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BEHAVIOR FACTORS IN HANDWRITING IDENTIFICATION

A. NAFTALI

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Identification in the legal sense may be considered as the definite recognition of an object, person, or activity on the basis of prior knowledge. In handwriting identification an expert is indirectly functioning as a witness to the identity of a person. In his procedure of work behavioural factors affect both the identifier and his means of identification—the writing. This paper will deal—first with the behavioural aspects related to the examiner of questioned documents and his methods and secondly with some behavioural factors influencing writing.

The role of the examiner is usually neglected when methods of forming scientific opinions are considered. Much has been written about errors of eyewitnesses due to limitation of perception, retention and interpretation, which are in turn related to the personality of the witness; but in science, even in experimental psychology, the experimenter is rarely ever included in the evaluation of the experimental results. Since in handwriting identification the personality of the expert is of the greatest importance, it is necessary to first examine his role as a witness to the identity of a person. What are his media of identification in their various stages when perceiving, remembering, comparing, eliminating or recognizing, and finally concluding with moral certainty the identity of authorship.

METHODS OF IDENTIFICATION

Generally speaking, there are two distinct kinds of identification. One is the "objective" method of comparing, measuring, or analyzing physical characteristics by their shape, number, location, or combination as is used in fingerprint identification

and in chemical analysis. The other is the direct non-analytical method of identifying faces, familiar objects, voices, tunes, and other "Gestalt" patterns by the process of quick comparison with earlier impressions retained as memory traces. These complex memory traces provide a subjective certainty of definite knowledge, usually called familiarity. A combination of objective and subjective methods is also used as for instance in medical diagnosis where laboratory techniques and clinical signs or impressions lead to the identification of a disease.

The objective method of identification relies on two factors: on the unchangeable character of classifiable physical properties observed, and on reasoning about the probabilities of the kind, combination, and pattern of identical signs occurring by chance in two different objects. In this method the prior knowledge required in any identification procedure is provided by standard procedure accessible to all and the evidence for the identity may be demonstrated to any intelligent observer by quantification or direct inspection. Not so in the subjective non-analytical method of identification where the prior knowledge cannot be communicated to others because it is based on memory, as for instance in an identification parade. The process of identification takes place in the central nervous system of the identifier who can at best state the reason for his familiarity with a person and point to details in his appearance.

For forensic purposes this second form of subjective identification or recognition is of prime importance, for it is our natural way of orientation in the environment and it permeates our daily

life. From early morning when we identify the hour by the position of the hands on the clock or distinguish between the right and left slippers by their form and relative position until the evening when a look at the sky tells us something about the next day's weather, we continuously interpret images, sounds, and signs which identify for us what we consider to be facts. The act of recognition may be a conscious process deliberately undertaken or it may come as a snap decision experienced as a sudden insight, possibly verbalized as "that's it". But recognition may also just be there as subjective certainty, never doubted but simply entering our minds as facts at the moment of perception.

Obviously also, the entire legal procedure, namely the task of fact-finding, depends heavily on this kind of identifying or eliminating decisions. The police officer at the scene of a crime, or reading statements of witnesses while seeking to apply a particular section of the criminal code to the particulars of an act is constantly perceiving and comparing images and signs or the meaning behind words until the two sides fit in his mind. Objects, persons, and their actions are identified not only by direct recognition of witnesses but also by verbal description or traces left at the scene of the crime. Persons may be identified by their gait and other patterns of movement, and even motives are identified by inference from overt expressive behaviour.

All members of the legal profession must rely on the same type of impressions; a judge may identify a falsehood by the blushing and stammering of a witness, or an attorney may identify the lack of interest of a judge who is "obviously" not listening to his argument and in fact "looks as if" he will presently fall asleep. To sum up, we heavily rely on our little pet signs for identifying facts—developed through empathy or by trial and error—signs forming a curious mixture of truth, imagination, and prejudice.

THE TASK OF THE EXAMINER OF Q.D. AND HIS METHOD OF WORK

In handwriting identification, the expert is called upon to identify a person by comparing recordings of movement, that is to say, by inference. His task is not performed through comparing and calculating fixed characteristics as is done in the objective method. It is also not the subjective form of direct identification based on

memory traces of fixed characteristics. In a way the handwriting expert may be compared to a witness identifying a person well known to him by his gait, posture, or other frequently perceived complex movement patterns without seeing his face. For the handwriting expert does just this: He compares traces of purposeful motor behaviour recorded in conventional symbols with a writing instrument in various situations. While the conventional symbols put some limitations on the free expression of individual movement patterns, the handwriting expert is in a slightly better position than our witness who can only compare fleeting impressions, for *he* can examine the records of that movement at his leisure. On the other hand, the examiner of Q.D. may have never seen the man whom he tries to identify, and he must attain his "earlier knowledge" from the so-called standard writing of an individual which is assumed to be representative of his motor behaviour.

Thus the task of the document examiner is somewhat similar to that of an art critic trying to establish authorship of a painting by getting familiar with other works of the same painter. All considerations regarding period, style, mannerism, content, means of expression, wilful changes, or forgeries, so important in the evaluation of creative arts, are prominent in the process of judging a piece of writing. To get at the causes of the subjective certainty of an examiner of Q.D. and also at the source of possible errors of judgment, the *mental process* involved in *comparing visual images* must be studied.

Let us first consider a child taking an intelligence test: its task is to fit a square piece of wood into one of the differently shaped holes in a board before him. He moves his eyes to and fro easily rejecting the round and triangular holes, hesitating over the rectangle and then, with an exclamation fits the square into the proper hole.

Then observe a witness—say a victim of robbery—going quickly through dozens of photographs of suspects at the police station, when with incredible speed he rejects one after the other, hesitates sometimes, picks out several for further scrutiny and then exclaims suddenly "that's the man!". It is as though a transparent but very clear image of that man had quickly been passed over each of the photographs showing at a glance obvious differences or similarities. But now—in contrast to the case of the child—the bystander cannot judge the correctness of the decision, because one of the compared objects is no longer

visible, it only exists as mental image in the brain of the witness.

In order to understand the mental activity of a document examiner, sitting at his desk, scrutinizing and comparing the details in a standard writing with those in a questioned document, let us consider the physiological processes involved in the retention and recall of images.

From the works of Hebb and others (11, 12, 19) on the organization of behaviour it would appear that images are retained through "imprinting" on selected parts of the brain by electrochemical reactions. These patterned electrical changes in the brain are what Hebb calls cell assemblies, consisting of neural cells electrically charged and connected with each other in a closed circuit. Cell assemblies related to visual impressions may be presumed to have the "code", if not the pattern, of the picture perceived, for they are capable of reproducing that picture both mentally, and as in the work of a painter, on canvas. The actual presence of anatomically structured "brain images" may be inferred from the following: If patterned memory traces are retained from movements perceived in the environment, they will invite imitation and they may actually be stored as action patterns for future behaviour, capable of producing patterned movement forms even if they had never been executed previously. For instance: If a man under hypnosis is told to be Napoleon or to pretend to be a woman, he will perform extremely complex tasks on the strength of a mental image and on the cue of a mere order.

The perception of an image and its recall may be influenced by conscious attention or in physiological terms by the amount of neurohormones produced in a given situation. Hormones help to impress an image on our mind with varying intensity and indelibility and hormones seem to give us the faculty to single out and put into the foreground selected images by mere concentration while other memory traces are fading into the background.

The dangerous effect of selective mental concentration is well known to the experienced examiner of questioned documents. If an examiner after having identified a piece of writing then tries for the sake of control to prove himself wrong by attending to *dissimilarities* he may discover to his horror that in many cases he will now see strong evidence in favour of non-identity. We can only conclude that expectation influences perception—

that images concentrated upon seek out their own likeness.

From Osborn (24) to Harrison (10), Hilton (13), and a host of German authors (4, 9, 20, 21, 27, 38, 39, 43, 44), many have pointed to this process of selective perception in handwriting examination while the schools of Gestalt-psychology and various methods of projective testing, elaborate on and use this phenomenon as a matter of routine. In conclusion it may be said that the mental integration of images leading up to either identification or elimination is influenced by behavioural factors changing the focus and the level of attention, the "set" of the examiner at the time of comparing, thereby affecting his ultimate decision.

BEHAVIOURAL FACTORS INFLUENCING WRITING

We have earlier stated that the examiner's basis for identification is obtained from a standard writing, which is assumed to be representative of the motor behaviour of one person to the exclusion of all other persons. After comparison with the questioned document, *identity* of authorship is concluded, in the absence of consistent differences, on the basis of similarities which by their combination and/or rarity are considered to be unique. *Non-identity* or elimination is concluded on the basis of significant differences which cannot be explained by any reasonable circumstantial factors.

The prevalent explanation of the uniqueness of a person's handwriting is based on uniqueness of personality, namely, the individual habits of his movements on paper causing significant deviations from copybook standards. The problems arising from such a variable medium of identification are usually dealt with in several ways. Some recommend expressing only various degrees of probability of identify. Others, in an attempt at attaining objective methods, simply add one more trait to their list of characteristics to be compared, namely, the degree of "natural variation". Again, others have tried to calculate statistically the evidential value of groupings or combinations of isolated features occurring together. And there is of course common agreement that all factors in the writing situations, such as writing material, purpose, speed, content, etc. must be studied and reckoned with (4, 10, 16, 24, 27, 38, 39).

While the natural-variation-concept and information on the writing situation will help explain

differences between the standard and the questioned writing or may conclusively prove the identity through the presence of the same kinds of variation, the main problem remains: How can the examiner safely distinguish between individual characteristics and class-characteristics common to a group of people like a nation, or a social, professional, or cultural group? The answer is: only by lengthy experience with many specimens from the group in question. Any expert trying to apply objective methods, measurement or any other form of quantification in handwriting examination will find them of aid in classification and elimination of authorship. But it is almost a truism, that for identification purposes handwriting cannot be treated on principles borrowed from fingerprint identification and that all such schemes have failed when anyone but their author tried to apply them. (16, 18)

It is therefore only natural that examiners of questioned documents are endeavouring to increase their knowledge by seeking new aspects of this problem. One such aspect is the medical one.

An attempt at studying the handwriting problem from the medical or neurophysiological point of view has been made by the Hamburg psychiatrist Pophal (29-34). On the basis of the work of Pophal and others (7, 15, 17, 19, 22, 23, 25, 26, 35, 36, 37, 41, 45) it is possible to discern five elements which influence writing:

1. Inborn movement forms.
2. Acquired movement patterns.
3. Changing neuromuscular tension.
4. Mental image of the desired writing form.
5. Behavioural factors in the specific writing situation.

The *first* element, the *inborn movement-forms*, have repetitive rhythmic character and are connected with reflexive and instinctive behaviour. These inborn to and fro movements, such as waving, nodding, rocking, appear in handwriting as alternating extensor and flexor action in the rhythmical up-and-down movement of the hand progressing to the end of the line. Its purest manifestation is the simple up-and-down movement as in the letters m, n, w. It also influences the speed and rhythm of writing of other more complex letters. This up-and-down motion is guided by an interplay of activating and restraining neural impulses emanating from the two antagonistic brain centers Globus Pallidus and Corpus Striatum, and it may be carried out without participa-

tion of higher centers. The rhythmic unit has some measurable qualities expressible in units of duration, size, and force applied. Most qualities of this elementary movement form cannot be measured, but they have specific Gestalt characteristics. These chiefly appear in the micro-structure of the stroke usually called "line-quality". They may be described in such terms as smoothly homogeneous or smudgy, brittle and fringed, as rigid, forceful, firm or soft, evenly flowing or jerky, halting or broken. (Pophal, 33)

This elementary to and fro movement is best executed with medium speed. If the movement is too fast, there is danger of jerkiness or cramp. If it is too slow, it may break up into single movements. Also too strong a pressure will hamper this movement which must be rhythmical and easy: sawing, filing, rubbing of hands—and writing are hampered by too much friction. So the successful to and fro movement shows balance, ease, and optimal coordination, typical of a well-functioning nervous system. The features of these elementary movement patterns are subject to involuntary changes although they are least susceptible to wilful changes.

The *second* element consists of *acquired movement patterns*, whose execution is partly directed by higher brain centers for conscious motor behaviour situated in the cortex (Hebb (12), Pophal (31)). The to and fro movement is a more primitive, elementary form of motor action regulated by brain-stem activity. The acquired movement patterns including isolated directed movements are more differentiated, being phylogenetically and ontogenetically newer. In present-day writing habits the two forms of motor behaviour are interwoven, because our writing requires both the rhythmical continuity of up-and-down movement and the quick simultaneous shaping of the conventional letter forms.

It has long been recognized that an individual's posture, movements, gestures, and facial expressions, in short his entire muscular activity—including his handwriting—belong to his behaviour patterns. They are considered to be one of the relatively permanent aspects of personality, having been developed during a person's lifetime on the basis of constitution and heredity, through trial and error, in permanent contact with the environment. The qualities of these movement patterns defy quantification even though they are struc-

tured and permeate an individual's entire behaviour.

Taft (41), Allport (17), Wolff (45), and many others (7, 17, 19, 25) demonstrated the relative consistency of these structured movement patterns recognizable in many of an individual's actions, in his performing little tasks and in other movements even if somewhat disguised. In handwriting these movement patterns modify copybook standards with regard to form, distribution in space and other characteristics such as, shading, size, degree of connection, slant and the entire set of well known features used for classification and identification of handwriting. These individual movement patterns are in fact causing deviations from copybook standards which are the very basis of work of the examiner of Q.D.

Deviations of handwriting from copybook standards are also utilized by graphologists for the purpose of evaluating personality, but a huge gap in communication exists between these two fields of handwriting study. Although there is general agreement that individuality of handwriting is somehow related to the unique personality pattern of the writer, the forensic examiner of Q.D. is still shying away from utilizing the findings of the more serious students of handwriting as a medium of personality assessment.

There is no reason why handwriting should not be used like any other personality test, for it is but a very complex response to a miniature life-situation which is also the basis of all psychological testing. Performance, motivation, social communication, expression and self-projection are all included in this particular form of motor behaviour. The examiner of Q.D. need not accept any claims based on the naive speculations of amateur graphologists, but should take heed of the scientific methodology developed by psychiatrists and physiologists in this field (7, 28, 30, 31, 34, 42, 45). It would certainly be useful, for example, to be able to distinguish between natural expressive movements and "role-playing" in handwriting, an achievement better accomplished with the aid of serious graphology. The relative consistency of natural expressive movements is less dependent on situational or wilful changes than the adopted pose. Therefore some knowledge of the changes *to be expected* in a given situation may provide the examiner of Q.D. with useful information on the "reliability" of a particular handwriting specimen, and help him to explain obvious differences between otherwise very similar handwritings.

The *third* element, *the muscular tension*, is one of the most consistent factors influencing handwriting and at the same time the most important single determinant of changes in handwriting. There is ample clinical and experimental evidence to show that permanent muscular tension is not only a characteristic of the individual but that the changing muscular tension forms part of a person's habitual defences (1, 2, 3, 5, 6, 7, 8, 13, 14, 17, 22, 23, 25, 35, 36, 37, 40, 42). The level of tension rises when the individual is alert to danger but also when merely facing problems of adjustment. It rises in frustration, conflict, and all other stress situations. An individual may not be aware of his adaptive efforts to changing life situations and yet his muscular tension will rise.

Physical movements serve as continuous mechanisms for discharging tension and relieving anxiety. Studies on anger show that the most frequent impulses of response to anger are verbal retort, physical attack, running away, or screaming. All these actions require preparation in the form of tension built up in the respective motor centers and causing fine contractions in those muscles which produce the anticipated activity in reality. If release of that tension is prevented by internal or external restraint, tension will persist not only in those muscles which are principally involved in the anticipated action, but also as generalized tension in all those muscles which serve to stabilize and immobilize the body. Furthermore, internal stimulation, such as increased bladder pressure, heightens the level of muscular tension. The increased tension persists until relieved by an appropriate act. Impulses which cannot break through into locomotor activity or postural shift may take the form of repetitive ticks or mannerisms (Levy).

Not only physical pain makes the individual tense but changing muscular tension has also been observed in persons undergoing psychotherapy. In states of "resistance" patients display stiffness of limbs which is relaxed as treatment progresses successfully so that changes of motor behaviour are considered a most reliable factor in evaluating therapeutical success (Naftali).

The physiological aspects of muscular tension have been examined among others by Pophal (29, 42) who differentiates between two distinct types of tension which are evident in handwriting. One is directed outwards and produces, by pressing the writing instrument against the paper, all varieties of shading. The application of this

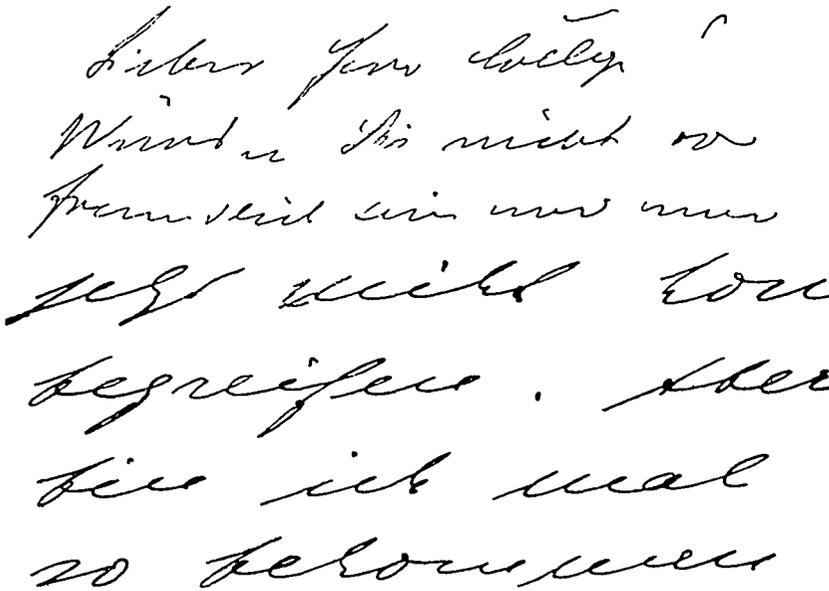


FIGURE 1

Insufficient tension or slackness displayed in the hand writing of two writers (Level I, II)

outward directed force releases tension and is called "pressure" (Druckspannung). The second form of tension stabilizes the joints of the hand by contraction of all muscles participating in holding the pen. It is produced by static energy and it is called by Pophal "stiffening tension" (Versteifungsspannung). *Pressure* is characterized by the rhythmical alternation of tension and release in the up-and-down strokes while the *stiffening tension* or better still gripping tension is a static form of "isotonic" muscular contraction, the polar opposite of which could be slackness.

In dealing with this permanent tension, Pophal established *five levels of stiffening of the joints*, which he found to be *indicative of the general state of muscular tension of an individual*.

Level I *Insufficient stiffening* or slackness causing sloppy movement. Here the effect of the activating brain centers has the upper hand, while the restraining action of the corpus striatum is too weak. Activating impulses are causing loose movements of the writing instrument which is slipping in all directions. (See Figure 1.)

Level II *Some stiffening* allowing relaxed repetitive movement. Here we have the perfect coordination of activating and restraining brain centers (Globus Pallidus and Corpus

Striatum) typical of the easy flow of repetitive inborn movement forms.

Level III *Moderate stiffening* producing well controlled elasticity of movement and poise. (See Figure 2) This level differs from the previous level by the added action of the cortical guidance. Single well controlled movements are carried out by the cooperation of the three centers. This stage is the ideal of human motor behaviour for here we find elasticity but not as loose as in level II, and here we find poise and control but not as rigid as in level IV.

Level IV *Excessive stiffening* causing tenseness, rigidity or inhibition of movement (Figure 3). Here there exist two possible manifestations of tenseness depending on which of the three cooperating brain centers plays the dominant role in the individual concerned. Inhibition of movement and poor line quality are caused by the over-activity of the inhibitory brain mechanism, while regularity and rigidity will appear in the handwriting of individuals whose personality is dominated by the higher brain centers. Voluntary control or compulsive behaviour may produce rigid forms and still show good line quality, i.e., homogeneous smoothness of the structure of the stroke.

es beweisen, daß ich so trau-
rig bin, ein Märchen aus
uralter Zeiten — —
zu dir fortan. Tyling Daburoge
dant zu foup, im des lange üba

FIGURE 2

Moderate tension or "poise" as displayed in the writing of two persons (Level III)

A
 dessen alle w. suchst,
 diesen Mittel - telet
 stärkungsmitteln, die
 das ganze Körperkrieger
 sein. how bald einmal etwas von
 heute hermit gegunnt von ihm

B
 see was es sitzt gees
 treest eies ptra fies,
 if see was 30 11 9 cevees

C

FIGURE 3

High tension as revealed in handwriting. Example A, tension in lower brain centers causing poor line quality. Examples B and C, cortical tension causing stereotype forms with good line quality (Level IV).

Level V *Extreme stiffening* causing cramps and jerky movement or near-immobilization (Figure 4). Here we have the extreme irregularity of chopped-up forms and poorest line quality. The movements of the writer

are analogous to the movements of a car attempting to break on an icy road, or a car trying to move fast with the brakes on.

From the works of Grunewald (9), Gross-Haase (11), and the experimental work of the author

A
 die drucklose Quastion auf
 nicht los. Will nicht Kraft die mir
 et mit dem Plettchen. sonst geht es
 besser hinweller. in haben

B
 die Sonst ich noch schreiben, das ich
 der Zuspinnung des Nervensystem zu
 fingen in der fette. die igant sind
 der druckling (sonst die für die
 Ziffern die nicht mehr soll so beduten
 C
 dass es so schwierig bin in die fassen
 und malten Ziffern

FIGURE 4

Three examples of high tension. Examples A and B, activating and restraining brain centers both very tense causing poor line quality and lack of control in shaping of forms. Example C, wilfully cramped hand causing general impediment of movement (Level V).

(23), it can be shown that Pophal's five levels of tension reflect both permanent muscular tension and changes in personality resulting from psychotherapy and/or changing life situations. They are, in fact, a direct reflection of an individual's adaptation potential—the manner and ability of responding to changes in the environment.

The samples in figure 5 show the changes brought about through psychotherapy or any therapy of psychosomatic diseases and differences caused by stressful life situations. The last sample in this series is of special interest because it shows that important changes in handwriting are possible within minutes if the writer for some reason achieves quick relief from tension. In this example this relief was effected by a deep relaxation exercise practiced twice for 3 minutes in one session lasting less than ten minutes. The irregular and rather jerky movements in the sample before the exercise

was practiced, had become rounded and better directed in the last sample because the joints of the hand holding the pen had lost their stiffness thereby facilitating all the turns and small movements necessary for letter shaping. Note that the direction of the changes produced is similar to that produced by psychotherapy.

The fourth element refers to the effect of the mental image of the desired writing form which is originally caused by copybook standards and strongly influenced by changing taste and developmental factors during a person's lifetime. But it is also well known that young people and some adults adopt forms and mannerisms of writing from the handwriting of their friends or superiors. Some very impressionable people, when concentrating on the writing of a letter they are about to answer, will produce writing similar to that of the addressee through the sheer process of

empathy. Lovers who correspond frequently, married couples or members of the same family, also tend to develop similar traits in their handwriting. Whether these latter similarities are the results of identical movement-patterns—inborn or acquired—or the result of “empathy”, they can be misleading.

Even temporary concentration on movements or forms recently perceived in the environment, may cause foreign elements to appear for a brief space of time in a person’s handwriting. Two cases observed by the author may illustrate this point: a police officer investigating an anonymous-letter case had been reading the letter and scrutinizing the writing in it for a long time. He then copied the text in longhand for some administrative reason—and two days later was suspected of having written the letter himself. This, because the officer, either susceptible to empathy, or in a playful mood, or just being tired at the time, had thoughtlessly copied not only the contents but also the style of the writing. In another case, an offender, before signing a confession, had been very carefully reading his statement, in which his name appeared several times in the handwriting of the recording officer. Being a manual labourer he had not developed any characteristic signature, so when signing he simply wrote his name in a style very similar to that of the police officer who had written the offender’s name in longhand also at the bottom of the page. Since the man used the officer’s thick ball-point pen the resulting similarity was so striking that the latter became briefly suspect of having signed the confession himself.

In short, there is evidence that sensory-motor integration in the brain works in both directions through neural connections between reception and action, causing “feedback”, overlapping and temporary “imprinting” of foreign movement patterns.

The *fifth* element—the writing situation—is well known to all examiners of questioned documents. It may be added that temporary physiological impairment of the central nervous system caused by *any* over-exertion, may produce states of a lowered frustration tolerance, which will have a similar effect to that of great hurry: an urge to complete, which makes the writer more impatient, and careless in the execution of forms. Anxiety poses a special problem. It was shown by Pavlov, (26) Sargant, (36) et al that there are two main responses to anxiety and breakdown under stress: one is the outward directed active form, causing

excessive movements, while the other amounts to passivity, withdrawal and immobility. Consequently, in states of anxiety or great excitement, we may expect either enlarged, irregular movements, or forms that are reduced in size, shading, and firmness. Joy, on the other hand, usually makes the writing bigger and its flow smoother.

The effects of drugs have been studied, with varying results. Present day knowledge would indicate that writing reflects, in fact *is*, behaviour. The same individual responses to identical drugs, known from other spheres of life, apply also to writing. Some people get a steady hand after two drinks or a tranquilizer, while others will lose control over their movements, because of the impairment of motor apparatus or of nerves transporting the “feedback” of movement execution to the brain.

To sum up: situational factors influencing handwriting are common knowledge, but individual adjustment-patterns will produce so many different responses to identical stimuli, that it is very difficult to generalize. We can only repeat the well known fact that in comparing two samples of writing for identification purposes, we should try to have them written in as similar circumstances as possible.

IMPLICATIONS FOR FORENSIC DOCUMENT EXAMINATION

How can the study of changing traits be applied by the examiner of Q.D. whose information about the writer is such that he cannot possibly be aware of all the behavioural factors influencing writing. It is well known that no forger is capable of disguise superior to his own skill: The genuine writing usually shows a better line quality than the disguised sample, a fact which is always considerably helpful in narrowing down the circle of suspects. Similarly, the examiner of Q.D. might be in a better position to evaluate the bits of information at his disposal, if he has some idea about the direction of *changes to be expected* from two given writing-situations. It is obvious that tension is higher if wilful changes are at work or if a suspected person gives specimens of handwriting, under dictation at a police station, or even when copying a text instead of freely writing it. Greater awareness of the significance of a writing act and any abnormal writing situation raises tension. Similarly, the medical experience of Pophal and others may be incorporated into the knowledge of the examiner of Q.D. who has reason to believe

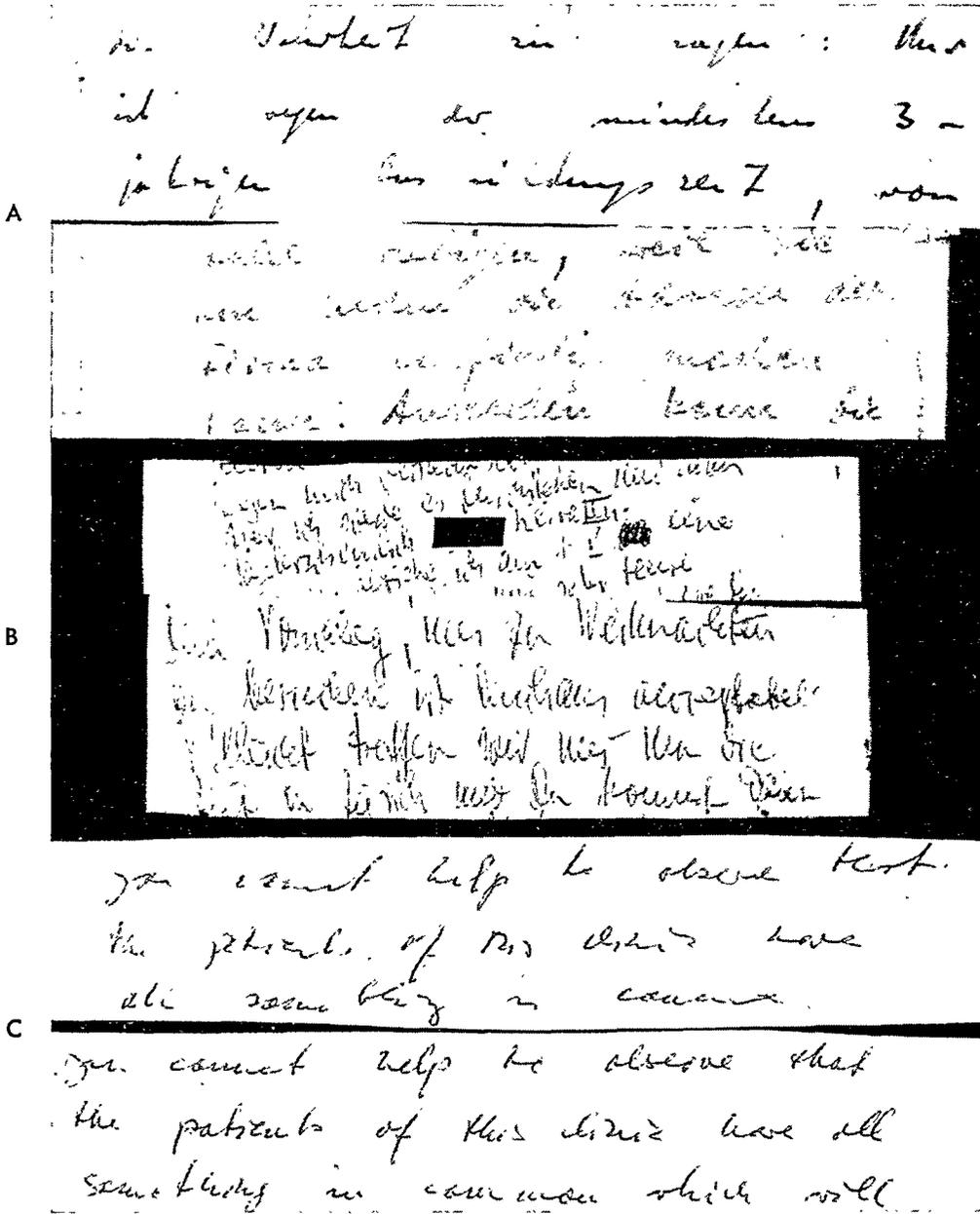


FIGURE 5

Examples of changing tension in the same writer. Example A, handwriting of a young male before and after psychotherapy. Example B, writing of an adult in stressful life situation compared with normal writing below. Example C, reveals changes within ten minutes through relaxation exercises.

that one specimen was written in a more stressful situation than the other. The examiner of Q.D. may then focus his attention on three possible areas of change: *movement, space, and form.*

Let us look at the effect of lessening of tension on each of these areas separately, starting at the

more primitive and least susceptible to wilful change.

1. Referring to Specimen *a* of figure 5, the elementary *movement* becomes smoother and more rhythmic if it had earlier been either rigidly regular or of poor line quality. The line quality

is always improved, and there is more continuity and cohesiveness of movement,

2. The *spacial distribution* is more even in all three specimens of figure 5. Two possibilities exist here, depending on the type of writing in the tense sample. If this shows excessive narrowness or cramping, the lessening of tension will cause the writing to literally develop and branch out. But if the tense sample has an uneven distribution in space with the letters falling asunder, then the relaxed sample will be more cohesive and orderly. In both cases improvement always tends towards Pophal's level III, the ideal of coordination.

3. Also regarding *form* (see figure 5) two possibilities may occur depending on the type of writing. If the forms had been complicated and elaborate, or extremely rigid and stereotype in the tense sample they will become simple and more natural. But if there were neglected or sloppy forms, they will become better defined, truer to copybook standards and more orderly.

SUMMARY

Medical experience in the evaluation of handwriting changes may be added to the points of consideration of the examiner of Q.D. Responses to stress or the changing health situation of a person as well as the effect of psychotherapy, have considerable influence on a person's permanent muscular tension which in turn will influence certain handwriting traits. *Therefore a piece of writing should not be considered as representing a person but rather as representative of that person at a particular life period and in a specific situation.* The direction of the changes to be expected has been discussed and demonstrated with regard to the three main areas: movement, space, and form.

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