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THE DETECTION OF FORGERY*

ORDWAY HILTON†

The purpose of this paper is to present to criminal investigators and to members of the legal profession some idea of the methodology involved in the detection of forgery.

The basis for this discussion consists of a series of signatures which had been secured by one of the writer's colleagues and used by him in conducting an experiment designed to test the accuracy of lay witness identification of handwriting.¹ These various signatures, which include some well-executed forgeries, provide excellent material for technical analysis and discussion.² They illustrate, in some manner at least, practically all aspects of the forgery problem. For this reason, rather than indulge in a theoretical or academic discussion of the subject of forgery, the writer intends to confine this paper to a detailed analysis of the signatures themselves.

* The author expresses his appreciation to Mr. John F. Tyrrell, Examiner of Questioned Documents, Milwaukee, Wisconsin, for his thorough review of this paper and for the valuable criticisms and suggestions which he offered.

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¹ The results of this experiment are to be found in an article currently appearing in the *Illinois Law Review* (Vol. 34, No. 4), entitled "Lay Witness Identification of Handwriting (An Experiment)," by Fred E. Inbau. The results of this experiment indicate that there is an appalling degree of inaccuracy in lay witness opinion testimony regarding handwriting identification: that is, in the ability of lay witnesses to determine from "mental comparisons" the genuineness or non-genuineness of documents allegedly written by a person with whose writing they were "familiar". Inbau extended his experiment to include tests of other types of identifying witnesses. By allowing a group of lay persons to make visual comparisons between the questioned signatures and standards the results were greatly improved (37% correct against 11% for one group of opinion witnesses and 14% for a second group). Bank employees were also examined and achieved a similar degree of accuracy (43%). Finally, a group of document examiners were tested, and the results of their examination, although not perfect, were far more accurate than any of the other groups (90% correct).

² The seven sets of signatures subsequently discussed in this paper were obtained in the following manner: each person furnished Inbau five signature specimens, written on individual white cards. Then for each writer three additional specimens were prepared on similar individual cards, consisting of one spurious specimen (in which no attempt was made to copy the letter formation of the genuine signature), one free-hand forgery, and one traced forgery. These three specimens, together with one of the genuine signatures, were selected as the questioned signatures; while the remaining four specimens, supplemented by two additional genuine signatures (furnished at a later date) were designated as the standards.

In doing this an explanation will be given of the technique which an expert employs in his examination and comparison of questioned documents. As an introduction to this analysis, however, some mention must be made of the fundamental principles involved in the detection of forgery.

It has long been recognized that a person's signature contains numerous constant characteristics by which it can be identified.³ These characteristics may be divided into two groups: class characteristics and individual characteristics. On the whole, class characteristics are those which result from, and are indicative of, the system of writing which the writer employs: in other words, the general style or form of writing which he has been taught or has adopted. (At times class characteristics and the nationality of the writers become interdependent.) Individual characteristics, on the other hand, result from numerous other factors, such as the writer's muscular control and coordination, his health, age, nervous temperament, the frequency at which he is called upon to write, and to a certain extent upon his personality and character.⁴ Cases sometimes occur, however, in which it is difficult to accurately identify class characteristics and to differentiate between them and individual characteristics.

After a casual examination, two pieces of writing may appear to have been written by the same person, when, in fact, the agreement is only one of class characteristics, and upon further examination, many differing individual characteristics may be discovered. In proving that two specimens were written by the same person, it is necessary to show that not only the class characteristics are the same but also that the individual characteristics agree closely. On the

³ For early legal references, see *Trial of Thomas Harrison*, 5 How. St. Tr. 1008 (1660); *Reilly v. Rivett*, 1 Phill. Ecc. 81, 161 Eng. R. Rep. 920 (1792); *Saph v. Atkinson*, 1 Add. 122, 162 Eng. R. Rep. 57 (1822); *People v. Molineux*, 168 N. Y. 264, 61 N. E. 286 (1901).

⁴ The author realizes that the use of the phrase "upon his personality and character" suggests a controversial issue. While the claims of such investigators as Dr. Robert Saudek, J. Crepieux-Jamin, or other graphologists, are open to debate, nevertheless, the reader must realize that personal idiosyncrasies are at least to some extent responsible for the peculiar modification of copy-book letter styles which occur in almost everyone's writing. These personal variations of letter formation may be compared to variations in dress preference, in mannerisms of speech and walk, and in other habits which are somewhat dependent upon what can be loosely termed the personality of the individual. Just why they exist is not entirely known, but that they do come to be associated with the individual is beyond dispute. In a like manner, we associate to some extent the variations in handwriting as belonging to and dependent upon the writer's personality. As examples of these characteristics there are the artistic handwritings of some artists or the rapid and sometimes illegible writings of the hurried business executive—extremes, of course.

other hand, the fact that two pieces of writing differ in their class characteristics is sufficient evidence, in the absence of indications of disguise, that they were executed by different writers. It follows from this discussion that the primary problem of the document examiner consists of the location and comparison of these identifying characteristics—and especially of the individual characteristics.

Although these characteristics are present in all writing, probably only a small group of individuals are aware of the major portion of them in their own signatures, and certainly a person thinks little about them as he signs his name. For one who writes many times a day, the process of executing his signature is somewhat of a habit, and, as a result, it becomes a rather uniform formation written with a characteristic speed, rhythm, and uniformity of motion. On the other hand, a person who writes only occasionally will produce signatures which may be less uniform or standardized, and in extreme cases may even show a lack of smoothness, slow pen motion, and an irregular rhythm. But no matter how frequently the writer may sign his name, the habit will not become so fixed as to preclude a certain degree of natural variation from one signature to another. In fact, some variation is the very essence of genuineness. However, variations also occur in the case of forgeries, but for the most part they differ in type from the natural variations which are found among several genuine signatures. To differentiate between these normal and abnormal variations, and thus between genuine and forged signatures, constitutes the second portion of the document examiner's problem.

In order that a forgery be successful, the characteristics revealed by a detailed examination of the authentic signature must be duplicated to a point where the variations from them are relatively few in number and of a type explainable either as chance variations or as natural variations of the genuine signatures. Some of these characteristics include: system of writing, shading, pen pressure, the apparent speed of writing, rhythm, size of writing, proportion of the various parts of letters as well as the proportion between individual letters, spacing, slant, letter formation, the use or lack of flourishes and other ornamentations, pen lifts, the connecting of letters, width of the ink line, smoothness, symmetry, terminals or the end of strokes as well as their beginnings, tremors, and any other characteristics which might help to identify an individual's signature. To successfully duplicate these writing characteristics to the necessary degree of accuracy is a tremendous task. But,

though it is highly improbable, it is not at all impossible for a forger to execute a perfect forgery.⁵ However, success is dependent to a large extent upon the style of signature (simple, ornate, etc.) and the experience and ability of the forger.

In attempting to simulate a signature, a forger might employ one of several methods. In any case, it will be necessary to have at least one genuine signature to use as a model for the forgery.⁶ With this model signature the forger may choose to copy it free-hand, or, feeling that he lacks the necessary skill to successfully accomplish this, he may choose to trace the signature. If a tracing is to be attempted, there are two readily available methods: either to place the genuine signature over a strong light, and over this the document on which the forged signature is to be written, and to trace the outline which shows through the paper; or to use a piece of "carbon paper" over the document to be forged, and, placing the genuine signature on top of both, to trace with some sharp-pointed instrument the outline of the model signature, giving a "carbon" offset on the lower sheet, which offset can in turn be covered over with a suitable ink stroke. (Since this latter method was not used in producing any of the forged signatures of this study, no further discussion of it will be made in this paper.)

What may result if the forger attempts to copy the genuine signature free-hand? In order to be successful in his attempt he must not only imitate all the habits and characteristics of the genuine signature, but he must as well discard all differing characteristics of his own writing. This requires him to make a careful study of the model signature to determine its salient characteristics, while at the same time he must possess a thorough knowledge of all differing characteristics of his own writing. In addition, his skill as a penman must be equal to or exceed that of the writer whose signature he is about to forge. The extent to which he can recognize these characteristics, coupled with his skill as a penman, will determine the degree of his success. More often than otherwise, the forger will have little or no idea of what the major and minor characteristics are either in his own

⁵ The author considers as a "perfect forgery" one in which all the characteristics of the genuine signature are duplicated to such a degree of accuracy that it is impossible to detect by any means that the signature is not genuine.

⁶ It is conceivable that the model signature might consist of a "mental recollection" or the forger's impression of the genuine signature. In principle the same process of determining the salient characteristics of the signature and reproducing them on paper would be employed as though the forger had an actual model signature at hand. In such a case the accuracy of reproduction, no doubt, would be reduced, and as a result the detection of the forgery more probable. However, this example represents a very exceptional type of case.

or in the model signature. In most cases he will attempt his forgery having available only one signature as a model, and frequently this factor alone will be responsible for some failures. But, even if he had studied the signature so carefully as to know and to keep in mind all its identifying characteristics, the process of combining and putting them on paper in a natural manner, and at the same time eliminating all his own writing habits, so that in the course of an expert examination no suggestion of forgery is found, remains an accomplishment which only a few very skilled persons can achieve.

How then may these failures be recognized? Too often the person attempting the forgery is so obsessed with the idea that the letter formation must be exactly duplicated that, in order to carry out this duplication with the utmost perfection, he will write very slowly and carefully, thus violating the first requirement of genuineness, line quality. The result is that the general appearance of the ink stroke fails to duplicate or often even to approximate the appearance of the genuine signature. The firmness of the line, the apparent speed and freedom of writing, the shading, and the pen pressure may all vary to some extent from the model signature. Pen lifts—points of discontinuity in the ink line due to the writer lifting his pen—may appear at places where they never occur in the genuine signatures. A closer examination of the writing may disclose unnatural tremors and abrupt changes in direction of the lines. In some cases letters may even be retouched in an attempt to perfect their formation. On the other hand, if these line qualities are more carefully executed, the letter formation and spacing may become less accurate and in some cases even incorporate a number of the characteristics of the forger's own writing.

Forgery by tracing allows the use of only a single signature as a model or standard.⁷ If the forger has available more than one genuine signature, he must first select one from this group as his standard, and apparently little thought is ever given to this choice. It is probable, however, that in the majority of instances only a single signature is available. Should this standard be of a sufficiently earlier or later date than that of the forged document, it is conceivable that its characteristics may vary sufficiently from those of the genuine writ-

⁷ The author realizes that a forger might conceivably attempt to use more than one model signature, combining them in any of several ways, but he is doubtful whether the results obtained would be as accurate as if the forgery were traced with but a single standard. However, this use of more than one model would be an exceptional case, and the method in itself would not influence the characteristic defects of a tracing.

ing at the document date as to cast suspicion on even the best of tracings. But, even if the model signature is a typical standard, the detection of the forgery is practically always possible. At times the results of an examination cannot demonstrate conclusively that this type of forgery is a tracing but can only prove that it is not genuine. Though it is advantageous to be able to demonstrate the manner in which the forgery was executed, this is only secondary in the analysis, and failure or inability to do so should not invalidate the primary findings of forgery.

The transmitted light process for executing a tracing has some very apparent defects. Even with a strong light and thin paper some of the finer details of the genuine signature will be lost, and the thicker the paper or the weaker the light, the greater loss of detail. The process of copying the signature must necessarily be more of a drawing than a writing process, for in order to assure accurate form reproduction, the average person must trace slowly. This will undoubtedly produce defects such as line tremors and abrupt changes in the direction of the stroke, besides the general appearance of slow writing. Another customary failure of this type of forgery is the absence of the natural shading and pen pressure characteristics of the genuine signature. Pen lifts frequently occur as the forger raises his pen to get a better view of the outline of the signature. Occasionally the forger will even make retracings or retouch the signature in an attempt to perfect the letter formation.

In cases in which the model signature is discovered, it may be possible to show similarity between this signature and the traced forgery, which would indicate that the tracing was actually made from this particular model. It is not to be expected, however, that the two signatures will duplicate each other exactly in every detail, but rather that both outlines will be practically identical. The amount of similarity or degree of identity is dependent upon the skill of the forger, and this, of course, will vary from case to case. Identity of form without the appearance of slow writing or poor duplication of the ink stroke does not necessarily mean forgery, as it is conceivably possible that a person will produce two signatures sufficiently similar as to suggest that one was the tracing of the other. But identity, coupled with other factors indicative of forgery, forms excellent proof that the signature is a traced forgery.⁵

From this discussion it becomes clear that the same faults may

⁵ A very complete and thorough discussion of this subject of identity in form may be found in Osborn, A. S., *Questioned Documents* (2d. ed., 1929), pp. 344-350.

appear in a traced signature as in a free-hand forgery. Tracings probably tend to contain more examples of abrupt changes in the direction of the line, more line tremors, and poorer duplication of the line quality than free-hand forgeries, but the general outline of the letters in a tracing may be more accurate than in free-hand forgeries. However, this should not be taken to mean that even the letter formation of a tracing will be without fault. Exceptional cases may be found in which these generalizations will not apply. In all cases the most positive proof of forgery by tracing is made possible by the discovery of the model signature.

In addition to the technical terminology previously used in this paper (i.e., genuine signature, traced forgery, free-hand forgery, and standard), the term spurious signature will occur in the following discussions. The word spurious has been arbitrarily applied to that group of signatures in which no attempt has been made to imitate the writing characteristics of the purported author. For the professional examiner this group of signatures causes the least difficulty, since in many cases even class characteristics differ between these signatures and the standards.

In the course of studying the following sets of signatures the reader should bear in mind that this analysis was written with full knowledge of the correct answers. However, with the exception that the conclusions are known to be correct and not merely the opinion of the examiner, the analysis is the same in form as any document examination in which the answers are unknown. It should be understood, nevertheless, that in actual practice cases do occasionally occur in which it is not possible to definitely determine the genuineness or non-genuineness of a questioned signature.

The discussions of the individual signatures of each set follow the same order as the illustrations in the majority of the cases, but for reasons of convenience in a few instances one of the signatures may be discussed out of its proper sequence.

SIGNATURES OF HAROLD C. HAVIGHURST

(Figure 1)

An examination of signature *A* reveals class characteristics similar to the standard signatures, but a more detailed inspection discloses dissimilarities between the individual characteristics of the questioned writing *A* and the standard specimens. On the basis of the class similarities an examiner might conclude that the writer respon-

sible for the questioned signature employed the same system or style of writing as Havighurst used in the execution of the standards. The absence of similarity among individual characteristics, however, indicates at once the unlikelihood of one person having written both signature A and the standards. But before definitely reaching such a conclusion, a careful examination must be made to determine whether or not the questioned signature might represent a disguise actually executed by Havighurst. The appearance of the ink stroke in this signature is indicative of a free and natural mode of writing in which the writer executes the signature without an effort to change or control his natural writing characteristics. With this factor known, the absence of Havighurst's individual characteristics indicates that in all probability he did not write the questioned signature. Since the dissimilarities between this signature and the standards are so pronounced, signature A must be labeled as a "spurious" specimen.

In signature B, although for the most part the appearance of the ink stroke is similar to the standard writing, exceptions occur in the terminals of the horizontal strokes. The best examples of these failures are found at the two horizontal cross bars of the "H's" and at the crossing of the final "t". In each case the stroke is blunt and heavier than the corresponding strokes of the standards. But even more frequent is the variation in letter formation. In the questioned signature the cross bar of the initial "H" is higher with reference to the following letters than in all but one of the standards. The initial stroke of both "a's" starts parallel to the horizontal base line in the questioned signature, but in the standards it is inclined at about thirty degrees from vertical. The connecting stroke between the "l" and "d", and the final stroke of the "d", make very sharp angles with their respective vertical downstrokes, instead of the even curve found in the standard signatures. The length of the horizontal stroke of the "v" is longer than in the authentic signatures, and the "i" has its peak well above the bar of the "v", unlike any available standard. The top of the questioned "g" has a wider opening than in the genuine "g's", giving it a "y" appearance, and the variation in the lower portion of this letter is conspicuous; while the large rounded hook on the beginning of the "h" does not occur in any genuine signature. The cross bar on the standard "t's" is practically horizontal in all cases, but in the questioned signature it has an upward slant, taking on increased pen pressure and terminating abruptly. Some slight variation from the usual proportion between the parts of compound letters is found especially in the case of the

QUESTIONED

Harold C. Harghurst

Harold C. Harghurst

Harold C. Harghurst

Harold C. Harghurst

STANDARDS

Harold C. Harghurst

Harold C. Harghurst

Harold C. Harghurst

Harold C. Harghurst

Harold C. Harghurst

Harold C. Harghurst

FIGURE 1

"d" and "g", but the spacing of letters has been fairly accurately simulated.

From this discussion it appears that the signature is a forgery. Although Havighurst does not write an ornate hand, the forger had a great deal of trouble in simulating the letter formations with the required degree of accuracy, and occasionally failure was encountered in duplicating the appearance of the pen stroke. The failure to duplicate letter formation is especially apparent in the case of small details, which to the casual observer might not appear important but which to the document examiner means the difference between forgery and genuineness.

A study of signature C discloses very marked similarities to the characteristics of the standard signatures, but some slight variation in letter formation does occur. In every case the proportions between the various parts of compound letters compare favorably with corresponding letters of standard signatures, and the spacing between letters is similar. A careful examination of the shading and pen pressure discloses close similarities to the standard signatures. The characteristics of the first "H" are very similar to the standards, the only observable exception being the heavier than usual initial stroke. The characteristic start of the "a" and the open "o" both compare very favorably with the corresponding letters of the genuine signatures; while the connecting stroke between the "l" and "d" is representative of similar strokes in the standards. Probably the most characteristic of the letters found in "Havighurst" are the "g" and "h". The comparison between the lower portion of the "g" in the questioned signature and the corresponding part of the standard "g's" is very good; while the upper loop of the "h" accurately matches the genuine letters. The greatest amount of variation in the formation of any letter is found in the final "t". The loop, occurring at the beginning of the horizontal cross stroke, is absent in all the standard signatures, but on one or two occasions some slight tendency toward the formation of such a loop does exist. For the most part, the comparison of this signature with the available standards is very favorable. The few variations in letter formation might be expected, but such characteristics as pen pressure, spacing, proportions between parts of letters, and appearance of the ink stroke, as well as a good comparison in the majority of letter forms, plus the all-important requirement of freedom of movement, all lead to the conclusion that the signature is genuine. It will be seen in the course of the following discussions that these latter characteristics are more

consistent in genuine signatures but usually vary to some extent, or are absent, in the forgeries.

There is a complete lack of freedom in the writing found in signature *D*, and this is accompanied by a great number of tremors and abrupt changes in the direction of the lines (observe particularly the upper part of the "C"). These characteristics do not occur in Havighurst's signatures and are indicative of a slow writing or tracing. Pen lifts occurring at the top of the vertical stroke of the final "t" and near the middle of the connecting stroke between the "s" and "t" further suggest the possibility of tracing.⁹ By means of transmitted light and the placing of signature *D* over *C*, the outlines of the two specimens can be made to coincide in such a manner as to permit the inference that signature *D* was traced from genuine signature *C* (as was actually the case). However, the tracing was not executed very accurately as, for example, the type of "r" used is different from the "r" in the model signature. In this instance the forger reverted to one of his own individual characteristics. The end strokes on several of the letters vary from the usual characteristics of the standards. Included among these are the end stroke of the "d" which has a small fleck to the left (a significantly different pen motion than occurs in the standards), and the tail of the "g" which also bends to the left instead of the right as in the genuine signatures. Further comparison of this specimen with the set of standards leaves little doubt that it is a forgery, for in addition to the indications that it was traced from signature *C*, an examination of each individual letter discloses some difference from characteristics of the standards.

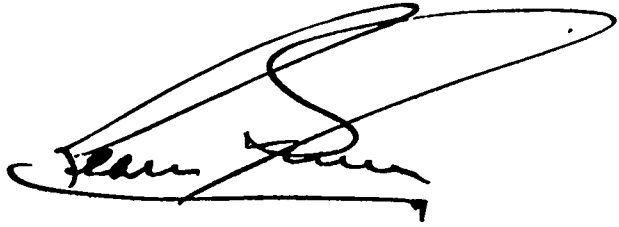
SIGNATURES OF LEON GREEN

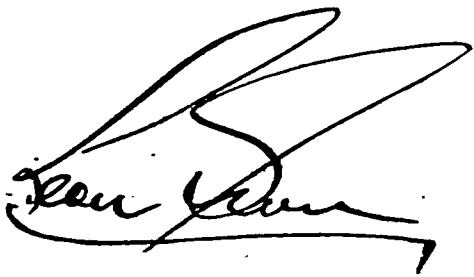
(Figure 2)

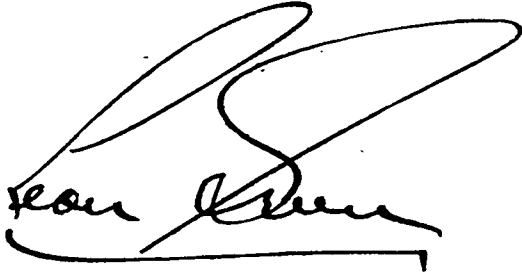
Because of the very marked dissimilarities between signature *A* and the standards, this signature stands out as spurious. For reasons similar to those stated in the discussion of the Havighurst signatures this signature is most probably not a disguise written by Green.

The shading of signature *C* is very similar to the standard writing in which this feature appears to be highly individualistic. The difference in the lower portion of the "L", the lack of the usual small loop in the lower left-hand portion of the "G", and the final "n" of "Green",

⁹ In reproducing the signatures for illustrative purposes some of the details are lost, as, for example, in this instance the pen lifts of signature *D* do not show in Figure 1. Unfortunately, this difficulty is encountered also in the illustrations of other signatures which are subsequently discussed.

A *Leon Green* 

B *Leon Green* 

C *Leon Green* 

D *Leon Green* 





FIGURE 2

which is narrower than customary, constitute the major variations from the standard letter formations. On the other hand, the appearance of the "eon" of "Leon" and the initial upstroke of the "G" compare favorably with the standard signatures, and the "ee" combinations, which appears more as a "u", agrees with the genuine writing. The questionable portion at the right-hand end of the underline appears to be caused by pen failure rather than any attempt of a forger to retouch the signature. The spacing of the letters in this signature conforms well with the standards, and the proportional size of lower and upper case letters is characteristic of Green's signatures. From this discussion it appears that there are the usual number of variations in some of the letter formations, but for the most part similarities predominate. In all, there seems to be no indication of forgery, but rather a combination of the characteristics which emphasize the genuineness of this signature.

Shading is a more pronounced feature in Green's genuine signatures than in the other writing illustrated in this study. Consequently the almost complete lack of shading in signature B at once becomes significant. Further examination of this feature discloses that the slight shading which does occur in this signature has been executed for the most part in a manner opposite to the usual characteristics of the standards. Also in this signature there are several points which suggest slow pen motion. Among these is the irregular and unsteady appearance of portions of the "L", of the "G" and of the "e" of "Leon". Letter formation varies in a number of cases from the characteristics found in the standards. The lower portion of the "L" has a formation different from any of the "L's" occurring in the standard signatures, but is similar to the corresponding letter of signature C. The "n" of "Leon" appears more angular than in the genuine signatures. The "G" fails to agree with the characteristics of the standard "G's". Its upper loop is not as pointed at the upper right-hand corner as the corresponding portion of the standards, while the diagonal downstroke, running from left to right, is very unlike any of these strokes found in the authentic writing. The usual loop at the lower left-hand corner of the "G" is lacking in this signature, which, however, is also the case in genuine signature C. The spacing between the "r" and the following "e" is much longer than is customary. The final "n" is more angular, and the tail of this letter curves upward instead of downward as in the standard signatures. The flourish under this signature is rounded at the right-hand end instead of being angular as in the case of the genuine signatures,

and in this questioned signature the usual wedge-shaped downstroke of the standards is a straight line with a small hook at the bottom. The results of this examination indicate that the signature is a forgery which was probably accomplished by means of tracing. Because of the similarity of the "L", and of the lower portion of the "g", between this signature and signature C, there is some slight possibility that signature C was used as a model, but, if this were the case, the tracing is a very inaccurate duplication of the genuine signature. Rather, this is a case where, although there are indications that the signature is a traced forgery, the exact model cannot be ascertained.

In signature D the shading corresponds fairly well with the standards, and the apparent pen speed is similar in the two pieces of writing. However, there are many differences between the standards and this questioned signature. The shape of the upper loop of the "L" differs from the standard "L's". The initial stroke of the "e" is longer than usual; while the questioned "n" of "Leon" is narrower, and its vertical strokes higher, than the standard letters. The flat part of the upper loop of the "G" is inclined at a greater angle to the horizontal than in the genuine signatures, and the diagonal stroke, which runs downward from left to right, is unlike any found in the group of standards. Besides, the initial stroke of this letter begins well above the base line instead of below as is normally the case. The irregularity of letter spacing in this signature, compared to the spacing in the standards, is particularly noticeable in the letters "reen". Finally, the underscoring is accomplished by a flourish which at the right-hand end is rounded instead of angular as in those standard signatures which are underlined. On the basis of this examination it appears that the signature is a forgery. In this case the failure of the forger was due to his inability to copy various letter formations and to maintain the proper spacing between successive letters, while successfully duplicating the shading and other characteristics of the ink strokes.

SIGNATURES OF JOHN H. WIGMORE

(Figure 3)

Signature B has the appearance of a spurious signature in which there has been no attempt to imitate the genuine writing of Wigmore.

By means of a microscopic examination, at a magnification of approximately twenty diameters (20X) the ink strokes in signature C appear to contain some slight natural tremor which is characteristic of Wigmore's standard writing. The comparison of letter formation and spacing reveals a close correspondence with the standard

QUESTIONED

STANDARDS

A John H. Wigmore

B John H. Wigmore

C John H. Wigmore

D John H. Wigmore

John H. Wigmore

John H. Wigmore

John H. Wigmore

John H. Wigmore

John H. Wigmore

John H. Wigmore

FIGURE 3

signatures. The lower loop of the "J", the loop of the "o" which connects this letter to the following "h", the proportions between the various parts of the "h", and the size of the "n" relative to the other letters of the signature, all suggest that this is a genuine signature. The "n" and the following "H" are not connected, but this also occurs in one instance among the standards. The questioned "H" duplicates closely the standard "H's", and the spacing between the three peaks of the "W" follows the pattern which occurs in several of the standard signatures. The comparison of the remaining letters is very satisfactory in all cases except the "r", where the questioned letter is less accurately written than the corresponding standard letters. The appearance of the flourishes on the "W" and the final "e", together with an apparent speed of writing similar to the authentic signatures, suggests genuineness. This examination reveals characteristics which correspond closely to those found among the standards and leaves no doubt as to the genuineness of this signature.

Signature A appears free from line tremors which are usually found in a traced signature. But upon examination under low magnification (20X), the appearance of the lines differ from those of the standards, as these lines of the questioned signature have a much more even or smooth appearance than those of the standards. This would indicate that the signature was probably executed by someone other than Wigmore. But, coupled with this poor duplication of line reproduction where the failure is not line tremors but the lack of natural tremors, a number of letter formations differ in some manner from the characteristics found in the available standards and further emphasize that the signature is a forgery. The lower loop of the "J" is much wider than those found in the genuine signatures, and the connecting stroke of the "hn" combination turns up more sharply than in the standard writing. The loop of the "h" is narrower and more pointed than the corresponding portion of the standard letters. The shoulders of the "n" are more rounded than the angular "n's" of the standards, and the stroke joining this letter to the following "H" waivers in an uncertain manner. The usual hook to the left at the bottom of the first vertical stroke of the "H" is absent in this specimen; while again, the "m" like the "n" has more rounded arches than the corresponding letter in the standards. The sharp bend in the connecting stroke between the "o" and the "r" constitutes an additional variation from the genuine characteristics. There are no examples among the available standards in which the loop of the "e" is not filled with ink, but in this signature

the loop is clear. Still another indication of forgery is the patching which occurs at the right-hand end of the flourish attached to the "W", a modification of the abrupt ending of the original stroke; while the blunt ending of the tail of the "e" is not characteristic of corresponding strokes in Wigmore's standards. Since these flourishes vary in form among the standards, the similar appearance of the corresponding strokes of signatures A and C suggest the possibility that signature A is a tracing. This hypothesis can be verified by superimposing A over C and examining them by means of transmitted light. The former signature can then be made to coincide with the general outline of the latter sufficiently well as to indicate that probably signature A was traced from signature C, but, if so, with a freedom and skill seldom seen in this type of forgery. The combination of these observations indicates conclusively that this is a forged signature and one which was most probably traced from signature C.

In signature D the characteristics of the ink stroke closely approximate those of the standard writing, and for the most part the pen pressure of the genuine signatures has been well duplicated. However, the blunt ending of the flourish which is connected to the "W" does not agree with the characteristic of this stroke in the standards. Several examples of dissimilar spacing also occur in this signature, such as between the "W" and "i", the "m" and "o", and the "o" and "r" of "Wigmore". In addition to these defects, variations from the characteristic letter formations of the genuine signatures exist in the questioned specimen. The lower loop of the "J" is wider than the corresponding part of the standard "J's". The stroke joining the "h" and the "n" is more rounded than in the case of the genuine signatures, and the two peaks of the "n" are farther apart. The "H" differs from the standards both in the first vertical stroke and in the cross bar, while the period following it is a long dash unlike any standard. The spaces between the three vertical strokes of the "W" are not in the same relative proportions as in the available standards. The lower loop of the "g" is longer than the corresponding loop of the standard "g's"; while the second portion of the "m" consists of a "u"-loop instead of the arch formation which appears in all of the available specimens of Wigmore's writing. The results of this examination leave little doubt that the signature is a forgery. This, incidentally, is an excellent illustration of the contention that in the great majority of instances when a forger concentrates his efforts on the duplication of the appearance of the ink strokes in the signature,

some other characteristic such as letter formation will vary sufficiently to clearly indicate forgery.

SIGNATURES OF CHARLES T. McCORMICK
(Figures 4 and 5)

For reasons previously discussed with reference to Figures 1, 2, and 3, signature *A* has the appearance of a spurious specimen.

Although the standards in the previous sets of signatures appeared to be representative of the authentic writing, and the genuine signature among the four questioned ones in each instance was quite similar to these available standards, such is not the case with McCormick's signatures. Instead, the standards of McCormick's writing proved to be less adequate or representative. An examination of signatures *B*, *C*, and *D* shows several characteristics which differ from the standards. The slant of the letters in "Chas" is forehand in the questioned specimens but backhand in the standards; there is a pronounced slant to the vertical stroke of the "T" which is not present in the six genuine signatures; the "cC" combination is joined in all three cases but never in the available standards; the "i" and "c" are connected in the questioned but not in the standard signatures; and finally, the formation of the "k" differs decidedly in these three signatures from the form of the corresponding letter in any of the standards. With so great a number of variations as have already been noted, the representativeness of the standards in this case must be questioned. Of course, in this discussion we have knowledge that one of the questioned specimens is genuine. For that reason it is evident that there is an insufficiency of standards and that the available standards do not reveal the true range of variation in McCormick's signatures. However, competent and cautious examiners guard against such contingencies by insisting upon many and varied standards and depend upon this type of dictated standards only in cases in which specimens prepared under more varied circumstances cannot be obtained. The wisdom of such practice is clearly substantiated by this set of specimens.

Further examination of signature *B* reveals additional variations from the characteristic letter formation of the standards, such as the point in the "C" formed by the initial stroke and the beginning of the letter proper; the lower portion of the "h", which is less angular than in the majority of the standard signatures; the tail of the "s", which is longer than in the standards, although a definite tendency exists among several which suggests that this variation might be

QUESTIONED

A Chas. T. McCormick

B Chas. T. McCormick

C Chas. T. McCormick

D Chas. T. McCormick

STANDARDS

Chas. T. McCormick

Chas. T. McCormick

Chas. T. McCormick

Chas. T. McCormick

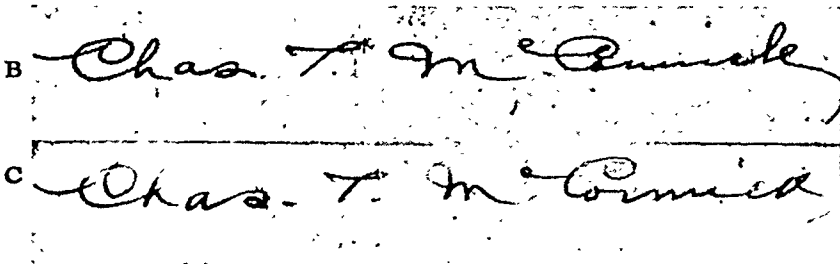
Chas. T. McCormick

Chas. T. McCormick

FIGURE 4

within the range of McCormick's genuine writing; the slant of the vertical strokes in the "M" as well as its formation; the dot of the "i", which is higher and consists of a careful mark instead of a careless dash as in the genuine specimens; and the "k", as mentioned above, which is written with a single continuous stroke instead of with the usual two strokes of the standards. However, the remainder of the letters compare favorably, especially "ormic", which are similar both in formation and spacing to several of the standards. Then too, the spacing of the letters accurately simulates the genuine signatures, and the usual faults of tremors, slow pen motion, and abrupt directional changes are entirely absent in this signature. But this specimen is defective with respect to the reproduction of the shading, which varies a great deal from the rather unusual shading of McCormick's

QUESTIONED



STANDARDS

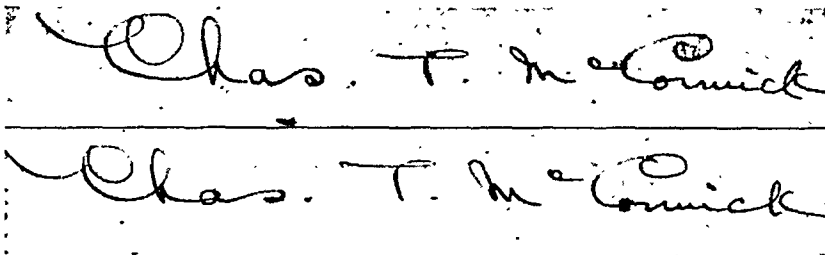


FIGURE 5

genuine signatures. In Figure 5 two of the genuine specimens of Figure 4, together with questioned signatures B and C, are reproduced on half-tone engravings in order to illustrate more clearly the fine variations in shading which do not appear in the "line cuts" of Figure 4. This illustration shows the ink stroke in signature C to be of uniform density throughout, but in the two standards, which are

representative of all six genuine specimens, there is a broadening of the line and an accumulation of ink at the bottom of several vertical strokes (see the "C's", "h", and "T"). This represents an individual characteristic of McCormick's signature, resulting, perhaps, from an increased pen pressure in portions of the stroke, and is entirely lacking in signature *B*. On the whole, by virtue of the above mentioned variations in its letter formations, coupled with the marked difference between its shading and that of the standards, it may be concluded that signature *B* represents a free-hand forgery.

In addition to the variations already mentioned as belonging to the three signatures *B*, *C*, and *D*, the formation and spacing of the letters "rmick" in signature *C* differ from the characteristics of the genuine signatures. On the other hand, the stroke of the "h" ends in the characteristic position relative to the "a", and the formation of both the "c" and "C" is characteristic of the standards, although these letters are never completely joined in the genuine signatures. Except for slant, the letter formation in the questioned "Chas" agrees rather closely with the standard writing, especially in freedom and rhythm of the pen movement. Although in the formation of the "M" there exists some similarities with the standard "M's", the questioned letter appears to be written more carefully. The greatest point of similarity between this signature and the standards is the delicate and highly individualistic shading and general appearance of the ink stroke, a very significant characteristic. Referring again to Figure 5, the similarity of the shading between signature *C* and the standards, reproduced in this illustration, is at once apparent. A comparison of the "C's", "h", and "T" reveals very close agreement in shading, for in the case of the genuine and questioned signatures the variation in density of ink occurs in a similar manner, heavier near the bottom of the stroke than at the top. Signature *C* appears to be a genuine signature, primarily because of the excellent comparison of the ink stroke, but also because of the agreement of various letter formations and the fact that some of the existing variations are of a type resulting most likely from more careful writing, as seen, for example, in the case of the "M" and the "ormic". Unfortunately, some of the inconsistencies in letter formation found among the standards probably are emphasized as a result of the fact that several of these signatures were written together rather than each at different times.

Besides the variations in letter formation discussed above, signature *D* contains numerous examples of tremors, abrupt changes in the direction of lines, a general appearance of slow writing, and

unnatural letter formations. The shading is very irregular and unlike the genuine writing of McCormick. A comparison of the outlines of this signature and signature C by means of transmitted light indicates that the latter signature might have been used as a model for tracing this signature. All in all, there is little doubt as to the method of preparation of this forgery, since the signature incorporates most of the faults common to a traced forgery, and furthermore it matches fairly accurately the outline of genuine signature C.

SIGNATURES OF FRED D. FAGG
(Figure 6)

Signature A corresponds well with the available standards in respect to letter formation, especially in details such as the proportions between various parts of letters and the relative size of capital and lower case letters. The spacing for the most part is very much like the standards, and a close comparison of the pen strokes in the questioned and standard signatures reveals a marked similarity. However, some of the flourishes, especially the one following the final "g", vary considerably in form from the available standards, but, as there is a noticeable amount of variation even among several standards, further form variation could easily be expected in this portion of the signature. In the questioned signature a small loop is found in the right extremity of the final flourish, and a very sharp pointed bend occurs at the top, neither of which appear in the genuine signatures. The appearance of the ink stroke in this flourish, as well as in the remainder of the signature, however, discloses that the writing was executed freely and rapidly, similar to Fagg's characteristic manner. The arched top of the "F" has a sharper curvature than usual, which is the most noticeable variation in letter formation. The failure to connect together the "dD" combination is not usual, but it does occur in one instance among the standards, indicating that this variation is one of Fagg's signature characteristics. For the most part, the remaining letters duplicate the standards very accurately, and this comparison is exceptionally good in the case of the "e", "d", and "g's". The characteristics of this signature are very similar to those of the standards, even more so than in the case of genuine signatures of the preceding sets, and the few variations which are present are natural and to be anticipated. As a matter of fact, these slight variations only help to emphasize the genuineness of the signature.

The appearance of signature B might suggest the possibility that

QUESTIONED

STANDARDS

A Fred D. Fagg

Fred D. Fagg

B Fred. H. Fagg

Fred. Fagg

C Fred D. Fagg

Fred. Fagg

D Fred D. Fagg

Fred. Fagg

Fred. Fagg

Fred. Fagg

FIGURE 6

some attempt had been made to vaguely copy the same type of letter formation as occurs in the standard, but even a person who has had no training in handwriting examination would not hesitate in stating that this signature is spurious. Of course, some caution must be exercised by the examiner to determine that this is not an attempt by Fagg to disguise his own signature, but a careful inspection indicates nothing which could be interpreted in this way.

Examples of slowly written strokes and letters, as well as other characteristics of traced forgeries, are found at various points in signature C. Among these are: the small loop at the extreme right-hand end of the signature where the stroke is very ragged and a pen lift occurs; the upper arch of the "F" of "Fagg", which bends sharply; the loop of the final "g", which contains several irregular abrupt turns; and several points where the shading is unnatural and indicative of slow pen motion. The final small flourish at the end of the long vertical stroke has been added after lifting the pen, forming another questionable portion of the signature. With the exception of these points already mentioned, however, the signature has not the appearance of being written slowly. Although these factors do not indicate conclusively that this signature is a tracing, additional variations, especially in letter formation, prove that it is a forgery. For example, the vertical strokes of the "F"s", which extend well below the base line, are longer than in the standards or signature A,¹⁰ and the horizontal bar extends farther to the right of the vertical stem than in any of the genuine signatures in which the "F" and "r" are disconnected. The proportion between the upper and lower loop of the "d" varies from the standard characteristic. In addition, the initial stroke of the "D" is more rounded and the overhang is much longer than usual. At the bottom of the vertical stem of the "g" a small hook projects toward the left, contrary to the standards in which this projection, when it occurs, is to the right. The evidence presented here indicates that the signature is a forgery which was probably accomplished by tracing. Signature A may have been used as the model, but in such a case signature C is an inaccurate duplication, for any attempt to match the two signatures by superimposing C over A reveals numerous points at which the lines fail to coincide. But even

¹⁰ This tendency to continue the vertical strokes below the base line unlike the model signature is a characteristic occurring in some traced forgeries. Because of the position of the forger's pen in executing the tracing, it is difficult to see exactly where the stroke ends in the model signature, and, as a result, instances may occur similar to this signature in which certain strokes fail to end at the proper point. For further discussion of this type of defect see Osborn, A. S., *Questioned Documents* (2d ed., 1929), Chapter XIX and p. 342.

though proof of the tracing is relatively weak, the indications of forgery are very conclusive.

The spacing of letters and words of signature *D* are unlike the available standards. The space between the "F" and the "r" and also the "F" and the "a" in the questioned signature is larger than in the standards; while the initial "D" is crowded closer to the following "F" than usual. The arches of the capital "F"s" are poor imitations of the genuine, for in the "F" of "Fred" the peak of the arch occurs decidedly to the right of the mid-point, instead of more nearly at the center as in the standards; while the arch of the second "F" terminates at a point lower than its beginning, which is the reverse of the usual case in the genuine signatures. Moreover, the end of the stroke in the arch of the first "F" hooks slightly to the right, opposite to the characteristics of the standard signatures; while a further indication of forgery appears in the vertical stroke of this letter, where this stroke is found to be practically a straight line instead of the usual complex curve. It is interesting to note the consistent differences in the characteristics of the two "F"s" in the genuine signatures, for often characteristics which can be attributed to the first letter cannot be attributed to the second. The width of the questioned "r" is much narrower than the standard letters and the upper loop of the "e" extends farther to the right. A loop at the top of the "D", not characteristic of the genuine signatures, and the formation of the "a", which is less neat and uniform in this signature than in the standards, further indicate the possibility of forgery. The stem of the "g"s" is longer than in the authentic signatures, and the end of the final flourish is probably an independent addition. The duplication of the pen stroke has been well executed and does not constitute a weakness in this signature. While these variations do not represent a complete list of all that appear in this signature, they are sufficient to indicate definitely that the signature is a free-hand forgery.

SIGNATURES OF NEWMAN F. BAKER

(Figure 7)

A comparison of signature *B* with the accompanying standards indicates quite conclusively that no attempt was made to copy the original signatures; while further examination fails to disclose any indication that it is an attempted disguise by Baker. Of the four questioned signatures this one stands out as being spurious.

The majority of letter forms in signature *C* agree closely with the standard signatures, and those variations which do occur are

slight and appear to be natural. Among them is the letter combination "wm" which appears more like "um"; although some tendency exists for the standard "w's" to assume a similar indistinct form. A closer examination of the connecting stroke reveals a slight bend, indicating the letter to be a poorly made "w" rather than a "u". According to the available standards the lowest point on the stroke between the "a" and "n" is usually nearer the "a" than the "n", but in this signature it occurs almost midway between the two letters, an insignificant variation. At the bottom of the "F" a small leftward hook occurs in this signature, although it is lacking in the available standards, and the "e" in "Baker" slants more than any standard "e". However, with the exception of these few variations, which for the most part are practically negligible, the remaining letter formations are in close agreement to the standards. "The "N", "B", "k", and "r" closely match the corresponding letters of the genuine signatures, while the stroke connecting the "F" and "B" is highly characteristic of Baker's authentic signatures. The spacing, slant, pen pressure, proportional size of letters, and general appearance of the writing all indicate that the signature is genuine. In fact, the variations which do exist are of a type which naturally occur from one genuine signature to another and only help to emphasize the genuineness of the questioned signature.

Indications that signature *A* might be a tracing appear at several points. Two points in the "B", one at the bottom of the initial vertical loop and the second along the upper portion of the lower right-hand loop, lack the natural freeness of Baker's writing. In addition, numerous small details vary considerably in this questioned signature from the characteristics usually found in the standards and further suggest that this signature might be a forgery. Among these are: the "N" in which both the initial stroke and the stroke joining the letter to the following "e" are connected to the main portion of the "N" by very sharp curves unlike the standards; the "wm" which is so executed to read "um"; the lower bar of the "F" which is straighter than usual; the line joining the "B" and the "a", which is concave upward instead of downward; the upper loop of "k" which is longer than any corresponding loop of the standards; and the very angular bend of the connecting stroke which joins the "k" and the "e". Finally, although on the whole this signature seems to have been executed with the same writing speed as the standards, the lines appear heavier than in the genuine specimens.

These variations from Baker's writing characteristics combine

QUESTIONED

STANDARDS

Newman 7 Baker Newman 7 Baker

Newman 7 Baker Newman 7 Baker

Newman 7 Baker Newman 7 Baker

Newman 7 Baker Newman 7 Baker

Newman 7 Baker

Newman 7 Baker

FIGURE 7

STANDARDS

QUESTIONED

A S. E. Thorne
S. E. Thorne

B S. E. Thorne
S. E. Thorne

C S. E. Thorne
S. E. Thorne

D S. E. Thorne
S. E. Thorne

S. E. Thorne

S. E. Thorne

FIGURE 8

to point out a forgery, and several, such as the lack of natural freedom and heavier than usual pen pressure, indicate that the forgery might have been accomplished by tracing this signature from some genuine model. But much more conclusive evidence of tracing can be obtained by placing a strong light below the signatures and fitting *A* over *C* to demonstrate definitely that *C* constituted the model for the tracing. The inaccuracy in duplicating the characteristics of Baker's genuine signatures, such as pen pressure, letter formation, and on occasion the freeness of writing, coupled with the fact that the outline of the signature coincides with that of signature *C*, forms conclusive proof that signature *A* is a traced forgery.

Upon examination under low magnification (20X) the pen strokes of signature *D* appear very irregular and jagged (due possibly to the low angle at which the pen was held), which is not characteristic of Baker's genuine signatures. The second shoulder of the "N" is more pointed and this point is directed farther to the right than in the genuine writing. Moreover, the spacing between the "N" and the "e" is longer than in the standards, while "Newman" is spelled with a "u" instead of a "w". The first arch of the "m" is more angular than the standard letter, and the downstroke from the last shoulder slants definitely to the left instead of vertically or slightly to the right. The "a" of "Baker" is more rounded and open than the corresponding letters occurring in the genuine specimens. The right-hand portion of the "k" is pointed, as is the corresponding part of the standard "k's", but it is inclined more to the right than in the standards. The maximum curvature in the connecting stroke between the "k" and "e" is much greater than in the available standards. Lastly, the final stroke of the "r" curves more sharply upward than this portion of the standard "r's". Although most of these differences are small, when considered as a group they form sufficient proof that the signature is a forgery.

SIGNATURES OF S. E. THORNE

(Figure 8)

As none of the characteristics of Thorne's genuine writing are present in signature *A* and as it appears to be written in a free, natural manner, there is little chance that it is a disguised signature executed by Thorne himself. Obviously, then, this signature must be spurious.

An examination of signature *B* discloses a great number of characteristics unlike those of the available standards. In the "S" there

are several flaws which suggest that the signature is not genuine. In the upper portion of the diagonal stroke appears a defect, either a pen lift or hesitation, but in either case, not characteristic of Thorne's writing. This diagonal turns at a higher point than in any of the available standards and is flatter, while the lower loop of the letter is much larger. The vertical stroke of the genuine "E's" consists of a double line joined to the upper horizontal stroke without a pen lift, but in the questioned signature it is formed by a single downstroke and consequently is not connected with a continuous line to the upper horizontal bar. In the standards the lower bar of the "E" and the vertical stem of the "T" intersect, but here again failure of the questioned signature to conform with a characteristic of the standards infers forgery. The "h" of signature B is a more correctly formed letter than Thorne is accustomed to write. The questioned "o" has its longer dimension vertically, while the standard "o's" are longer horizontally. The bulb at the top of the "r" points in a vertical direction in this signature, rather than at an angle of about forty-five degrees as is characteristic of the standards. The arch of the "n" is more angular in the genuine writing than in the questioned signature, and the loop of the "e" is generally smaller. From the examination of this signature some variation has been discovered in almost every letter, leaving little doubt that it is a free-hand forgery.

In signature C there are some differences from the characteristics found among the standards, but on the basis of the available standards, variations seem to occur more frequently in Thorne's signatures than in the other signatures used in this study. However, most of the variations are minor and appear in the formation of the letters. For example, the lower portions of the "S" and the "E" intersect unlike any of the available standards, but except for this difference the two letters are very representative of Thorne's writing. The "E" and "T" intersect in the customary manner and the joining of the top of the "T" and "h" tends to emphasize the genuineness of this signature, even though the vertical stroke and the shoulder are closer together than in any standard. The similarity of the questioned and standard "n's", together with the slant of the bulb in the "r", forms additional proof of the authenticity of this signature. The loop of the "e" is larger than in the genuine writing, but the tail is characteristic of the standard signatures. The appearance of the ink lines compares favorably with the standard specimens in so far as comparisons can be made, but, since apparently two different pens were used in the preparation of the standards, some artificial variation has been

introduced, thereby curtailing this examination to a certain extent. Furthermore, the spacing of the letters follows closely the pattern of the genuine specimens. In general, since the characteristics of signature *C* are in agreement with those of the standards, the signature is undoubtedly genuine.

The appearance of the pen stroke in signature *D* is questionable. At several points the lines have been patched and tampered with, a feature which is not found in Thorne's genuine signatures. These points are located at the start of the "S", on the diagonal of the same letter, on both downstrokes of the "n", and again at the right-hand edge of the loop of the "e".¹¹ Furthermore, in this signature the center bar of the "E" intersects the vertical stroke below the mid-point, and the base bar does not touch the upstroke of the "T", contrary to the characteristics of the available standards. Another variation from Thorne's genuine signatures is the arch of the "h", which is rounded and closer to the initial vertical stroke. This examination has already disclosed numerous indications of forgery and some slight suggestion of the possibility that the signature was traced. As further proof of tracing the model specimen should be located. With the aid of transmitted light, signature *D* can be fitted fairly accurately over signature *C*, indicating that the latter was probably used as a model. The retouchings in this signature were undoubtedly made in an attempt to improve the tracing, but instead the presence of the retouching in the signature is sufficient to cause its genuineness to be questioned. This combination of variations from the characteristics of the genuine signatures indicates that the specimen is a forgery, while the patching of several letters, together with the rather close duplication of the outline of signature *C*, leaves little doubt that signature *D* was actually traced from *C*.

SUMMARY AND CONCLUSIONS

In the course of the detailed discussion of the several sets of signatures, numerous characteristics of the standards were examined and compared with corresponding portions of the questioned specimens. A signature was declared genuine when a sufficient number of the standard characteristics were found to exist in the questioned signatures without the presence of a number of significant variations. For the most part, the letter formation, spacing, proportional size of letters, shading, pen pressure, flourishes, and other writing charac-

¹¹ The reproduction of signature *D* fails to show these four retouchings as clearly as they appear in the originals.

teristics of the signatures, which were selected as genuine, were in close agreement with those of the standards. With the exception of McCormick's signatures, the existing variations were very few and occurred primarily in letter formations. But as should be expected, the degree of agreement between the genuine one of the questioned specimens and standards varied in each instance, and no empirical rule can be set up to determine a point of division between genuineness and forgery.

The forgeries of this experiment probably represent a more accurate class than are usually encountered in document cases, as they were written as exhibits of skill rather than, as most forgeries, with the knowledge that detection of the forgery would mean punishment or disgrace. This mental handicap under which a forger works undoubtedly has an effect on the quality of his work. However, though these more accurate forgeries make the problem of examination more difficult, the principles of detection remain the same regardless of the quality of workmanship.

It is apparent from the case discussions that in each non-genuine signature there existed numerous variations from the characteristics of the standards, together with occasional defects indicative of traced and free-hand forgeries. Among the types of variations and defects which occurred were abrupt directional changes in the stroke, line tremors, poor duplication of the line quality, poor simulation of letter formation, and other variations.

In most of the tracings the forger attempted to write more rapidly than is customary in this type of forgery. As a result, the letter formation was not so accurately duplicated, but there was relatively little hesitation and few tremors in the lines, all of which not only caused difficulty in proving the exact model but even in showing conclusively that the signature was a tracing. Nevertheless, some indications of the method of preparation were present in almost every signature.

Most important of all for the reader who is not experienced in the field of document examination should be the realization that no opinion can be based on one or two characteristics, regardless of how important they may seem to the examiner at the time of examination. In every case, before any opinion is rendered, all characteristics which can be discovered in the signatures should be examined, weighed, and evaluated. In the preceding discussions of the signatures, although a great many characteristics were analyzed, not every one of them was pointed out, for otherwise this paper would have

extended far beyond its original scope and purpose. It is hoped, however, that the reader will take time to examine the illustrations accompanying the discussions, both to verify the characteristics which were mentioned, as well as to locate and study other factors which might either modify or further substantiate the conclusions.

No reproduction of a handwritten document is capable of duplicating completely all the details of the original material. Consequently, experts always attempt to obtain the original document instead of depending upon photographs, photostats, or other types of reproductions, and when opinions are expressed based on reproductions, they should usually be provisional and subject to confirmation upon examination of the originals. However, in publishing a report upon a study of this nature, it is obviously necessary to resort to reproductions. In such reproductions some of the finer details of the writing are lost. Because of this fact the reader cannot accurately verify all the statements made in this article, particularly in regard to such details as shading and alteration of the ink stroke, since some of these features fail to show as clearly in the accompanying illustrations as in the original signatures.

The preparation and adequacy of the standards should be of particular interest both to criminal investigators and document examiners. Often in criminal investigations it is necessary to depend on standards prepared in a manner similar to those presented in this paper. The method of obtaining these standards was to request the person to sign his name on two occasions: at first four specimens were provided, while at the later date two more were furnished. In grouping these standards in the exhibits which accompany this article, the first four standards in each exhibit are those of the earlier date, while the remaining two are of the second date. A study of the characteristics of the various sets of standards discloses certain group characteristics belonging to the first group and others belonging to the second which differ from one another. The consistent repetition of this phenomena throughout successive sets of signatures tends to indicate that the full range of writing can be best obtained by having a person furnish standards on several different occasions rather than by furnishing the entire number at one time. In other words, on the basis of the present evidence, the adequacy of this type of standards does not necessarily depend on the number of standards available, but rather on the number of different occasions at which the standards were written. This observation should prove important to all who might have need of securing standards of a similar type.