination and adaptation in space and time of motor and sensory reactions (facilitation, richness and accuracy of movements and orientation)". (1) After the physical maturation of the nervous tracts, a stage of apprenticeship is required for the subject to acquire perfect ease in writing. The period of physiological maturation and that of psychophysical acquisition of a fluent hand do overlap; the date of their

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(1) Monakow, C.von, et Mourgue, R., - "Introduction biologique a l'étude de la neurologie et de la psychopathologie", Paris, 1928, p.66.

beginning and the length of their duration vary with individuals. The graphic expression of the progress achieved is not equally free under all circumstances, and the interpretation of the signs expected to disclose introversion or extraversion remains a most difficult and often a fruitless task.

On the other hand, the handwriting of children, however immature it may be, does present recognizable individual differences (1), and it is equally proven, "that children long before the normal age of school entrance, even as young as two or three years, have already developed characteristic attitudes of introversion and extraversion toward certain significant situations". (2) Therefore, the problem is:-

1. Are there individual differences in graphism of the child which correlate with the individual differences in that aspect of personality called introversion-extraversion?

2. Are such differences in graphism related to the graphic signs already recognized in the handwriting of adults?

The investigation reported here is far from giving an adequate answer to the two questions. As we shall see, the criterion used is certainly not the best available, and the pattern of graphic signs correlated with it is too scanty to warrant finality in the conclusions. This is rather a preliminary investigation, a mere prospection over a field that has not been surveyed yet. But the results are sufficient

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(1) Crépieux - Jamin, J., "Les Bases fondamentales de la Graphologie", 1926, p. 2 and 16.

(2) Marston, L.R., - "The Emotions of Young Children". An experimental study in introversion and extraversion. University of Iowa Studies. Studies in Child Welfare, 1925, 3. No. 3.

to stimulate further research in the same direction.

The subjects are 107 children attending the Elizabeth Ballantyne School, Montreal West. They are divided into 4 groups. Group A includes 37 boys in the VII grade (age: 11 years. 9 m. to 16 yrs. 11 m.; average: 13 years); group B, 28 girls in the VII grade (age: 11 to 16 years; average: 12 years 8 m.); Group C, 21 boys in Grade III (age: 7 to 10 yrs; average: 8 years 2 m.); Group D, 21 girls in Grade III (age: 8 to 9 yrs; average: 8 years 2 m.).

They were rated on a five-point scale of introversion-extraversion by their respective teachers. Before rating the pupils, each teacher was given to read a good description of the types couched in popular language (1). None of the teachers had any special training in psychology, and no mention was made to them of the normal distribution expected. The scores are given in table 20.

TABLE 20

INTROVERSION-EXTRAVERSION SCORES OF SCHOOL CHILDREN

TEACHERS' RATINGS

		Group "A"	Group "B"	Group "C"	Group "D"
Introverts	1.	7	7	5	2
Ambiverts-intro.	2.	9	7	4	6
Ambiverts	3.	12	5	4	6
Ambiverts-extra.	4.	4	7	5	4
Extraverts	5.	5	2	3	3

(1) Roback, A.A. - "Success in Handling Types", p. 16 ff.

As a specimen of their handwriting, all the children gave the experimenter a sheet of white unruled paper (uniform in all cases) on which they had written with pen and ink the following sentence:- "Herbert is fond of picking flowers every day". They had also signed their names and written their age on the same paper.

The scripts of Group A were studied first. This group is the largest, the oldest, and the most regularly distributed. The handwritings of the 7 introverts and 5 extraverts of this group were scored with the battery of 9 signs established in chapter 4.

Right at the start it became evident that signs 1 and 2 could not be taken into account. They do not become distinguishable until the writer has reached a certain degree of graphic maturity. Moreover, they presuppose a spontaneity which was not attained in this experiment. The children knew that the text dictated to them came from the principal's office. They knew also that their copies were to be given to the principal and then to be scrutinized by some examiner from outside who would undoubtedly communicate his findings to those in authority. In vain were they told that the exercise did not "count". The whole procedure was so unusual that they felt as though their whole personality was under the magnifying glass of the graphologist. They tried hard to do their best. As a consequence they departed as little as possible from the standard school-copy. Stiltedness (sign 1) prevailed much more than usual, and budding originality (sign 2) faded into nothingness.

Sign 6 was neglected because the shortness of the text made it very difficult to determine.

The other signs, when identified according to the norms adopted for adults, gave scores which had no correlation whatsoever with the criterion. Only one of the five extraverts - rated as decidedly so by the teacher - had a graphic score of extraversion. And the extreme introverts were scattered all the way from I 1 to I 5. It became necessary to analyse the signs separately, and to find out which were significant. They were tabulated according to the frequency of their appearance under either of their opposite forms (introversion - I - or extraversion - E -) in the handwritings of either sub-group of subjects. Table 21 gives the results:-

TABLE 21

FREQUENCY OF GRAPHIC SIGNS OF INTROVERSION-EXTRAVERSION IN THE SCRIPTS OF 12 CHILDREN. (7 INTROVERTS and 5 EXTRAVERTS).

Sign No.	Introvert Sub-group 7 Subjects	Extravert Sub-group 5 Subjects
3	6 I. - 1 E.	5 E.
4	5 I. - 2 E.	5 I.-
5	5 I. - 2 E.	3 I.- 2 E.
7	5 I. - 2 E.	2 I.- 3 E.
8	7 I. -	4 I.- 1 E.
9	3 I. - 3 E.	2 I.- 1 E.

If one examines this table, one sees that only three signs are present under only one form in a sub-group. They are:-

(a) sign 3, under its E form for all extraverts.
(b) sign 4, under its I form for all extraverts.
(c) sign 8, under its I form for all introverts.

Sign 3 (rhythmical and final pressure) may be retained. Under its E form it is evident in all cases of extraversion, and present in only 15% of the cases of introversion. Its correlation with the criterion is high, and with the help of other features it may constitute a good battery.

Sign 4 (initial adjustments) indicates introversion in every script of the extravert group, and extraversion is 30% of the introvert cases. This is a flagrant contradiction which destroys entirely the diagnostic value of the sign, taken simply or with others.

Sign 8 (primary speed or slowness), implies no such contradiction, but it occurs so many times under its I form in extravert script that it is significant only when it presents itself under the E form. If a child shows primary speed in his handwriting, he is undoubtedly an extravert. But primary slowness has no meaning.

The other signs - 4, 5, 7, 9 - are sprinkled over the two groups so indiscriminately that it is impossible to accept them as significant features.

This analysis leaves only sign 3 on the list. It is the only one to be present and valid under its two opposite forms. We shall give a little later its correlation with the criterion in all four groups.

In order to supplement it, sign 10 (number of adjustments in graphic conflict) was revived under a slightly different form. Writing was evidently a difficult task for all those children. Why could we

not assimilate this experiment to that of graphic conflict? In his endeavor to overcome the difficulties encountered in writing, the child will hesitate and stop. As a consequence he will readjust his pen oftener than a fluent writer would. If he is an introvert he will hesitate and stop all the more. The scatter in the number of stops may give us a distribution which will correlate with the temperamental make-up of the child.

In conformity with this hypothesis, the experimenter counted the total number of pen stops required when the sentence dictated to the children was written by an expert writer conformably to the standard script of the school copy. There were 45 of them. Then he counted how many stops were apparent in the scripts of the children. In all cases there were more than 45. Table 22 gives the range, the average, and the standard deviation for each group.

TABLE 22

NUMBER OF PEN STOPS

IN THE HANDWRITING OF FOUR GROUPS OF CHILDREN

Group	No.	Sex	School-Grade	Range	Average	S.D.
A.	37	Boys	VII	53-94	71.72	9.30
B.	28	Girls	VII	64-88	75.21	5.70
C.	21	Boys	III	64-102	81.43	11.25
D.	21	Girls	III	54-99	72.21	9.30

The correlations between the criterion and the number of adjustments were as follows:-

Group A.	.57
Group B.	.09
Group C.	.21
Group D.	-.12

The correlations between the criterion and rhythmical pressure were:-

Group A.	.60
Group B.	.19
Group C.	.25
Group D.	.68

The correlation between the two signs (rhythmical pressure and number of stops) was calculated for Group A, and it was found to be .20. This would mean that the two signs fulfill the necessary conditions to become parts of a battery, (a) high correlation with the criterion, and (b) low correlation between themselves.

In order to combine the two signs, the scores in number of stops were weighted in terms of their standard deviations, i.e., the scores falling between + 1 S.D. and - 1 S.D. were rated 0 (ambiversion); those between 1 S.D. and 2 S.D. were rated -1 or +1 (ambiversion - introversion or ambiversion-extraversion); and those beyond +2 S.D. and - S.D. were rated -2 or +2 (introversion or extraversion). Rhythmical pressure was rated +1, and its absence was rated -1. The algebraic sum of these weights gave the graphic score obtained by the combination of the two signs. The correlations between the criterion and this graphic score are as follows:-

Group A.	.63
Group B.	.13
Group C.	.38
Group D.	.21

The whole investigation was carried under severe handicaps, both on the side of the criterion used and on the side of the specimens analysed. The children were rated on the introversion-extraversion scale by only one teacher for each group, and the raters had a very superficial knowledge of the trait to be measured. This leaves room for inaccuracy and personal bias. On the other hand the script to be studied was obtained from copying set material; it was very short; and it was written under circumstances which inhibited freedom of self-expression. Lastly, each group taken separately was rather small.

Nevertheless, the results are not altogether insignificant. For group A they are very good indeed. For group C, they are equal to the best results obtained by Hull and Montgomery and by Brown (1) with groups of similar sizes and under much more favorable circumstances.

In the case of girls, Groups B and D, one correlation is high (Group D, rhythmical pressure and criterion, r = .68). But on the whole, they present a graphic pattern which is lacking in consistency. Their lower standard deviations seem to indicate that they are less likely to diverge individually from a reaction pattern common to the group. Under the circumstances of this experiment they show less personality than the boys. And then, it is very possible that they were not given the most objective ratings desirable on the criterion

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(1) Hull, C.L., - "Aptitude Testing", Pp. 149,150.

scale.

We may conclude this study by answering in the following manner the two questions which were asked at the beginning of the present chapter.

1. Yes, there are very probably individual differences in the graphism of the child which correlate to some extent with that aspect of personality called introversion-extraversion.

2. These differences are related to some of the graphic signs already recognised as indicative of introversion-extraversion in the handwriting of adults.

In a new experiment along these lines it would be advisable to introduce the following technical improvements:

1. The rating on the introversion-extraversion scale should be based on the most reliable experimental procedure already tested for studying this trait in children. (1)

2. Each child should give several specimens written at different times and under different circumstances.

3. The specimens should be fair samples of spontaneous writing, e.g., letters written when no thought of an experiment exists.

4. They should be long enough to permit the appraisal of signs 6 and 7 (straight, broken, or sinuous lines).

5. In the analysis of the specimens the primary signs of speed should be modified so as to suit the imperfect maturity of the writers. For instance, sign 4 of speed (connection of diacritical signs with the following letter) is not likely to appear under the pen of a writer who

(1) Marston, L.R., - Op.cit.

has reached neither the word not the sentence impulse. In sign 2 (tendency to the right or to the left), and sign 5 (letters curtailed or carefully formed at the end of words), the divergence from the standard copy need not be so considerable as in adult writing to warrant a positive or negative score.

CHAPTER VII

SUMMARY AND CONCLUSIONS

Handwriting is the permanent record of man's expressive movements. It bears the stamp of the individual personality; it is the product and the expression of both nature and nurture; its development follows the curve of man's physiological maturation and intellectual progress; it varies with the writer's moods and emotions; it adapts itself to the changes of the social environment and reflects in various degrees the fashions of the day. No wonder that the students of human nature have always entertained the hope that, once a key is found to decipher the psychological meaning of its changing features, a great advance will be made in the knowledge of character and personality.

The pioneers in the science of the interpretation of handwriting were two Frenchmen, Abbé Michon and Crépieux-Jamin. Michon coined the name "graphology" and published his treatise in 1875. Crépieux-Jamin, his continuator, is still living. His life has been a long - and somewhat successful - effort to make graphology both scientific and popular.

Germany contributed its usual share to the development of the new discipline: meticulous psychophysical measurements and broad metaphysical doctrines.

In America, Dr. Downey was for years the only psychologist who made use of handwriting tests in the study of personality and investigated with a sympathetic attitude the claims of graphology. But educational psychologists, bent on finding the motor factors of excellence in

in penmanship, contributed a wealth of experimental data which made possible what Dr. Roback very aptly calls a "new" graphology. (1)

The man who successfully broke away from dogmatic speculations in graphology and brought order into the growing heap of experimental findings on the handwriting movement was Dr. Robert Saudek, a Czechoslovakian of cosmopolitan culture, who could study at first-hand the various national handwritings and take from each school its real contribution to a truly catholic science of graphology.

Everything that Saudek published on graphology will retain for a long time an important place in graphological literature. But his personal contribution to the growing science could be summed up in his three methods of (a) determining the relative speed of handwriting, (b) appraising the standard level of personality, (c) diaghosing dishonesty from handwriting.

That these methods are founded on sound experimental evidence, I am quite ready to admit. But, except in his discussion of the signs of dishonesty, Saudek does not give the actual number of cases on which he based his conclusions, and he does not translate his assertions in those statistical terms which are more and more widely accepted as the universal language of scientific research workers in psychology, education and allied sciences.

Statistics were used lately by some American workers in the common field of psychology and graphology, but without any clear description of the graphic signs employed, and without any justification

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(1) Roback, A.A., - "Dr. Robert Saudek", Character and Personality, 1935, 3, p. 265.

of their choice.

It has been the purpose of the present study to bridge the gap between the two methods on a well-defined point. Introversion-extraversion was determined with the aid of questionnaires. The scores obtained were taken as a criterion. Then the graphic signs established by Saudek were tried as means of diagnosing the trait taken for study. When they proved to be insufficient, other signs were singled out and arranged in a battery which is described, discussed and presented to whoever wishes to criticize or to improve it.

First, I turned my attention to the handwriting of subjects suffering from two forms of psychosis generally accepted as correlates of the two constitutional types under study. Then in a first normal group, I chose the cases showing definite introversion or extraversion, and I took from their script what I considered the most outstanding features all subjects of each sub-group had in common. These new features, combined with a few that had been retained from Saudek's signs in my study of psychotic scripts, became the battery, which, applied to the entire first experimental group, to a second less homogeneous group, and to the abnormal subjects again, gave correlations which put this battery on a par with most personality tests already in use.

The ontogenetic aspect of the traits could not be ignored. Be they mechanisms, constitutional tendencies, or what not, they are generally believed to be better described as invariants which cannot undergo a radical change without imperiling the integration of the

personality. Has our battery of graphic signs enough resiliency to manifest this relative unchangeableness of the type through the process of maturation and the vicissitudes of life? A study of the variations of the graphic scores of introversion-extraversion from childhood to adult age gave the question an answer which strengthens the position of both our battery and the popular belief in the actual unchangeableness of types.

Having proceeded backwards from the mature handwriting of the adult to the formless script of the child, I was curious to know whether some lineaments of the graphic features of adult introversion and extraversion could be recognized in the early attempts to use the pen. The results are not negative and they justify further research along the same lines.

Realizing that the greater refinements attained in measuring pressure with more and more complicated apparatus were taking the experimenters farther and farther away from the practical application of graphology to psychodiagnostics, I tried to show that a qualitative distribution of point-pressure into three well-defined groups gave results which compared very well with those obtained in the highly artificial conditions of the laboratory where the pressure-scale or the pressure-pencil are used.

The whole study indicates conclusions as follows:-

1. For general purposes of graphological analysis, rhythmical point-pressure is rated with a sufficient degree of precision when one makes use of the qualitative grouping into the three classes of slight,

medium and heavy pressure described in the present dissertation.

2. Further experimentation with more refined apparatus is necessary before we may take the kymograph record of pressure as a measure of the vertical rhythm of the handwriting movements much more reliable than that obtained by means of observation with the aid of a magnifying glass.

3. In rating pressure according to the method of observation accepted here, the graphologist will be greatly helped if he is informed of the actual width and resiliency of the pen used.

4. In rating vertical rhythm with the pressure pencil, or the pressure scale, the kymograph records will not tell the whole story until some means are found to record the action of the extensor muscles of the hand and fore-arm.

5. The signs of relative speed and slowness established by Saudek are not sufficient to distinguish either the scripts of schizophrenic patients from those of manic-depressive subjects, or the scripts of normal introverts from those of normal extraverts.

6. However, these signs have an indicative value. The primary signs may be retained as a group, and two secondary signs, slightly modified, may be used as separate predictors.

7. For the purpose of diagnosing introversion-extraversion, the initial and the final pen-adjustments are of value if grouped according to McAllister's quadrants.

8. From the discussion of these signs, and from the observation of introverted and extraverted handwriting, a battery of nine signs has

been established which gives scores correlating in a satisfactory degree with those of questionnaires already in use to diagnose introversion-extraversion.

9. These signs are all opposite pairs of deviations from the normal school copy. The deviation in one direction means introversion, in the opposite direction it means extraversion.

10. All these signs may be observed in a specimen of handwriting written without the observance of any laboratory procedure.

11. Adding to the battery a tenth sign which requires experimental procedure in the writing performance does not raise to a much higher level the validity of this graphic test.

12. This battery of nine graphic signs, when applied to the scripts of schizophrenic and manic-depressive patients, separates them into two well-defined groups.

13. A few of the signs of the battery, taken separately, have a very high correlation with either psychosis.

14. None of them, taken separately, has a high correlation with normal introversion-extraversion.

15. The weighting of the signs by means of elaborate statistical methods does not change noticeably the predicting efficiency of the battery.

16. In the present state of our knowledge, it seems preferable to reduce the fifteen-point distribution of the graphic scores of introversion-extraversion to a five-point one where the central group would include six points of the original score, or two standard deviations -

one on either side of the mean - the next outlying sections would include three points, and the remotest sections would include the extreme cases. The general population would thus be distributed according to the normal frequency curve into extraverts (E), ambivert-introverts (A E), ambiverts (A), ambivert-introverts (A I), and introverts (I).

17. In the course of his life, from the age of graphic maturity to adulthood, i.e., from 10 years onwards, a subject shows slight fluctuations in his graphic scores.

18. These fluctuations do not shift his graphic score outside one standard deviation of the normal distribution, i.e. beyond three points on the scale.

19. In every case where a variation in the graphic score brought the fluctuation curve beyond the limits of a standard deviation, it was found that this extreme variation coincided with serious physical illness or with deep-reaching psychological maladjustments experienced by the subject.

20. A complete and definite change from one style of handwriting to another does not prove to affect the graphic score of introversion-extraversion. This holds true whether the change is imposed upon the subject or spontaneously adopted by him.

21. The analysis of the handwriting of children of ten years or below does not yield very definite results with the present battery. However, there is some indication that, with some refinements and modifications, the same graphic features or their early prototypes

may eventually be used in diagnosing introversion and extraversion in children.

In the present study, care has been taken to describe as fully as possible the graphic features accepted as significant. Typical samples of each feature, not already demonstrated in Saudek's works, have been reproduced in various charts. This was done in order to allow other workers to verify the findings here given, and to test the value of the battery on specimens which they have in their possession. The ultimate purpose is to make the diagnosis of introversion-extraversion from handwriting an achievement possible for all well-trained psychologists. But a note of warning must be sounded here: if a serious study of the signs given here is sufficient for one who limits himself to the diagnosis of clear cases of introversion or extraversion, it is utterly inadequate for research work or even for the diagnosis of ambiguous cases. Unless one has acquired the "clinical eye", he should no more venture to "read" a difficult script than he would dare interpret a puzzling radiograph. After years of study and research, Dr. Saudek published his monumental "Psychology of Handwriting" in 1925. Yet, he was writing to a friend in 1930: (1) "I have to study each writing for 30-90 minutes before I can satisfy myself about its conclusive symptoms". Of course, it is a great deal easier to trace out a single feature, such as introversion-extraversion, than to bring out a life-size picture of the whole personality from a

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(1) Roback, A.A., - "Dr. Robert Saudek", Character and Personality, 1935, 3, p.265.

page of written text. But, for one who knows by experience how long one may have to pore and pain before seeing anything in a script, Dr. Saudek's example is a consolation as well as a lesson. When many research workers have followed in his steps with the same conscientious care not to forego the canons of scientific investigation, graphology will forever be distinguished from the various popular guessing games that go under its names.

In psychodiagnostics such a science could render great services. When a few more personality traits have become ratable from graphic features, the clinical psychologist and the vocational counselor will be able to draw the psychogram of a subject without having to put him through time-consuming laboratory tests, and without having to gauge by accessory and often unreliable means his comprehension of the questionnaires and his truthfulness in answering them.

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APPENDIX

I. Personal Questionnaire (Menzies-Webster)

PERSONAL QUESTIONNAIRE

DIRECTIONS

NAME _____ Sex _____

Please answer the following questions concerning yourself as accurately as possible. Answer each by circling one of the four letters at the end of the question. Try to answer all questions. The interpretation given the letters is as follows:

'a' a definitely negative answer such as No, Never, Under no circumstances.
'b' such answers as Sometimes, Occasionally, Slightly.
'c' " " " Generally, Usually, Often.
'd' a definitely positive answer as Always, Invariably.

1. Do you feel a good deal of hesitancy over borrowing an article from a friend? .... a b c d
2. Does it make you uncomfortable to be unconventional? ..... a b c d
3. Do you cross the street or go out of your way to avoid meeting some person because of unpleasant thoughts connected with that person? ..... a b c d
4. Can you stand just criticism without feeling hurt? ..... a b c d
5. Are you affected by the praise or blame of others in your presence? ..... a b c d
6. Do you feel self-conscious in the presence of superiors? ..... a b c d
7. Are you slow in making decisions that involve some hurt to your feelings? ..... a b c d
8. Are you troubled with shyness? ..... a b c d
9. Do you worry too long over humiliating experiences? ..... a b c d
10. Do jeers humiliate you when you know you are right? ..... a b c d
11. Are your feelings easily hurt? ..... a b c d
12. Are people successful in taking advantage of you because you do not want to hurt their feelings? ..... a b c d
13. Do you work better if you are blamed? ..... a b c d
14. Do you worry over possible misfortune? ..... a b c d
15. Are you self-conscious when walking on the street? ..... a b c d
16. Do you experience very pleasant or very unpleasant moods? ..... a b c d
17. Do you meditate and think about yourself? ..... a b c d
18. Do you have difficulty in forgetting unpleasant experience? ... a b c d
19. Do you stumble and fall over things more than most people? .... a b c d

1. Do you daydream about improbable occurrences? ..... a b c d
2. Do you feel 'just miserable'? ..... a b c d
3. Do you prefer to play solitaire rather than bridge? ..... a b c d
4. Do you think you could become absorbed so permanently in work that you would not notice a lack of intimate friends? ..... a b c d
5. Do you find telling others your personal good news is the greatest part of the enjoyment of it? ..... a b c d
6. Do you enjoy spending an evening alone? ..... a b c d
7. Do you like to make new friends? ..... a b c d

8. Do you take the lead to enliven a dull party? ..... a b c d
9. If you have a decided opinion on a topic are you forward in expressing it? ..... a b c d
10. If you are going for a walk do you prefer to go alone rather than with others of your own sex? ..... a b c d
11. Do you act on suggestions quickly rather than stop to think? ..... a b c d
12. Do you keep quiet when out in company? ..... a b c d
13. Do you have the experience of being unable to apply yourself to work? ..... a b c d
14. Would you prefer to take part in athletics calling for co-operation (as in basketball, hockey, etc.) to those where competition is individual (as in swimming, track, etc.) ? ..... a b c d
15. Do you enjoy organizing activities? ..... a b c d
16. Can you easily drop your work and assume a play attitude in recreation? ..... a b c d
17. Do you cross the street, or go down a side street, in preference to catching up with a friend simply because you prefer to be alone?..... a b c d
18. In a group of friends is your behaviour reserved rather than assertive? ..... a b c d
19. Do you prefer a play (not of the musical comedy type) to a dance? ..... a b c d