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The late Ordway Hilton was for many years one of the foremost experts in the field of forensic document examination in general and handwriting examination in particular. His magnum opus was *Scientific Examination of Questioned Documents*, originally published in 1956 and published in revised form in 1982. He also wrote *Detecting and Deciphering Erased Pencil Writing*, published in 1991. He wrote more than 90 published articles and presented many other papers at professional meetings. From 1959 to 1960, Mr. Hilton served as President of the American Academy of Forensic Sciences and from 1960 to 1962, President of the American Society of Questioned Document Examiners. Ordway Hilton died in 1998 after 55 years in the profession of forensic document examination.

In the following article, Mr. Hilton outlines some of the basic rules of handwriting identification. Mr. Hilton held degrees in mathematics and here he applies the form of mathematical rules

and corollaries to the principles of handwriting examination. The result is concise and cogent treatment of the basic principles undergirding the identification of handwriting. The reprinting of this article is considered especially timely given the increased scrutiny that handwriting examination has been receiving in some court systems. While some of the material is a bit dated (research using computers is now confirming what document examiners have known all along, that each person's handwriting is individual to that person), for the most part, the information in this article has stood the test of time.

The article was originally published in the April 1963 issue of *Medicine, Science and the Law*, the journal of the British Academy of Forensic Sciences. The British Academy of Forensic Sciences still holds the copyright to this article and it is being republished here with their kind permission.

Some Basic Rules for the Identification of Handwriting

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Articles For the Non-Specialist

The following article by Mr. Ordway Hilton, one of America's leading experts in suspect document examination, is the first of a series of articles written by medical and scientific experts for the lawyer (and other non-specialists) on topics affecting his everyday practice.

The importance to the lawyer, and not only the criminal lawyer, of some knowledge of the basic rules of handwriting identification ought not to have to be stressed, considering the weighty is-

ssues which frequently depend on the authenticity of a document. In the field of criminal law the following offences were known to the police in 1960: blackmail 241, falsifying accounts 1,551, forgery and uttering 6,502, libel 31, while in civil proceedings the disposal of wealth depends on the proof of the signature on an agreement or on a will.

The rules and corollaries stated in this paper represent some of the basic concepts necessary

for accurate identification of handwriting. Rather than attempting to include all conceivable rules, the more important have been selected. Their full comprehension may assist students in becoming proficient in the examination of handwriting but they are far from a cure-all. The accurate identification of writing requires the interpretation of all physical facts found within the writing not only in the light of these rules but also with intelligence and common sense. It is essential to understand how writing is produced and what physical facts result from each and every writing movement. Only then can accuracy and proficiency be attained.

Some Basic Rules for the Identification of Handwriting

The basic rules for the identification of handwriting have long been established. They have been discussed by numerous writers over the years. The present paper represents an attempt to codify some of them as simple statements in the manner of mathematical axioms and basic laws of the physical sciences. Such a presentation may help to clarify the fundamentals of this phase of questioned document examination so that workers with limited experience can better understand the basis upon which this work rests. This approach cannot replace the excellent discussions that have already been published, but rather serves as a summary of certain aspects of the problem.

Individuality of Handwriting

Rule 1. Each mature writer has a handwriting which is personal and individual to him alone.

This rule is the basis of all handwriting identification. Early workers in the field, who pioneered in the scientific identification of handwriting, assumed that no two writers write exactly alike. This assumption has stood the test of time. With the innumerable problems which have been submitted to document examiners throughout the years, there has never been found an example of two writers with identical handwriting.

This lack of identity between two individuals' writings presumes that we are dealing with more than a few lines of writing. With some writers and only two or three simple words, it may be extremely difficult to determine definitely that two specimens were written by different individuals, but as the amount of writing is expanded, the

differences become more obvious. The rule pertains to the whole of a person's writing. Thus, the fact that occasionally with a very limited amount of writing it may not be possible to distinguish between the works of two different writers in no way invalidates the basic rule that each person's writing is individual to him. Nor is it intended by this discussion to infer that normally the writer of two or three words cannot be identified.

Corollary 1. Every individual's handwriting undergoes gradual changes in the course of his life.

Modification and changes come into an individual's handwriting during different periods of his life, but in most instances they are very gradual and may not be discernible except by studying specimens written at widely separated dates. There are certain periods in which these modifications appear more rapidly than others. Early maturity usually is one such period. It probably is due to the fact that writers have completed that phase of education during which their handwriting is under supervision. Now this skill must be put to use in everyday affairs. With some, the changes represent personal innovations, with others a gradual decline due to carelessness and hasty writing and with still another group increased vigour, freedom, and sureness. The long span of middle life as a rule sees only slight modifications, if any. Finally, the declining years may be accompanied by a corresponding decline in writing ability but this condition is far from universal.

Corollary 2. The gradual changes in handwriting which occur during a person's life time while following certain general patterns are individual to each writer.

Writing is an acquired art. In the initial stages of learning to write, a person carefully imitates the copybook writing with as much accuracy as he can. Gradually, as the forms become known to him, this copying procedure is supplanted by a writing process rather than a drawing and imitating process. When this occurs and how it occurs varies with each person. A few never progress past the drawing state.

The periods in a writer's life when his handwriting tends to undergo its greatest changes have already been noted. In early maturity, a person's writing is developing its true individuality, even though as a student his handwriting has some distinct qualities. With

each writer what occurs in his writing is personal, with some little development is found, with others it is pronounced. By the same token, the effects of intoxication, of illness, of nervous tension, of age produce different results with different individuals. For example, some elderly people write vigorously, others "show their age." We can expect certain kinds of changes due to a particular cause, but we must see the individual's writing to know exactly whether and how it changes.

Rule 2. Deterioration of an individual's writing due to any cause affects all of the writing properties and is not confined to changes of one or two elements.

Deterioration in writing results from less accurate co-ordination of the highly complicated, interrelated factors which go into the writing process. Thus, one would not expect only one or two identifying characteristics to be altered, while the others continue to be reproduced exactly as before. Yet, a defence for fraudulent writing which contains obvious evidence of unnatural writing movement is often based upon the assertion that the defects in movement and possibly those forms which were not copied accurately are due to illness. If a person's handwriting is influenced by poor health or the infirmity of age, both its form and quality of execution become less precise. If weakness produces infirm strokes, it is not logical that accurate forms can be maintained. The weaknesses which cause the pen to move irregularly to produce the infirm strokes are going to cause the pen to follow a less accurate track in forming letters than when the writer was more vigorous.

Corollary 1. An individual's handwriting may deteriorate very rapidly due to a sharp physical decline resulting from either severe illness or old age.

Both illness and old age may be reflected in handwriting. Not every serious illness, however, causes a lessening in writing ability. Rather, those which weaken the person so that he is unable to perform skilful operations are most likely to affect his handwriting. Diseases such as heart ailments, high blood pressure, and the like, normally are not accompanied by a deterioration in handwriting, although a layman may attempt to explain away a poorly forged signature by this type of illness. Writing during sickness in which the patient is confined to bed probably reflects more

strongly the effects of adverse writing conditions than the illness itself.

What applies to physical conditions brought about by severe illness also applies to old age. There are many individuals well advanced in years whose handwriting hardly betrays their age. But those older writers who have suffered a general physical deterioration are very apt to write with less vigour and skill.

It is obvious that the converse to the corollary does not hold. That is to say, we cannot conclude that illness or old age always causes a deterioration in the handwriting. As discussed above, there are some individuals who despite illnesses which restrict their physical activity, such as serious heart trouble, may still write with their normal vigour. There are even some writers who can sign a good signature while very weak or near death.

Corollary 2. A transitory change may be injected into handwriting by temporary physical and mental conditions, such as fatigue, nervous tension, and intoxication or severe illness, from which the writer ultimately recovers. In these cases, handwriting reverts to its normal qualities after the causes of deterioration are removed.

By transitory changes are meant those changes which continue only while the basic cause is affecting the writer. Ultimately, his handwriting recovers or assumes its normal qualities when the cause of deterioration has been removed. Both physical and some mental states can affect a writer's penmanship. Thus, fatigue or intoxication may produce a much lower than normal quality of handwriting. By the same token, a person who is extremely nervous or has been subjected to a sudden shock may likewise produce abnormal writing. There are many illnesses in which the writer becomes weak and cannot produce his normal handwriting, but in due course completely recovers and unlike a permanently handicapping disease, such as a stroke with partial paralysis, his handwriting recovers. Thus, in all of the instances discussed, when the handicapping condition is once removed, handwriting again assumes its normal qualities and habits.

Rule 3. A writer cannot exceed his maximum writing ability or skill without serious effort and training applied over a period of time.

Good handwriting is developed by a combination of manual skill and serious, continued practice and training. The skill with which it is executed depends upon the individual and upon the

extent of his formal writing training. While writing ability is difficult to measure precisely, it is one of the more stable qualities of handwriting. Rule 2 and its corollaries set forth conditions under which it may decline even sharply, but under no conditions can there be a sudden surge above a writer's highest level of achievement. Improvement comes only with practice and training.

This fact is of particular importance in the case of disguise or of a forged signature. Employing a strange style of penmanship does not lead to a more skilful writing. Thus, if the ability or skill shown in a disputed writing is appreciably better than the capabilities of the suspected writer, he is clearly not its author. In reaching such a conclusion in a practical problem, however, one must constantly guard against the danger of the standard writings failing to show the highest degree of skill of which the writer is really capable.

Rule 4. Attempted disguise leads to an inferior never a better quality of handwriting.

The preceding rule states that no writer can spontaneously exceed his best handwriting. Disguise for the most part is completely unpractised, and even if it has been practised, it is never developed to the point that the person's writing ability has been improved. Without practice, changes in normal writing habits are bound to bring about a less fluent and less skilful mode of writing. Even practice in disguise hardly enables the writer to achieve his best writing. Never is he able to exceed this level without violation of rule 3.

Corollary 1. A lack of uniformity in execution and form, especially in extended specimens, is typical of disguise.

Corollary 2. Converse. Uniformity of writing qualities in an extended specimen of handwriting is an indication of a lack of disguise.

Disguise is seldom rehearsed. It is an unnatural form of writing. In its execution the writer must concentrate his attention on eliminating personal identifying details and at the same time devise and execute a new style of writing. This task cannot be accomplished on the spur of the moment. We did not learn to write the way we do now in a short time. The end result is that a page of disguised writing contains inconsistencies and irregularities. In contrast, uniformity throughout an extended specimen of writing is the mark of an undisguised, skilfully executed handwriting.

A crude, unskilful, non-uniform writing may suggest disguise, but it can be the work of a semi-literate individual. Writing of this class standing alone may be hard to distinguish from disguised writing until known specimens are made available, but, as a general rule, the semi-skilled writer struggles throughout the entire specimen, while a writer disguising may occasionally insert free and skilful strokes. In other words, disguise may contain writing pulsations – spurts of higher skill.

Rule 5. Writing variation is an essential property of everyone's handwriting.

Variation in writing is a natural attribute, and its extent or range is an individual quality. With some writers successive specimens show wide variations, alternate forms, and a lack of precision in execution. At the other extreme are those who deviate but slightly from a fixed pattern. Two examples of a single, short word may be so much alike that they cannot be distinguished, but with each additional letter and word, the chance of this coincidence is rapidly reduced with its probability of occurrence approaching zero asymptotically.

Corollary 1. The degree of variation in writing tends to increase with more rapid and less careful execution.

A precise and accurate handwriting requires care in its execution and is generally written with a moderate to slow speed. It is based upon a well developed writing skill. This class of writing tends to contain the minimum degree of variations. But with persons who write faster and those who take less care, successive writings are very apt to show wider divergencies. A high degree of variation is common to those who are speedy and careless writers.

Corollary 2. Variation in writing is related to the conditions under which it was prepared.

The writing position and surrounding conditions may have a sharp effect upon the amount of variation between two specimens of handwriting. If one was prepared under normal writing conditions and the second under less favourable circumstances, wider variations between them are to be expected than if both were executed under normal circumstances.

Corollary 3. The purpose for which writings were intended may govern the degree of variation in them.

In general lack of care and undue haste are a mark of informal and impromptu writing. On the other hand important papers may be prepared with greater care. A mark of the former class of writing is a lack of preciseness; of the latter, higher uniformity. Both of these are measured within the framework of the individual writer concerned. Thus, the intended use of the writing may of itself introduce divergencies.

Corollary 4. In repeated specimens of writing prepared at one time, variation tends to be less than between specimens written from day to day.

This corollary is based upon the observed facts of comparing request writing with day-to-day writing specimens. A person who is asked to furnish a group of signatures, and does so by writing them all at one time, seldom incorporates as much variation between specimens as will be found in a study of a comparable number of signatures which were executed even under similar writing conditions, but each at a separate time. Actually, variation in handwriting results from a large number of causes, some of which are at work as a person writes a page of handwriting, while others are found only when the individual writes at different occasions under different writing conditions. Since variation is a significant factor in handwriting identification, this corollary sets forth a definite restriction on the value of request specimens in identification problems.

How Writing Is Identified

Rule 1. The individuality of handwriting is the basis of all identifications.

Rule 2. Handwriting is identified by the combination of all its attributes and qualities, including both those derived from the writing movement and those related to form.

Despite writing individuality, there are common qualities to many writings. These arise from a number of factors. The most common cause, of course, is the writing system which was taught. However, there are instances in which members of the same family tend to write somewhat alike, undoubtedly due to imitation as well as to similar writing backgrounds. Certain types of individuality in writing develop in a number of persons' writings – for example, the common open "a" and "o" which while helping to individualise a writing may not be absolutely unique to one writer. Thus, the individuality in handwriting

which is peculiar to each and every person is actually a unique combination of forms and writing qualities rather than one or two highly distinctive identifying elements.

Every element of writing, therefore, serves as part of the ultimate identification, and a sound scientific conclusion that two specimens are by a single writer cannot be based on only one or two points of agreement. Of course, the writing properties which are most personal have the greatest identifying value, but all others both personal and group characteristics also contribute to the ultimate conclusion.

Corollary 1. Handwriting portrays through its various attributes the writing movements by which it was formed.

The elements of movement such as skill, speed, rhythm, writing pressure, emphasis and shading, location and quality of starts and stops, pen lifts, and the like are reflected in the finished specimen. It is the combination of these and other elements which describe the fundamental writing movement.

It may be possible from a study of the writing to describe how the writing was executed, that is by finger movement or arm movement, but this is not always true. It is possible, however, to distinguish between well developed movement as opposed to the rugged type of execution or the writing of a more primitive nature which is typical of the near illiterate.

Corollary 2. A particular writing instrument may not fully reflect all of the qualities of writing movement.

The various elements which make up writing movement are not always reflected in the specimens prepared with some classes of writing instruments. For example, variation in pen emphasis appears as shading with a flexible pen, but most of this is lost when the writing is performed with a stiff pen. By the same token, pencils and ball pens fail to portray certain basic elements of how the writing was executed, for example, pen position, which may be clearly disclosed when the writer uses a relatively flexible nib pen. If one specimen of writing fails to show certain writing qualities because of the instrument used and another does disclose these qualities, this does not mean that we are dealing with a significant difference between the two writings and that we are dealing with two different writers. The examiner must carefully determine the kind of writing in-

strument used in each specimen and with this knowledge evaluate apparent differences of this nature.

Rule 3. Writing standards are necessary to establish the individual's normal writing habits and to show the degree of variation common to his writing.

This rule actually defines adequate and proper standards. Unless they completely fulfil these conditions their usefulness in any examination is limited. In fact standards which do not comply with these requirements may in certain instances lead to erroneous conclusions, especially in the elimination of a writer who actually prepared the specimen in question.

Corollary 1. The best standards include writing which was prepared for a comparable purpose and under similar writing conditions to the matter under investigation.

With standards consisting of a relatively small sample of a person's total writing, it is well to select them carefully. Statistical studies have shown that a small sample properly selected and controlled may give a much more accurate picture of the whole than the substantially larger but uncontrolled sample. The problem is one of selection and control. Thus, in selecting writing standards all influencing factors should be kept as much like those of the questioned material as possible. This means that writing with similar writing instruments prepared under comparable conditions at or about the same time should be sought. It does not mean, however, that writing which was prepared for very different purposes may not permit an accurate identification. If the two writings contain the same identifying elements, then certainly the identification is valid. It does mean, however, that the best procedure is to seek writing prepared for a similar purpose, as experience has shown that this writing generally leads to the best identification and requires far less interpretation by the expert.

Rule 4. A specimen of writing was written by a particular person if all its identifying elements are a part of his handwriting and furthermore the variation within this specimen falls within his range of writing variation.

Rule 5. Converse. A specimen of writing was not written by a particular person if there exist significant differences between its identifying ele-

ments and those of the suspected writer.

In identifying the writer of the unknown material, the standards must contain all of the identifying elements present in the questioned specimen. These elements include personal writing habits, the manner of execution, and the quality and extent of variation. The known writing may contain elements not found in the unknown. If these elements are rare or unusual characteristics of the known writer, or if the unknown material is very limited, their occurrence does not necessarily invalidate the identification. With longer questioned specimens prepared by the same writer and under similar conditions to the standards not only should the same combination of identifying characteristics be expected but also these personal writing attributes should occur in a somewhat similar frequency in both specimens.

Differences between the known and unknown writing become significant due to their clearly fundamental nature or to the repeated occurrence of the same small, unconscious elements. It is then that the converse rule governs, and the writings are by different writers. Fundamental differences must be clearly distinguished from variables which are a part of every writer's handwriting. Thus, the identification of writing involves certain points of judgment as to whether an apparent difference is really fundamental or is a variable or was introduced purely by chance. Fortunately, in the vast majority of questions, non-identity is established by the presence of not one but a number of significant basic differences.

These rules are basic and fundamental. Others no doubt could be added, but such omissions in this paper in no way detract from or mitigate against the significance of the axioms and corollaries set forth herein. The accurate identification of handwriting depends upon a consideration of each of these rules whenever applicable.