

GUIDE TO
FINGER-PRINT
IDENTIFICATION.



BY
HENRY FAULDS, L. F. P. S.



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“Echo makes a most excellent wife for Pan, as being no other than genuine philosophy, which faithfully repeats his words, or only transcribes exactly as nature dictates; thus representing the true image and reflection of the world without adding a title.”—*Lord Bacon.*



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PREFACE.

AN extraordinary and almost unprecedented discussion has arisen within the last few weeks as to the use of "Finger Clues." The chief occasion for this curious clamour seems to have been the faulty use of this new way of finger-prints in the case of the two brothers Stratton, who were hanged for a double murder at Deptford, known as the "Mask" murders. Mr. James P. Budden, the well-known criminal solicitor, who was for the defence, asked Inspector Collins, "Can you give me the name of any medical or legal authority who takes any notice of this so-called science?"—"I do not know any."—[*Standard*, 26th April, 1905.] In what is headed as "A Strong Letter," Mr. Budden wrote to the *Birmingham Gazette and Express* (July 12th) giving some additional details of interest. He says: "On this point a remark made by Inspector Collins, of the Scotland Yard Finger-print Department, when I cross-examined him is significant. I asked him whether his finger-print system, of which he appeared in court as an expert, was an exact science. He replied that it was. 'Then, if it is an exact science,' I said, 'it must have a name,' and I asked him for the name of his science. He said he did not know it. It was then suggested to him that it had been called 'dactylography' or 'dactyloscopy'—terms of Greek origin—and he said, 'Oh, yes! that's a German name for it.' I ask," continues Mr. Budden,

“whether the using of the finger-print system against prisoners should be left in the hands of non-scientific men.” Mr. Budden also states that his views on “the use of finger-prints as evidence against an accused person are the same as those expressed by Mr. Justice Channell in his masterly charge to the jury in the Stratton Case. I think the opinion of a judge of such wide experience and authority well worth following by an ordinary individual.” I was privileged with a seat at the solicitor’s table during that important trial, and was afforded an opportunity of scrutinising the exhibits, commented on in another part of this work. Just before the trial I had publicly expressed somewhat similar views to those held by Mr. Budden, and happen to know that the learned judge having been made acquainted with my opinion as to the necessity of scientific training for experts, entirely agreed with that view and expressed himself to that effect before his remarkable charge was delivered to the jury.

It is now announced that Inspector Collins, whose name will always be honourably associated with the technical side of the art, “is making a tour of the country instructing police officers in various parts in the art of taking impressions of fingers and thumbs, and in the art of reading them when they have them.”

The present brief guide to Dactylography (a term of English origin, by the way) is thus intended to supply a want of quite recent origin, frequently felt and expressed.

Its aim is to give in compact and portable form, and without unnecessary technicalities, the main facts and principles likely to be found useful in medical and legal inquiries involving identification by this method. Biological discussions as to the influence of heredity, and elaborate calculations based on data lacking in precision have been avoided. In a field so fresh where practical experience has yet hardly had time to become definitely formulated in literature, imperfections, of course, may be fully expected. My practical work as a scientific

student, however, now extends over a quarter of a century, and I have had the benefit of suggestions from not a few scientific correspondents who have been interested in details of this investigation. I trust, moreover, that suggestions will yet be afforded me for the remedy of any defects by which a future edition may benefit. Even while going through the press some useful hints have been received from legal experts for which I have to express my gratitude.

Somewhat less than fifteen years ago it was impossible to get any medical man or jurist to listen quite patiently to the proposal to use finger-prints for purposes of identification. To-day almost every police inspector in England is convinced of the practical utility of the system. What is more striking is that many highly educated people cling to the notion of its foreign origin.

One main object I have kept in view is to check a reaction against previous indifference to this method as a mere curiosity of science too fine for the everyday world. Officials are now becoming rather disposed to swing to the opposite extreme and to treat the matter as one which can be dealt with by subordinate officials untrained in scientific observation. In this current misapprehension lurks some danger to the community. As a system of English origin its strength lies in an ultimate appeal to that sturdy common-sense which takes no official opinion for granted. All that the scientific expert can do is to keep this kind of evidence free from fallacy that might betray an ordinary juryman.

I owe my best thanks to Mr. Gover, photographer of this borough, whose technical skill has been of great assistance to me. My acknowledgments are also due to Mr. Pocock, F.Z.S., F.L.S., the superintendent of the Zoological Gardens, London, for specimens reproduced in this work.

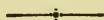
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GUIDE TO Finger-Print Identification.

CHAPTER I.

INTRODUCTORY.

Old Methods of Identification.

It is not easy for anyone at the present day to imagine how our grandsires dealt with the identifying of prisoners in criminal procedure. An early edition of the *Pickwick Papers* may afford some help. That work contains a picture showing the greatly embarrassed hero of the famous story having his "portrait" taken by an unsympathetic group of Bow Street runners. This was not being done by any fine chemical or artistic process. Each official was simply endeavouring by staring hard and fixedly at the suffering victim to fasten his important image on the memory. Even in the present year (1905) it is stated by *The Lancet* that, "Recognition by memory of the prisoner by someone present at his previous trial and conviction is the usual means employed at the present time of proving previous convictions in court. Some police officers, no doubt, have good memories for faces, but the reliance that is to be placed upon such recognition after perhaps an interval of several years is obviously most uncertain. Identification by finger prints is here very valuable, but the identification should be made by properly expert persons." (13th May.)

No doubt in the early days by dint of practice and the driving of necessity many feats of skill in the use of memory were accom-

plished. The following example of an application of old methods in their strength and weakness is contained in Taylor's *Manual of Medical Jurisprudence*. "A trial took place at the Old Bailey in 1834, in which a man was wrongly charged with being a convict, and with having unlawfully returned from transportation. The chief clerk of Bow Street produced a certificate, dated in 1817, of the conviction of a person, alleged to be the prisoner, under the name of Stuart. The governor of the gaol in which Stuart was confined believed the prisoner to be the person who was then in his custody. The guard of the hulks to which Stuart was consigned from the gaol, swore most positively that the prisoner was the man. On the cross-examination of this witness, he admitted that the prisoner Stuart, who was in his custody in 1817, had a wen on his left hand; and so well marked was this that it formed a part of his description in the books of the convict-hulk. The prisoner said his name was *Stipler*: he denied that he was the person named Stuart, but from the lapse of years he was unable to bring forward any evidence. The recorder was proceeding to charge the jury, when the counsel for the defence requested to be permitted to put a question to an eminent surgeon, Carpue, who happened accidentally to be present in court. He deposed that it was impossible to *remove such a wen as had been described without leaving a mark or cicatrix*. Both hands of the prisoner were examined, but no wen, nor any mark of a wen having been removed, was found. Upon this the jury acquitted the prisoner." [Twelfth Edition (1891), p. 317-318.]

After that period daguerrotypes, and, a little later, photographs, came into use for identification, and are still occasionally useful, but the results were found often to be very deceptive and misleading. Photographs done officially are not, as a rule, works of art, at the best. Two photographs of the same person, even when done by good artists about the same time, often look very discordant, from certain effects of light and shadow, not to mention the variations in a sitter's expression. If anyone will take the trouble to compare a collection of photographs of celebrated persons made at different periods of life, he will probably be greatly surprised to find how difficult it is to *feel* persuaded, even after the most irresistible evidence, that these are portraits of one and the same person made without bias by the infallible sun and unemotional chemicals.

In *Cymbeline*, when Iachimo emerges from the trunk to contemplate the fair image of the sleeping Imogen, he whispers to himself:—

*But my design,
To note the chamber: I will write all down:—
Such and such pictures;—there the window;—such
Th' adornment of her bed;—the arras, figures,
Why, such and such;—and the contents o' the story.
Ah, but some natural notes about her body,
Above ten thousand meaner moveables
Would testify, to enrich mine inventory.
 . . . On her left breast
A mole cinque-spotted, like the crimson drops
I' the bottom of a cowslip: here's a voucher,
Stronger than ever law could make.*

Alas, even freckles and moles have been shown by science to rank among the “meaner moveables,” and stronger vouchers than moles are now required to prove identity.

After the Tichborne Trial had drawn to its weary close many minds had become attracted to the scientific problem then so dramatically raised. Human face and form change with time, influenced by emotions and the vicissitudes of life itself; the hair alters in colour and in texture; the dialect changes with the local environment and company; the voice itself alters in tone and timbre; temperament and character, affections and pursuits, vary in the different periods of life. I have myself witnessed extraordinary and rapid changes in cases of typhoid fever; changes in feature, form and character; the hair altering its colour, and even the nose decidedly changing its shape.

Modern Methods.

Two scientific methods of personal identification were within a year or so of each other publicly proposed and expounded, namely: That of finger-prints by myself in 1880, and that of comparative measurements by Mons. Alphonse Bertillon in 1881. The two methods thus springing into publicity in Europe so closely together in time have come to be somewhat confused not only in the popular imagination but even among authors and journalists of repute. Thus in a very recently published part of the *Harmsworth Encyclopædia*,

under the heading "Anthropology," where "Bertillonage" is explained, we read:—"The natural structure of the skin, as seen in the palm of the hand and sole of the foot, where it shows fine alternating ridges and furrows, has led to elaborate methods of recording, classifying, and interpreting the finger-print patterns which may be obtained from the palmar surface of the terminal phalanges of the digits," from which anyone would naturally infer that this was part of that system of Anthropometry due to the ingenuity of Mons. Bertillon. In the same usually correct work, under the "Bertillon System of Anthropometry," it is stated that "the characteristic lines made by the print of the finger are also recorded," but Mons. Bertillon does not consider that a part of *his* system. The writer of the article in the *Encyclopædia Britannica* on "Anthropometry" also enters on a short discussion of finger-prints as a part of that study. The subject of finger-prints is, however, nowhere to be found in the copious and elaborate index to the whole work, including the additional series of volumes which were recently published. Then again, among newspapers, *The Daily Telegraph*, in a leader of May 8th, 1905, commenting on a trial for murder in which finger-print evidence had been prominent, says:—"The Bertillon system of identification is comparatively new in this country, and there is naturally an intelligible hesitation on the part of jurors to hang a man on the evidence of a finger-print, especially when, as in this case, it is rather indistinct." No one can have a greater respect for the delicate metric methods of M. Bertillon than the present writer, but they have no relation whatever to identification by finger-prints, a method which is English in inception. Mr. F. Galton, writing in *The Nineteenth Century* (August, 1891), says: "M. Alphonse Bertillon assures me that he does not use finger-prints in connection with his system of anthropometric identification which is now employed in the French criminal service." The finger-print method was after that period added in Paris to the mode of measuring various parts of the body, now called "Bertillonage." Shortly after the Stratton Case had made the matter interesting Mons. Bertillon wrote me officially as Chef du Service de l'Identité Judiciaire à la Préfecture de Police,—Palais de la Justice, Paris. As to the time when the employment of finger-prints began in his department, he says:—"Les impressions digitales, à Paris sont adjoints au signalement

anthropométrique depuis l'année 1894. J'ajoute que nous nous en trouvons fort bien. Quoique nous n'ayons *jamais* fait d'identification erronée antièrement nous sommes encore mieux garantis, si possible, en ce qui regarde l'avenir."

The recent adoption of the finger-print method in Germany, Spain, and Austria, and its proposed adoption in the United States of America, has nothing in itself to do with anthropometry, which may be associated with it but which it tends to displace and supersede.

Popular confusion of "Bertillonage" with Finger-prints.

The name of Bertillon is now, however, so popularly entwined with the finger-print method in this country that a few sentences may be useful to explain how this curious mis-conception has arisen and been propagated. The blunder is certainly in no way due to M. Bertillon himself, but has arisen from an official and English source in a simple enough way.

In 1893, Mr. Asquith, who was then Home Secretary, appointed a Departmental Committee, with Charles Edward Troup, Esq., of the Home Office, as chairman. It included also the Inspector of Prisons and the Chief Constable of the Metropolitan Police. This Committee was to enquire into the method then prevailing in England of identifying previous criminals; and also into the Anthropometric *and* Finger-print Systems. Their Report was published as a Blue Book "*Identification of Habitual Criminals*" (1894, price 10d.).

As a result of the information then received it was decided to *adopt a combination of the two methods*—measurements and finger-prints—as the system previously in use had been found untrustworthy. Dr. Garson, a distinguished vice-president of the Anthropological Society, was appointed medical supervisor of the metrical work, assisted by Mr. Collins (now Inspector), who after some training by Mr. F. Galton, who had recently begun the study, took charge of the Finger-print Department. For some time the two rival systems were carried on side by side in harmonious co-operation. Finally, however, the victory lay with the fittest. The English system of finger-prints took the place of honour as the recognised official system of criminal identification in this country.

It was thus, as it seems, the temporary official association of the two methods that gave Bertillon's name the glory of a system, to the

discovery of which it is only just to say, that eminent scientist has never made the slightest claim.

Another Committee to deal with this now very important question was appointed in the autumn of 1900, with Lord Belper as its chairman. No report of its proceedings has ever been published, so far as the present writer has been able to ascertain. It is safe, however, to say, that the English or finger-print system itself, now *without* the system of measurements, was recommended to be used henceforth in the official identification of criminals. The addition of anthropometric details as an extra precaution had been found by experience to be cumbrous, unworkable, and indeed, quite superfluous. Identification, it was officially concluded, could be made safely and simply, by finger-prints alone. The simple finger-print method, although now stamped with official approval, did not, however, come into actual operation in England till fully another year had passed.

War Office Committee.

In May, 1902, Mr. Brodrick, who was then Secretary for War, and was ardent to effect reforms in his own department, appointed a Military Committee to consider the applicability of the method of finger-print identification to recruits, who are suspected sometimes to re-enlist without the recognition of the authorities. This committee sat in the War Office, and an official of high rank from the Home Office took a leading part in the investigation. I was the only expert who was called or examined, and was able, I believe, to clear away a multitude of difficulties and misapprehensions with which the subject had become involved in official minds.

A London daily newspaper throws some light (?) on the proposals of what it describes as the "thumb mark board," now sitting at the War Office. "An irritating feature of recruiting for the Army has hitherto been the frequency of fraudulent enlistment, and though the utmost vigilance is exercised the percentage of re-enlisted men who have been discharged as 'bad characters' and so on does not decrease. A remedy for this will probably be found in the adoption of the anthropometric system of identification perfected by Mons. A. Bertillon (*sic*). 'We have been considering the Bertillon System for some time,' said a high official of the War Office, on Saturday, 'but have not yet decided to adopt it. You see the taking of the

thumb marks (!) of all the thousands of men in the Army would be a very large undertaking, and to identify any one particular man by his one particular thumb mark seems a huge task where there are such large numbers concerned.'” It was never any proposal of mine to lean upon *thumb* marks alone. My plan, now generally adopted, was to have all ten fingers on record, and in serial order. There is no difficulty in taking all those marks, and if my system of classification were adopted the largest records could easily be compared with precision and confidence.

CHAPTER II.

ON THE NATURE OF SKIN RIDGES AND FURROWS.

Patterns in Nature.

To the eye of a keen observer nature is everywhere full of *patterns*, which may or may not seem to have beauty, but do always possess variety. The veining of leaves and petals, the grain of oak or maple, the spots of pigment on a frog's foot, the weathering of stone, the cracks and linings on the bark of trees, the scribbles on a yellow-hammer's eggs, a zebra's stripes, the streaks in marble, and a hundred other things will occur to anyone who reflects for a little on the subject. The Palace of the Mikado on the Strand at Tokyo (*Hama-goten*) is guarded from the ravages of the waves in Yedo Bay by a rough kind of cyclopean wall capped by gnarled and ancient pines. The hungry sea has made strange inroads on the textures of those massive stones and curious devices now adorn them as if the tool of some deft engraver had chiselled some hieroglyphic chronicle over their surface. Some of the most beautiful patterns of natural origin I have ever seen are found on the carved and fretted surface of the large scales on a sturgeon's head. They remind one indeed of arabesque carvings in ivory done by Indian artists. One of the reef-forming corals—*Meandrina*—shows lineations of a striking kind. Many such patterns as nature has so lavishly provided are, however, quite fugitive and transitory. The bark of the Oriental plane tree that gives an almost rustic character to some London streets scales off in varying forms each season of growth; the pigment markings on a frog's foot, as my illustrious teacher, Lord Lister, demonstrated long ago, unlike the spots of the leopard, change from time to time, the coloured particles migrating like living things. So have I seen captured cuttle-fish on the shores of the Pacific flush in dying agony

with all the colours of the rainbow, seemingly by means of a network of fine canals connected with reservoirs of differently coloured pigments, which flowed hither and thither as emotion drove them. There are clam-like shells, however, on those same shores on which children can find letters and even short words written in English, Greek, or Chinese, and these change not.

*Dic, quibus in terris inscripti nomina Regum
Nascantur flores ; et Phyllida solus habeto.**

Uses of Finger-prints.

Such patterns as are to be found in the skin ridges of human fingers have recently sprung into the greatest importance, and now promise to fulfil a great sociological purpose in the identification of persons during life and after death, criminals in prison or in the dock, travellers in foreign lands, sailors at sea and soldiers after battle.

Sir Thomas Browne, in his *Religio Medici*, has a curious passage which refers no doubt to the palmar creases, long familiar even to the ancients. This language, however, would be more appropriate to the finger-prints. Speaking of the physiognomy, which reveals so much of a man's nature, he goes on ;—"Now there are, besides these characters in our faces, certain mystical figures in our hands, which I dare not call mere dashes, strokes *à la volée*, or at random, because delineated by a pencil that never works in vain ; and hereof I take more particular notice, because I carry that in mine own hand, which I could never read of, nor discover in another. Aristotle, I confess, in his acute, and singular book of physiognomy, hath made no mention of chiromancy ; yet I believe the Egyptians, who were nearer addicted to these abstruse and mystical sciences, had a knowledge therein ; to which those vagabond and counterfeit Egyptians did after pretend, and perhaps retained a few corrupted principles, which sometimes might verify their prognostics. It is the common wonder of all men, how among so many millions of faces, there should be none alike : now, contrary, I wonder as much how there should be any. He that shall consider how many thousand several words have been carelessly and without study composed out of twenty-four letters ; withal, how

* P. Verg. Mar. Ecl. III., 106. "Tell, in what land flowers grow, inscribed with royal names, and Phyllis shall be yours alone."

many hundred lines there are to be drawn in the fabric of one man, shall easily find that this variety is necessary : and it will be very hard that they shall so concur, as to make one portrait like another. Let a painter carelessly limn out a million of faces, and you shall find them all different. . . . For even in things alike there is diversity ; and those that do seem to accord do manifestly disagree. And thus is man like God ; for in the same things that we resemble Him, we are utterly different from Him. There was never anything so like another, as in all points to concur ; there will ever some reserved difference slip in, to prevent the identity, without which, two several things would not be alike, but the same, which is impossible.”

Ridges and Furrows.

I propose now to describe these ridges of the skin which make patterns that form the basis of my method of identification. On the face or palmar surface of our hands and feet the skin is marked with alternate rows of ridges and grooves or furrows, which collectively are not unlike the aspect of a ploughed field. On the crest or back generally of these ridges open out the sweat pores of the skin, but it is not clear what definite relation subsists between them. There are pores where there are no ridges, but most ridges seem to be punctured with pore-holes. Those furrows fade away insensibly, as a rule but sometimes abruptly, at the boundary of the palms ; but in

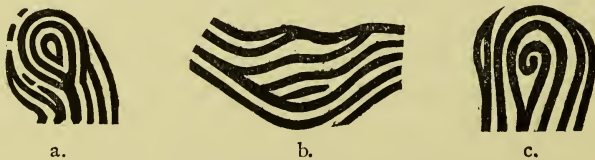


Fig. 1. Skin Ridges and Furrows (enlarged).

many places instead of being arranged in parallel lines (generally somewhat curved) as in a well ordered farm one may see them turn into a loop or circle, giving a new direction to the neighbouring ridges and furrows and thus forming patterns of great distinctiveness and significance. Even the more regular ridges are seen to split or join, like a railway plan, as in fig. 2. Often those patterns are freak-like, but again, to preserve the figure of a ploughed field, they often look as if the ploughman had encountered some hidden rock or stump of an



Fig. 2. Right Thumb (adult male), direct nature-print from a greasy finger. The lines are dark on a white ground (enlarged by photography).



Fig. 2a. Whitened smudge of same finger as in fig. 2, left on japanned tin. The lines are white on a dark ground (enlarged).

ancient tree, and had done his best by going round the obstruction. No such hidden cause has as yet, however, been suggested to explain why the ridges of skin should grow so. The traveller in semi-civilised lands often encounters curious winding paths that no competent engineer would devise. The explanation is that some such spot is unlucky. What determines the course of the *rugae* is as yet unknown, but the resulting patterns, so full of character and so permanent, can be utilised apart from the nature of their unknown causation. In comparing them to ridges in a field it is well to remember the comparison does not always hold good. The lines are not of uniform width. Oftimes they may be likened rather to the mountains and valleys in a good survey. The ridges sometimes split or send little spurs down into the neighbouring valleys: at other times a ridge seems to cleave, giving rise to a form like a tarn or lake in a limestone range: here and there solitary islands rise in the valleys, and sometimes quite an archipelago takes the place of some of the commoner patterns. Indeed the nomenclature of an ordinary physical geography map may be found quite helpful in laying a case clearly before a magistrate or a jury. And just as we find in the case of mountains and valleys in a map, every variety of shape may occur in a finger pattern. The ridges (*rugae*) and the valleys or grooves (*sulci*) which lie alongside of the former are by no means confined to the fingers, as we have seen.

In fig. 3 there are represented diagrams of a number of those curious elements into which finger-prints may be analysed, but no attempt has been made to exhaust the list, which might easily be expanded into a great many pages. By applying the principle of permutations it may readily be judged that just as chemical forces combine a few kinds of atoms into the immense variety of composite substances that occur in nature so biological laws induce in the ridges of skin endless combinations of those simpler elements. It is to be remembered, however, that imprinted lines from skin vary somewhat in thickness and are irregularly dotted over with the openings of the perspiratory ducts or sweat tubes which give a most characteristic appearance to finger-prints.

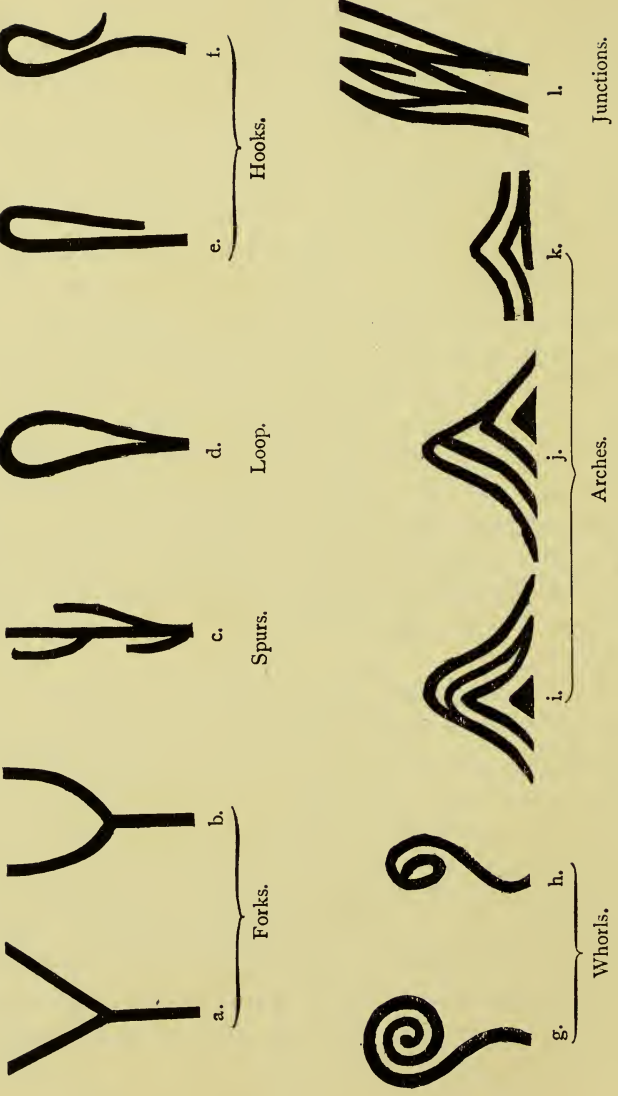


Fig. 3.

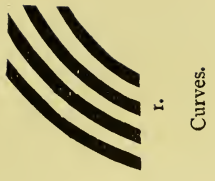
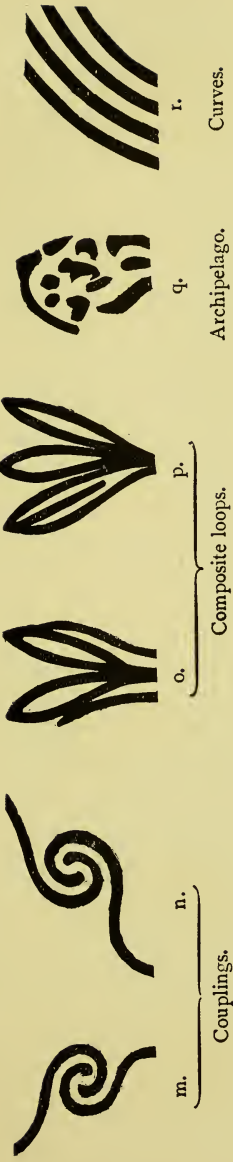


Fig. 3.

Dermatographs.

An impression prevails that the distinguishing patterns are only to be found on the last joint of each finger. On many other parts of the palm, and often in corresponding parts of the feet, the ridges are not only distinct, but gather up into complex patterns of much character and variety. Such elaborate mathematical calculations as some have indulged in are therefore rendered futile by ignoring this important element in the proving of crime by identification of alleged "finger-prints." The blurred mark or smudge which has to be compared with the known finger-print of a suspected man is not necessarily a *finger*-print at all, even if actually impressed by the accused person's hand. I have tested this point over and over again, and it involves very important consequences in criminal trials. These patterns might be named generally *dermatographs*.

In one pair of hands which I have just inspected while penning these words—and the case is not very exceptional—there are thirteen good patterns on the two hands, quite exclusive of the patterns on the last joints of the fingers at the bulbous part, technically called "finger-prints."

Variety of Patterns.

The multiplicity of patterns so formed on the surface of human fingers is very striking. Leibniz, in his "Monadology," says that the monads, of which he supposed the universe to be composed, were *necessarily* each unlike all the others. "Each monad, indeed, must be different from every other. For there are never in nature two beings which are exactly alike, and in which it is not possible to find a difference either internal or based on an intrinsic property." But then he assures us that these are subject to change as is the lot of every created being. This well-known theory of his was once emphasised by him while on a visit to this country. The incident is related by Thomas de Quincey in his essay on Charlemagne. Leibniz, who was explaining to Her Royal Highness the Princess of Wales the infinite variety which these elements possessed, turned to a gentleman in attendance and challenged him to produce two leaves from any tree or shrub which should be exact duplicates of each other in their leaf venation. The challenge was promptly accepted, but Leibniz was in the right. "It is in fact" De Quincey goes on to say,

“upon this infinite variety in the superficial lines of the human palm that palmistry is grounded (or the science of divination by the hieroglyphics written on each man’s hand), and has its *primò facie* justification. Were it otherwise, this mode of divination would not have even a plausible sanction; for, without the inexhaustible varieties which are actually found in the combination of these lines, and which give to each separate individual his own separate type, the same identical fortunes must be often repeated, and there would be no foundation for assigning to each his peculiar and characteristic destiny.” These fanciful impressions as to the creases in one’s palm, produced very much as those in one’s shoes are produced, do not help us in the consideration of the finger patterns. To the careful student of the subject an impression is produced at a very early stage that no two finger-prints can be identical. As experience increases it comes to be perceived that this is not a practical conclusion to be accepted at once without further discussion, as we shall see in a later chapter.

Heredity.

The subject of heredity is hardly yet ripe for scientific treatment in this connection, nor would this be the place for such a discussion. Likenesses of the prints of children to those of their parents are often striking, but while close resemblances occur in the general trend of the lineations, and often marked correspondence in a general way, of finger with finger, yet the evidence of individual differences in detail and in measurement, is usually quite secure. I have not yet encountered a case of heredity which would present any practical difficulty in the ordinary identification of old offenders. The patterns of son and sire might, indeed, be strikingly similar at first sight, but when particular ridges or furrows were carefully followed up, each by each, the two individual patterns were seen to diverge, just as the points and sidings at similar stations on the same railway system would be found to present variety of detail.

Origin of Ridges.

Herbert Spencer, not many years after I had called attention to the patterns formed by the skin ridges of the hand, writing “On the Factors of Organic Evolution” in *The Nineteenth Century* (May, 1886) endeavours, I think not quite satisfactorily, to explain the

origin of these linings or ribbings of the palm and fingers. He says:—
 “Continuous pressure on any portion of the surface causes absorption, while intermittent pressure causes growth: the one impeding circulation and the passage of plasma from the capillaries into the tissues, and the other aiding both. There are yet further mechanically produced effects. That the general character of the ribbed skin on the under surfaces of the feet and inside of the hands is indirectly due to friction and intermittent pressure we have the proofs; first, that the tracts most exposed to rough usage are the most ribbed; second, that the insides of hands subject to unusual amounts of rough usage, as those of sailors, are strongly ribbed all over; and third, that in hands which are very little used the parts commonly ribbed become quite smooth.”

The theory might be very excellent if the facts were always as stated. Some of the most distinctly ribbed hands are, in my own extensive experience, those of people who use their hands very little for grasping or rough work. General servants, who are scrubbing at all times, have often hands with very slightly marked ridges, which do not print clearly at all on paper. It is not correct to say that people who do not work have smooth hands in this sense.

In whatever way they originally began to be the ridges seem distinctly now to serve a useful function in enabling the hand to grasp objects firmly without slipping. So the elastic tyres of a bicycle or motor car are sometimes moulded with a ribbed surface to grip the ground. It is not surprising to find that some makers have designed the ribbing so as to preserve their own names before the public. It struck me before knowing that fact that if the ribbing in a bicycle wheel were varied in direction, as in the human hand, the gripping under varying conditions would be more effective. If Sir Charles Bell or Archdeacon Paley had dealt with this theme no scientist at the present time has the basis of an effective answer ready. Mr. F. Galton seems to think that the ridges act as auxiliary organs of touch “in a similar way to the whiskers of a dog or cat.” (*The Nineteenth Century*, May, 1891.) But the *rugae* are neither so conspicuous nor variable in pattern at the very finger tips which we use chiefly for touch, as in other parts of the hand. Again, they are particularly well developed in many parts of the palm and feet where sensation is proportionately less acute and less discriminating. Mr. Galton’s

Zoological Society's Gardens.

Regents Park, London. N.W.

TELEGRAPHIC ADDRESS,
"ZOOLOGICAL",
LONDON.

190.



Fig. 4. Young Gorilla, "Chloe," right hand (showing palmar creases).

explanation of the arrangement of special lineations, chiefly used for identification, is not more fortunate. He attributes the apparent freak in the direction of the lineations to the inset of the finger nail; but there are just such patterns, just such divergences of direction of the lineations in several other parts of the palm, besides the region of the finger nails, which are in no possible way affected by them.

Permanence of Patterns.

It has already been stated that the patterns have the quality of permanence without which they would be no more helpful in identification than ordinary freckles, the pigmentary particles composing which migrate slowly under the influence of light and other causes. Those freckle spots wax or wane sometimes quite noticeably, as in that harmless affection *leucoderma* (white-skin), which has often been confounded with leprosy. This happens very noticeably in dark races, and especially in certain malarious districts. Inflammation often leaves old pigmentary lines behind it, and an application of cantharidis (Spanish fly blister) sometimes makes a white patch on a negro's skin, and a dark patch on the skin of a white man. I do not think it necessarily creates or destroys pigmentary particles but simply re-assembles in a new form those that formerly were there. In some cases, however, the activity of the tissues may lead to new pigment particles being developed. Now, in applying cantharidis to the finger patterns I have never found any alterations due to the increased activity of the skin growth. You may shave these patterns away almost to the quick and they come up into view again. If rubbed quite smooth with sandpaper or pumice stone still the ridges come into prominence again exactly with the same arrangement as before so long as the *derma* or true skin is left intact below. If that is destroyed a ridgeless scar is produced. I know of no cause likely to make these patterns alter.

Effects of Age and Disease.

Age does not, in my now lengthened experience, change the patterns as such, though its effects may be seen in a certain drying up and wilting of the skin. In printing, the pattern will then only show a few fresh white hatches, generally, but not always transverse to the ridges, just as if a boxwood

engraving block had shrunk on drying, leaving some tiny cracks on the engraved surface. A little vigorous shampooing may partially efface those fine wrinkles and restore the pattern nearly to its youthful fulness. Ague in the cold or algid stage also tends to produce a somewhat similar effect. This fact is worth bearing in mind in a country where so many warriors return from tropical service, perhaps ruined for life. There is an affection called Reynaud's Disease, which is commoner than is usually supposed. The finger-tips of the sufferer become bloodless, cold, feelingless, and leaden blue or white. The prick of a needle will neither cause pain nor draw blood. I have noticed such cases before any complaint has been made, and in them the finger-prints, I believe, from visual examination, show some considerable shrinking in size, but at present I do not possess any imprints of those. Such diseases as typhoid and scarlet fever may have some effect in inducing alterations, but little is yet known as to their effect on the patterns.

CHAPTER III.

OUTLINES OF PRACTICAL DACTYLOGRAPHY.

Nature of the Study.

When the ridges and furrows of the skin are systematically examined either *directly* by the unaided vision or with the assistance of lenses, or *indirectly* by the medium of casts of wax, paraffin, clay, or the like, or again by means of printed impressions in ink, grease, blood and so on there emerges the science of Dactylography.

“Dactyloscopy,” which has been proposed, should in my opinion now be restricted to the *direct* method of inspection; a method, indeed, which I have found to be far more suggestive often than the study of finger-prints, but which is apt to be irksome to those who have not good myopic eyes for near vision.*

This science of Dactylography has reference to a much wider field than that of criminal detection, the identification of old criminals, or even that of personal identification generally. It tends to deal with such questions as developmental descent, the relations of anterior and posterior limbs, heredity, race, and the like; with these subjects, however, the present work, of which the aim is purely *practical*, has little concern.

Accidental Imprints or Smudges.

The patterns, as presented for consideration, may be officially printed, as in the case of old offenders, where all the lineations are usually clear and distinct. On the other hand they may have been quite unwittingly impressed from the finger or hand of some evil-doer on glass or metal, on wood or paper, on a knife or other weapon, on a white wall or a wooden floor. It is very common to see such imprints

* *St. Thomas's Hospital Gazette*, article by the Author, Jan., 1904, p. 15.

upon a newspaper or book from a public library, where no crime is involved. In one case of sudden death, which as acting police surgeon I was called to examine, there were said to be vivid finger-marks on the neck of the deceased. No such marks could be detected by me, but a clear story of laudanum poisoning was by and by revealed. It was no murder, but a deliberate suicide. Besides impressions similar to those made by ordinary printing type, fingers and hands generally may leave *relief* impressions in sealing-wax,—not so much used now—on beeswax, paraffin candles, pitch, clay, putty, varnish, soft paint, and many other substances used in everyday life. If care is taken from the moment of discovery in case of crime, good photographs may usually be obtained from any of those materials. The varying conditions under which they are made will involve careful consideration of each case. Criminals in the haste and urgency of some deed of darkness do not stay to consider thoughtfully the wants of the jurist, yet under those very conditions remarkably good imprints have often been made, leading to good circumstantial evidence, and to conviction by a jury.

Such accidental and unpremeditated smudges as are now often offered as evidence in our courts will require detailed and very careful consideration.

Mirror Patterns.

This is a matter that will be seen to have great practical importance. The impressed or printed pattern, as in ordinary printing, shows just the reverse arrangement existing in the actual ridges and furrows of the skin. A loop or whorl veering to the left in print, actually in nature veers to the right, and so on throughout.



Fig. 5. Mirror Patterns.

In fig. 5, for example, the actual ridge pattern or dactylograph *a* may be that of John Doe, while *b* is that of Richard Roe. Now let Richard's finger-print by some mishap in photography take the corresponding "mirror pattern" *c*, and at once Richard Roe is in urgent

danger of being hanged as John Doe. These are diagrams of two actual fingers from different hands, and the correspondences were much greater than the maximum which has been said never to be exceeded by two really different fingers.

Mirror patterns of a complex kind do not often occur, for many which appear to be such will reveal to careful scrutiny divergences of a non-mirror quality. Now this point may seem to be clear and simple, and to many who have not estimated its gravity even trivial. If we recall, however, how our early Victorian warriors, returning from the Crimea, were disconcerted by finding the faithful daguerrotype pourtray them as wearing their victorious sword on the right, and therefore wrong, side, we may judge that even in finger-print study some perplexity might easily arise. Indeed, by ignoring such facts, a false identification might readily be made.

Chirality.

A great deal has been written on this subject of *Chirality*, as Pasteur has termed it, in writing of certain chemical compounds which are analogous, to the correspondence and difference of the two hands in a pair of gloves. They are as like as two Euclidean triangles, coincide just like them, but let anyone try to put his left hand glove on his right hand! Lord Kelvin has used the term similarly in dealing with certain properties of light. Kant,* so far as

* *Prolegomena zu einer jeden künftigen metaphysik, &c.*, Erdmann's edition (Leipzig, 1878), sec. 13, p. 37:—"Was kann wol meiner Hand oder meinem Ohr ähnlicher und in allen Stücken gleicher sein als ihr Bild im Spiegel? Und dennoch kann ich eine solche Hand, als im Spiegel gesehen wird, nicht an die Stelle ihres Urbildes setzen; denn, wenn dieses eine rechte Hand war, so ist jene im Spiegel eine linke, und das Bild des rechten Ohres ist ein linkes, das nimmermehr die Stelle des ersteren vertreten kann. Nun sind hier keine inneren Unterschiede, die irgend ein Verstand nur denken könnte; und dennoch sind die Unterschiede innerlich, so weit die Sinne lehren, denn die linke Hand kann mit der rechten unerachtet aller beiderseitigen Gleichheit und Aehnlichkeit doch nicht zwischen denselben Grenzen eingeschlossen sein (sie können nicht congruiren), der Handschuh der einen Hand kann nicht auf der anderen gebraucht werden. Was ist nun die Auflösung? Diese Gegenstände sind nicht etwa Vorstellungen der Dinge, wie sie an sich selbst sind und wie sie der pure Verstand erkennen würde, sondern es sind sinnliche Anschauungen d.i. Erscheinungen, deren Möglichkeit auf dem Verhältnisse gewisser an sich unbekannter Dinge zu etwas Anderem, nämlich unserer Sinnlichkeit beruht. . . . Wir können daher auch den Unterschied ähnlicher und gleicher, aber doch incongruenter Dinge (z. B. widersinnig gewundener Schnecken) durch keinen einzigen Begriff verständlich machen, sondern nur durch das Verhältniss zur rechten und linken Hand, welches unmittelbar auf Anschauung geht."

I can remember, was the first to call attention to such correspondence with a difference, and a learned translator of his once unfortunately turned the expression "*wider-sinnig gewundener Schnecken*," into "snails rolled up contrary to all sense."† The term "symmetrical helices" would have accurately expressed what Kant really meant, as in the case of two winding stairways built similarly, but one with a right and the other with a left hand turning.

Reversible Patterns.

Mr. Galton, in mentioning the effect of simple reversal by lithography and the like, makes a useful remark which has a wider application:—"It is worth recollecting that there are twelve capital letters in the English alphabet which, if printed in block type, are unaffected by being reversed. They are **A, H, I, M, O, T, U, V, W, X, Y, Z**. Some symbols do the same, such as $*$ $+$ $-$ $=$ $:$ $:$. These and the letters **H, O, I, X**, have the further peculiarity of appearing unaltered when upside down." [*Finger Prints*, p. 71-2.]

Now a practical point to be remembered is that a given smudge may resemble a suspect's real finger-print when placed one way and be quite unlike it when reversed or placed any other way. May the apparent reversal be due to the effect of photography on the exhibit? The original smudge has been photographed and then enlarged for presentation. Has it been reversed and then in printing reversed again? The fact must be got at very clearly from the first or there will be the most hopeless confusion and bewilderment. In patterns, which like the letters **H, O, I, X**, can be turned upside down or either way, the danger of a mistake is even in one sense greater, but in so far again the evidence for identification afforded by such patterns would be much less convincing.

Suppose we find such a mark as we might symbolically denote by **H**, which has been left on some weapon or other article at the scene of a crime. In the case of ordinary irreversible patterns, such as we might denote by **L** or **B**, to prove identity we must find a suspect, one of whose finger-prints will agree with **L** or **B** respectively, only when we get the imprint into the right position or that which it occupied at the moment of imprint. But with **H** on the other hand,

† See Preface to English Edition of Kant's *Prolegomena*, by Dr. Paul Carus, [Kegan Paul, Trench, Trübner & Co., Ltd., 1902.]



Fig. 6. Whitened smudge of same finger as in fig. 2, left on japanned tin, with white lines on dark ground (enlarged).

we might perhaps be able to find four suspects each agreeing with **H** in some finger pattern printed in a different direction, which we might here describe for simplicity as north, south, east, and west. Now it is obvious that this would not form a scientific identification at all. No expert might be able to say which part of **H** during impression was north, or south, or east, or west.



Fig. 7. A Simple Core.

In fig. 7 we have a simple enough core or internal pattern of frequent occurrence. Suppose that this formed the centre of a clearly printed part of a smudge and that the outside lineations were somewhat blurred and obscure.



Fig. 8. Similar Cores.

In fig. 8 there are three diagrams of finger-prints each containing a similar core. If the exterior lineations were hazy or blurred, as they often are in such cases, too much stress might readily be laid upon the resemblance at the centre part, which is so far really complete, yet the three resembling patterns belong to Tom, Dick, and Harry respectively.

It is difficult to make the matter clearer without an extensive series of costly enlargements, but I am myself thoroughly convinced that the danger is real of false identification through neglect of this great class of facts, which no expert seems to me to have thoroughly grasped up till now.

There are, then, many patterns where the importance of symmetrical reversal or chirality is very great. If this is remembered once and for all the matter need not present any practical difficulty, where expert evidence is available.

Symmetrical and Unsymmetrical Sets of Fingers.

In many hands the whole ten finger patterns show this quality, five pointing one way with the main loop and just reversing the direction on the other hand. The details of lineations may, of course, be very different. What might be taken perhaps as the normal type would show in nature (the reverse of course in a printed pattern) each loop on the left fingers pointing upwards to the left, and on the right each pointing upwards to the right, thus :

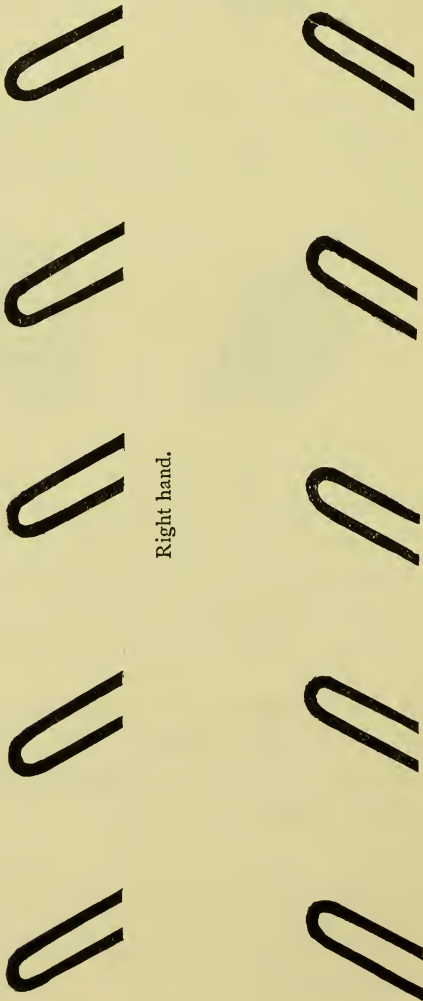


Fig. 9. Symmetrical Loops.

Often there is no such general accord of the patterns, and even when the general form of the central lines may be like the above the directions may be different, some right fingers pointing to the left and some left ones pointing to the right. This has to be remembered, for beginners in the study have a great tendency to look for symmetry and to judge as to what hand or finger a print *should* belong to by the general drift of the lineations. Such irregularities in the general direction of the lineations may readily occur, as in the following examples:—

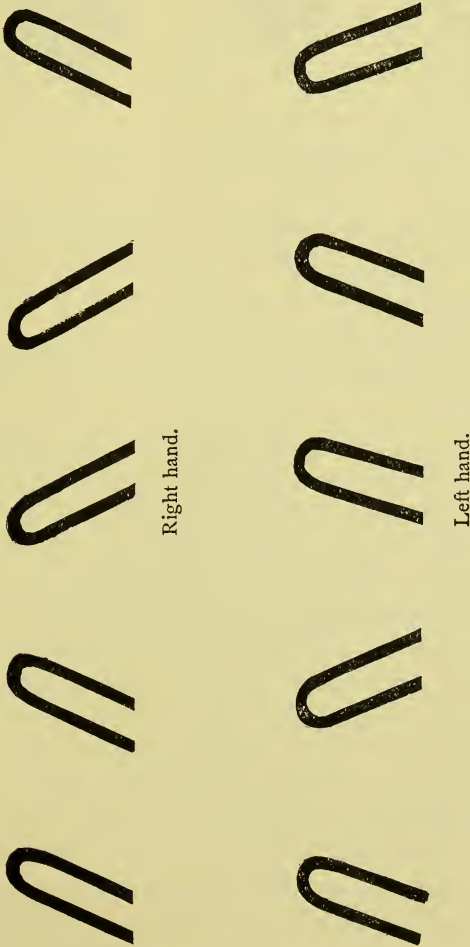


Fig. 10. Unsymmetrical Loops.

and so on in great variety.

Loops and Whorls.

These patterns are what in 1880 (*Nature*, October 28th) I called "loops," others again, adopting a term used in botany, I called "whorls." These are often coiled like a watch-spring, and again the loop itself may form a whorl just as a simple line may do, thus :—

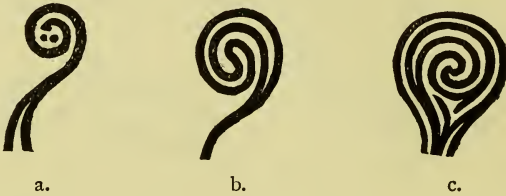


Fig. 11. Whorls, simple and complex.

and so on, in all degrees of complexity. On the whole it may safely be said that if the ordinary citizen of England were to bear on his coat, as the Japanese citizen does, a heraldic crest or badge, nature has already provided a system of designs which could easily be made to yield the necessary variety, by a little combination, if not singly.

In all those varieties of loops, whorls, etc., the designs—if we may call them so—are not only various in themselves but occur in the most varied positions. It is in this respect that care must be taken to discover whether a particular pattern coincides with some other in such a way that the coincidence is one of actual position and not a mirror repetition or a repetition of a pattern which may occur in other parts of the palmar surface than the last joint of the fingers, often called finger-tips. The official recognition of "recidivists" or habitual criminals is based upon the serial resemblance of all ten fingers, which is the method recommended by me ever since 1880. In respect to security against false identification it would seem to leave little room for improvement. The recognition of each general pattern is simple enough in most cases. Any lady who has "matched" a pattern of a curtain, wallpaper, or bit of printed calico is quite competent to perceive the coincidence if it be actually present.

Classification of Patterns.

In my first article on this subject published twenty-five years ago the various patterns are spoken of as consisting of curved and parallel lines, oval and spiral whorls, loops (simple, broken, or returning), junctions, and symmetrical (or "mirror") images.

According to the system of classification which is at present followed in Scotland Yard there are four main types, namely: Arches, loops, whorls and composites.

Arches	...	are	divided	into	simple	and	tented.	
Loops	...	„	„	„	ulnar	and	radial.	
Whorls	...	„	„	„	single	and	double.	
Composites	„	„	„	}	those with central pockets.			
					„	„	lateral	„
					„	„	twinned loops.	
					accidentals.			

My own more advanced method, long ago worked out into a system capable of dealing with immense numbers, as for insurance, passports, etc., was laid in outline before Mr. Brodrick's Committee. It recognises a large number of *primary* classes, which may be indefinitely expanded, and each finger is denoted for convenience by a syllable. An alphabetic index is the only element required to be dealt with by anyone but the scientific experts. This kind of index can be easily applied to any previous collection without dislocation of old records. To enter into greater detail would be quite foreign to the purpose of this work. One important feature has always been kept in view—an index of *single fingers*. Unless such an index is kept it is difficult to see how a smudge can be compared with the 900,000 or so of finger records now kept in Scotland Yard. It would seem to be a usual practice to look up suspected persons and compare their old records with the smudge left at the scene of a crime. By a system of indexing single fingers any smudge could be matched with its counterpart, if that really existed in the collection. To compare directly 900,000 fingers—one with the others—is obviously impossible.

Imperfect Imprints.

Cases of imperfect or blurred printing are common enough, and lead to wrong inferences sometimes, but official prints are now usually clear and pretty uniform in their character. Imperfections arise from "fluff," bits of grit in ink, blood clots and the like, and quite commonly from minor scratches or other injuries, some of which may have been deep enough to obliterate the ridges and cause slight and permanent scars. A case of bad obliteration of the special patterns might be in itself a suspicious circumstance, and is now of somewhat frequent occurrence. If accidental, the fact would be parallel to the case of a person who had lost one or more fingers.

My contention in 1880 still seems to hold good. Finger patterns remain permanent and cognisable for all practical purposes of identification through life.

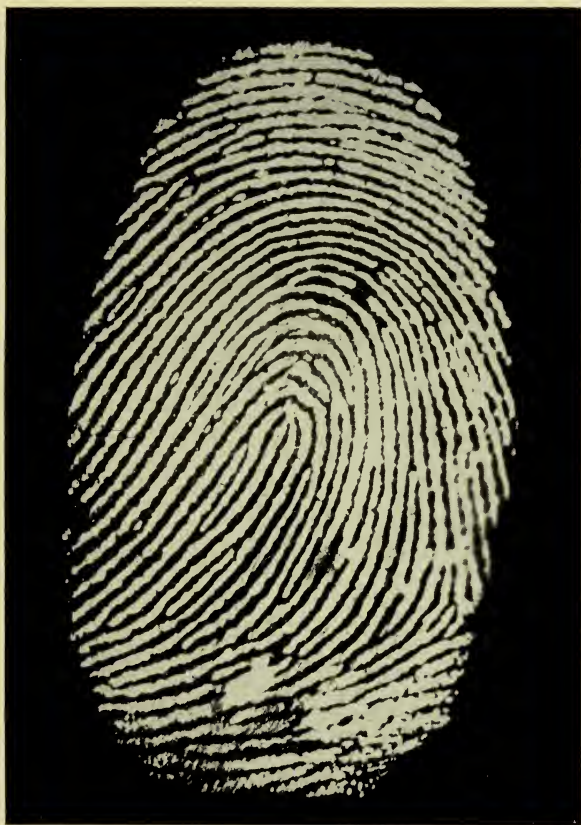


Fig. 12. Whitened finger-print on cash-box (enlarged).

CHAPTER IV.

EVOLUTION OF THE METHOD.

Major Griffiths.

In an article on "Fatal Finger-prints," contained in the *Birmingham Gazette and Express* of May 13th, 1905, Major Arthur Griffiths, late Inspector of Prisons, and a member of Mr. Asquith's Committee on the means of identifying criminals, wrote that the finger-print system "so recently adopted by the police of this country is so little understood here that the most absurd mistakes are made as to its origin and history," and he himself refers—not very correctly—to "this ancient system of identification." The evidence of its antiquity has never seemed to me to be the least clear or convincing, and the scepticism which I have early and often expressed on this subject does not abate. The writer has evidently confused two different things, the existence of ancient finger-prints, with their quite modern use for identification.

Ancient Examples of Finger-prints.

From Dr. Stevenson's translation of the *Kalpa Sūtra*, chap. v., p. 76, it appears that such marks were anciently used for *decorative* purposes:—"Also erect a large pavilion, adorned with parti-coloured cloth, hung around with flags, attaching festoons to the ceilings, and put finger-marks on it of the finest white and red Cashmerian sandal wood." This, says the translator in a footnote, was "a common practice." I have often heard of the existence of such a practice in India in very recent times, but never actually saw an example of such decorative work, although travelling about for two years in different parts of Bengal, British Bhutan, and Sikkhim.

A well-known brewer's sign in England is a blood-red open hand. A similar design of some antiquity is said to be printed on tambourines and on all kinds of domestic utensils used in Arabia; it occurs also in Spain, and is supposed to be a sign of good luck. The finger patterns are not shown on any specimen of these lucky hands known to me, but possibly some may be actual imprints and it would be interesting to know in that case if the lineations are sometimes to be clearly discerned. Single finger-prints of women have been described to me as having been found on Japanese documents of the ninth century of our era, but I have had no opportunity as yet of verifying them, and I am quite sure they were unknown to the great Japanese archæologist Ninagawa whom I knew intimately. Fanciful renderings of finger-print patterns occur in one or two old Buddhist or Taoist books along with mythical imprints of the sacred foot of Buddha, showing the "eight glorious emblems." Those mythical figures are similar to the sketches contained in Dr. L. Austine Waddell's learned work on *The Buddhism of Tibet*, p. 392. Mythical footprints of holy personages are shown on the continent, and belong to the Christian era, but were possibly derived from Buddhist tradition. One in particular is described in Théophile Gautier's charming *Wanderings in Spain*, which is not accessible to me at the moment of writing. All this, however, though it has been confused with it, has nothing whatever to do with the modern question of *identification* by means of finger-prints. A leading article in the *Daily Mail* of Dec. 2nd, 1903, contains the following curious remarks on a method of identification which is a credit "to Francis Galton, the originator (!) of the system now in vogue at Scotland Yard." The writer says, "It is eighty years since the first suggestion of such a means of tracing the identity of criminals was first mooted, but with the exception of one or two Indian judges the system was received with little favour among experts in this or any other country. The French were the first to acquiesce in its accuracy." I may state that I wrote recommending the use of finger-print identification to the head of the Parisian police in 1880, but no action was taken till a good many years afterwards. The method has been adopted there within the last decade as an *aïd* to recognition of old offenders.

It would be interesting to know the names and dates of the Indian judges referred to above, and to have particulars of cases adjudicated

upon by them—prior to 1880. I have not been able to find any mention of those judges or of any work they ever did in respect to identification by finger-prints.

Egypt and China.

With regard to Egypt and China, nothing authentic has yet been brought forward as an example of identification in anything like ancient times—nothing more recent, that I at least know of, than the last decade or so. In 1880 I wrote in *Nature* (Oct. 28th) that I had heard since working out my system of identification (with the ten fingers serially arranged) by means of careful observation and experiment “that the Chinese criminals from early times have been made to give the impressions of their fingers, just as we make ours yield their photographs. I have not yet, however, succeeded in getting any precise or authenticated facts on that point. . . . It need not surprise us to find that the Chinese have been before us in this as in other matters. I shall be glad to find that this is really so, as it would only serve to confirm the utility of the method, and the facts which may thus have been accumulated would be a rich anthropological mine for patient observers.” Here was a distinct invitation, in the leading scientific journal for those who knew of such facts to give science the benefit of them in authentic form.

On Nov. 25th of the same year Sir Wm. Herschel, in the same journal, *Nature*, says:—“It would be particularly interesting to hear whether the Chinese have really used finger-marks *in this* way. Finger-dips (mere blots) are common in the East, as ‘marks.’” At that period I was residing in the Far East and constantly meeting travellers, consuls, ministers and other members of Far Eastern legations, and had made many diligent enquiries as to this alleged custom, but never traced a single authentic case of finger-tip identification occurring before 1880. To secure as much accuracy as possible on this point I wrote to that eminent authority Sir Robert K. Douglas, of the Department of Oriental Printed Books and Manuscripts in the British Museum. He replied to me on July 15th, 1905:—

“DEAR SIR,—I have never heard of the lines of the hand being used for purposes of identification in China; but it is a fact that now, and for how long I cannot say, thumb impressions have been in use for that purpose.—Yours faithfully (*Signed*), ROBERT K. DOUGLAS.”

The opinion of so high an expert in Oriental matters is so far quite decisive as to present use, but my original enquiry, while still living in the Far East, was for examples of identification prior to 1880, as the suggestion had been made that the custom has had a very recent origin even in China, where it certainly is not quite general at present. No case therefore is known to experts in finger-prints where the system has been used for identification in China prior to 1880. It must be remembered that the Chinese in treaty ports rapidly assimilate new ideas, such as the bicycle, jinrikishas, etc.

The only evidence I know of for the antiquity of the method in *Egypt* is a very unfortunate sentence of my own, viz.:—"That the Egyptians caused their criminals to seal their confessions with their thumb nails, a recent discovery proves." I took the statement about *nails*, which has nothing to do with *finger-prints*, in good faith from a source I thought trustworthy. It cannot be verified by any Egyptologist known to me and seems to be a blunder. The plain thumb-nail marks sometimes found on old documents, coins, etc., have really nothing in common with complex finger-marks as a means of identification. Those ancient and ghostly Egyptian thumb-nails, however, often rise up in judgment against me, in most novel and appalling finger-print forms, and will not be laid by any known form of exorcism.

Recency of the System.

I propose in this chapter to sketch briefly and in chronological order, as far as limits may allow, the events which mark the origin and development of a system which, I believe, is not much more than a quarter of a century old and has only been in official operation for a few years. I repeat, I had not been able to trace a single hint of identification by finger-prints in this or any foreign land that could in any sense be called ancient. If Major Griffiths can now throw more definite light on this problem he will deservedly excite much admiration and gratitude.

The elaborate *Index Medicus* of the United States, when I last saw it a few years ago, contained as the first entry on this theme, this paragraph:—"Faulds, H.—On the skin-furrows of the hand, *Nature*, London, xxii., 605."

Purkenje.

That article was published on October 28th, 1880, and at that time, I think, no one in Europe or America knew even of the existence of Purkenje's Latin pamphlet, which was some eight or nine years afterwards unearthed by the librarian of the Royal College of Surgeons. In an article on anthropometry in the additional volumes of the *Encyclopædia Britannica* it is stated—although that matter has little to do with anthropometry, that “in 1823 Purkenje, the eminent physiologist of Breslau, drew attention to the subject of finger impressions. He distinguished nine types, and suggested a system of classification, but it was not followed up.” It is evident that Purkenje only valued the “impressions” as a means of knowing the ridges and furrows of the skin *anatomically*. His crude and really incorrect classification was such as anyone looking at the patterns for the first time would think of as natural, the obvious and most striking features only being noticed. It had obviously not occurred to Purkenje that the classification might require to be carried out into detail involving such vast numbers of patterns as now require to be dealt with practically. Neither Purkenje, nor his age for that part, had yet felt any imperious need for a trustworthy scientific method of identification. It is curious that, in spite of Purkenje, in the middle of last century the very existence of such patterns had generally been lost sight of by anatomists, who were becoming too much interested in the dazzling revelations of the microscope to have much time to look at their own plainly visible finger-tips. I have not been able to recall or to discover as yet a single example of their mention in the text books of my student days, and on all matters relating to the organs of sense I read eagerly. When I came to revise earlier knowledge of the nerves of touch received as a student in Glasgow it greatly impressed me that a man of Purkenje's calibre, whose studies of those nerves of touch had otherwise been so fruitful, could hardly have failed to perceive the related patterns on human fingers which are now so familiar to everybody. I made enquiries extending over a period of three or four years among Dutch and German medical men and antiquarian booksellers, and set enquiry going in America. On returning finally to England I expressed my views on the matter to the then librarian of the Royal College of Surgeons, who agreed with my general conviction that Purkenje would leave something on

the subject in manuscript or otherwise. I was right. It was considered a great matter when somebody deduced the existence and orbit of a dull plodding planet like Uranus from *à priori* considerations! Mr. Galton—such is the luck of war—came into possession, however, of Purkenje's badly printed little Latin pamphlet dealing partly with finger-prints, published as a thesis and buried, as no doubt many others quite as good have been before and since. I only know it, however, from Mr. Galton's description. Only two other copies are at present known to exist. I have heard innumerable hints that still earlier references are to be found in old anatomical text books, not in general circulation nowadays. Those indicated to me, however, contain reference only to the *palmar creases*, but more precise facts may yet come to light now that the subject is becoming much better understood by all.

Prof. Bowditch.

Not in Purkenje's Latin thesis, nor in any other of his works had it occurred to that distinguished anatomist to propose finger-prints as a means of personal identification. Professor Bowditch, the distinguished biologist, of Harvard University, U.S., wrote me on Nov. 18th, 1880, however, thus (showing that the fact of finger-print patterns had not been altogether forgotten):—

“Dr. Faulds,

DEAR SIR,—I have just read in *Nature* of Oct. 28th your article on the skin furrows of the hand. The subject interested me because it so happened that fourteen years ago at the suggestion of the late Professor Jeffries Wyman I made some prints of the finger and toe tips with the hope of throwing some light on the question of the antero-posterior symmetry of the body. Since reading your article I have made some new impressions from the same individual and it is interesting to notice the unchanged character of the cutaneous furrows.” Some other interesting particulars are added in the letter, and a fine imprint was enclosed.

My Proposal to Use Finger-prints.

In the article in *Nature* just referred to, which led to much correspondence of a scientific character, I had proposed the identification of important criminals by using in serial order the imprints from the

last phalanx of the ten fingers. Those portions of skin contain patterns of great variety which I deemed after much experiment to be practically permanent for my purpose. Explanations were given as to how prints could be done, and I do not think those hints can now be very greatly improved upon. I suggested also that crime, when the finger-prints of old criminals were already on record, might be detected by greasy smudges on glass, sooty or bloody marks, and the like. Mention was further made of instances where this had been successfully done by me. The editorial note in *Nature* appended to my article says :—“Some very interesting examples of nature-printed finger-tips accompanied this.—ED.” It was unfortunate that these impressions could not be printed along with the article, but space and expense have to be considered even in a journal like *Nature*. I had shown the general character of some of the patterns illustrated, and referred incidentally to them in the text as parallels, whorls, loops (open and closed), spirals, ovals, junctions, and branches, being at that time quite unaware of Purkenje’s actual attempt at classification. I avoided putting forth my elaborate division of patterns. Reference was made to symmetrical or mirror patterns, dealt with in an earlier chapter of this work, and which I foresaw were likely to become very important in legal cases. In that article was contained the first proposal that has ever appeared in print to use this method of identification in jurisprudence.

Sir Wm. Herschel’s Claim.

Sir Wm. Herschel, of the Indian Civil Service, wrote to *Nature* from Oxford after seeing my article. This note appeared in the issue of November 25th, 1880, of that journal. He stated that he had been taking “sign-manuals” by finger impressions for more than twenty years, and that this practice had “put a summary and absolute stop to the very idea of either personation or repudiation from the moment half a dozen men had made their marks and compared them together.” It is further explained by him that “on commitment to jail each prisoner had to sign with his finger.” One finger then was apparently considered to be sufficient. We find it stated again, however, that *two* were used, and we are not told how the records were classified and compared. Sir Wm. Herschel is certainly the only writer who claims priority to me—not of publication, for that he

naturally concedes, and a leading Home Office official admitted my claim to priority of publication as quite "indisputable." A reference in the Blue Book of 1894 led to some little public correspondence on this matter of actual priority, which may be found in *Nature* (October 4th and November 22nd in that year, 1894).

Is Priority of Publication not henceforth to be considered Final ?

An anonymous writer in the *Birmingham Gazette*—which has laid its columns freely open to a discussion on "finger clues,"—treats on "How the Orient has Taught us to Identify Criminals." The writer, though expert with the pen, is very ill-informed on this subject, and has succeeded in producing a most extraordinary tissue of complicated blunders which it would be tedious and profitless to unravel. He states, however, on this point, that Sir Wm. Herschel, an eminent "scientist," published a "book" on this subject. The article in the *Encyclopædia Britannica*, which forms the probable basis of this statement, calls the work a "report." Sir Wm. Herschel, however, modestly describes it as a "demi-official letter," and it certainly is not longer than to be correctly described as such. It is therein stated that the "two forefingers (*sic*) of the right hand" were used. Mr. Galton, who frequently acts as a kind of graceful chorus to Sir William, explains this cryptic expression to mean the middle finger and the forefinger. The letter, or report, or book, is addressed to some mysterious personality, known only to literature as "My dear B—," and is luminously certified as "True copy of office copy," but by whom certified is not stated. The date is August 15th, 1877, and the published copy appears in *Nature*, November 22nd, 1894.

Now, undoubtedly good identifications may be made in this way on a very small register, but it appeared to me from the first that any system whatever, carried out on a large scale, would involve as a prior *necessity* a scientific classification of much comprehensiveness and precision. It is pretty much this original problem that is at the bottom of all the present stir among recent students of the subject. I also concluded after scrutinising several thousands of fingers that by the law of permutations ten fingers would presumably yield an effective basis of classification for immense masses of men, as in modern armies. In addition, as I frequently emphasised, for criminal

registers the two complete sets of fingers were important in cases of wilful or accidental mutilation, and also as giving a wider range of possible coincidence in the case of smudges left at a seat of crime. In an army one hand might do for the purpose of preventing re-enlistment, for a mutilated man would not be eligible. But again in the army, during a battle mutilation might destroy evidence of identity from one hand while leaving the other intact. On the whole, for general purposes of identification, the two hand method which I proposed has met all anticipations, and the extra labour is reported to be very little.

Of Sir William's mute, or at least inarticulate, musings over a period of some twenty years in India, I in Japan knew nothing. Mr. Galton tells us that Sir Wm. Herschel "thought he would use the signature of the *hand* (my italics) itself, chiefly with the intention of frightening the man who made it from afterwards denying his formal act." It is to be hoped that this foreign object, already imported into English police procedure on an unfortunate occasion, may be abandoned in any future use of the finger-print system, which rests on an appeal to calm scientific verification and not to superstitious fears. Mr. Galton goes on to state further that Sir William "finally introduced the use of finger-prints in several departments at Hooghly in 1877." This rather variable system, of a hand, one finger, two forefingers, a fore and mid finger, which Sir William Herschel introduced in 1877 vanished, it appears, very speedily into utter oblivion within a year or so in spite of the marvels it had worked on so inadequate a scientific basis. Major Ferris, of the Indian Staff Corps, as appears in p. 149 of Mr. Galton's book, "knowing but little of what Sir W. Herschel had done," gave his views to Mr. Galton, a short time before that writer's work on "Finger-prints" was published, on the desirability of introducing finger-print identification into India. There is not a word in that official's reported views that could lead anyone to suppose that the system had ever been heard of officially before in India, or that it had been effective in stopping personation of pensioners, or why should Major Ferris then make the startlingly novel proposal that it should be *tried* for that very purpose in India?

What I proposed in 1880 is what is now officially adopted, namely, the record for old and important criminals, *of each of the ten*

fingers in serial order. Without this provision identification by fingerprints tends at least to become almost a useless superstition. In order to secure the correct serial order of the fingers on the records I provided in 1879-80 forms for the two sets of fingers so that no displacement would occur. To prove that a smudge from a possible right forefinger agrees with a prisoner's left mid-finger is no great step towards identification at all. But the discussion of such problems belongs to a later chapter.

Minor problems of identification, as in the passport system, insurances and so on, may, however, safely be met by the use of two finger-prints, but still better by three. There are undoubtedly even many cases where a single finger-print of great character and some complexity may give very excellent direct evidence by itself, just as a single face out of a crowd will haunt the memory for weeks.

Permanence of Patterns.

The permanence or otherwise of the patterns had if possible to be ascertained if they were to have any value for identification. By the most careful experiments I could devise and with the co-operation of an excellent band of enthusiastic students of biology this was now tested.* The fact of the practical permanence of finger-print patterns is hardly now a matter for much serious discussion, and yet I recommend the utmost vigilance of observation on this subject of so recent growth. I have elsewhere suggested the advisability of looking for such changes occurring after typhoid (enteric) fever and scarlatina, where many bodily changes are often to be noted during and even after convalescence, and where the skin peels off in a way which shows great activity. Not a single case has yet been reported to me, however, of patterns so changing. One reads of such changes in the daily papers frequently, but names are lacking or facts are useless. Those conclusions had not been flippantly put forth, but had been the result of numerous careful, anxious observations and experiments conducted by a considerable but varying number of ardent medical students trained in practical biology and working under my own constant direction and supervision, with every conceivable precaution to secure accuracy.

* See article by the Author on Dactyloscopy, in *St. Thomas's Hospital Gazette*, January, 1904.

I had left England at the close of 1873, and one of the last impressions I carried away to Japan was of the immense crowds awaiting the issue of the Tichborne Trial. From that time the question of identification as a pressing scientific problem in medical jurisprudence was never long absent from my mind. Many medical students and several doctors in practice came to Tsukiji Hospital in Tokyo, which I superintended from 1874 to 1886, for instruction in modern methods of surgical practice. Many of those gentlemen, trained in the old Dutch school, were Buddhists and dissection of the human body was then illegal in the country. My illustrative examples were therefore taken largely from the phenomena of vegetable diseases. Having been an early disciple of Lord (then Mr.) Lister in Glasgow, it became my privilege to be the first to introduce the antiseptic system of surgery into the Mikado's Empire, where it has since been of the greatest utility not only in time of peace, but also during the recent war with China and the present more serious one with Russia. After some study of the difficult language of Japan, I began to prepare a course of lectures on the "Testimony of the Senses"—a phrase which had been used by John Locke and reiterated with new force and meaning by the much misunderstood Dr. Thomas Reid, of Glasgow. Those lectures were meant partly as a corrective to an extreme form of western agnosticism just then much in vogue. An attempt was therefore made to harmonize the teachings of Reid and Lotze with the latest results of such investigators as Wundt, and even eminent statesmen in Japan made enquiries and were interested. I had to read rather hard for such work, and was not in the best of health, yet those were after all among the happiest days of my life. There were certain curious Oriental preconceptions—as rational, no doubt, as most of ours—to overcome. However unsuccessful these efforts were they had much local influence amongst the thinking classes and aroused much furious opposition elsewhere, which soon subsided. The curious impression left on my mind was that the Japanese meant to see into everything for themselves, and that modern sociological problems were viewed, not as dialectic subtleties but as life and death business for serious and patriotic men. The first meeting of a society to help the deaf, dumb and blind was held in my humble residence. Mori Arinori, who was afterwards Japanese Minister to England, was present. He was assassinated, I believe

as a reformer, after his return to Japan, as were some others whom I knew in the Far East.

Now, it was when the subject of "touch" came to be dealt with in detail in those lectures that the skin patterns of feet and hands first began seriously to arrest my attention. The exact date is unknown to me now, but I have notes made in 1878 which show that the matter had then been in my mind for some months before. In *The Staffordshire Sentinel* (May 4th, 1905) some account is given of my early observations on finger-marks in pre-historic pottery, found at Omori and many other places in the Bay of Yedo amongst ancient shell-heaps, and also in other parts of Japan, especially in the north. In many cases it was obvious that those primitive specimens of ware had been moulded by hand and the finger-ridges were very clear and conspicuous, but in no way different, so far as I could determine, from those made by people of our own day.

In 1880 I wrote to the late Charles Darwin on the subject of finger-patterns in man and monkeys. He was then living in the country and was in a very poor state of health. My letter was dated Feb. 15th, and was written in the hope that the great naturalist, who had inspired so many of us, might aid me in getting material from the brute creation for further research. Darwin, to judge from his answer, had not had this class of facts brought under his notice before, although it would now appear that everybody else knew all about them. He stated his inability to help me in this fresh field, through ill-health and remoteness from town, but added, "I will, however, forward your letter to Mr. F. Galton, who is the most likely man that I can think of to take up the subject, to make further enquiries." This letter, along with the envelope carefully addressed by himself, is now in the possession of Dr. Duncan, the learned secretary and librarian of the Faculty of Physicians and Surgeons, Glasgow. Along with it is the original proof sheet of a copperplate form for the fingers, etc., of the right hand, which was done for me before that date by a Japanese engraver. The left hand form was soon afterwards prepared in the same way.

Mr. Galton, after studying finger-print identification for less than three years, writes thus (August, 1891), in *The Nineteenth Century* :— "Finger-prints have been proposed over and over again before now as a means of identification," but nothing had been definitely

established, etc. "No investigation had been made into what points are and are not suitable for comparison. No method of sorting patterns under heads had been brought forward that is comparable in its simplicity and exactitude" with *Mr. Galton's own system*, afterwards expounded in a work abounding in grave errors and set forth in a way which the Blue Book of 1894 characterises.* The very elementary system of classification proposed by Mr. Galton has already, I understand, been superseded in Scotland Yard by another on somewhat similar lines. My own much more elaborate method, which I explained in brief outline to Inspector Tunbridge of Scotland Yard, sent officially for that purpose to my house, and afterwards more fully to Mr. Brodrick's War Office Committee and to an Under-Secretary of the Home Office sitting with them, is based on something very like the requirements of a printing office dealing with characters like those used in China. In China there are at least some 30,000 distinct characters in use. Of course there are many varieties of *type* besides. Many of the characters are unusual and now perhaps obsolete, but many others are only used in Japan, and new ones are being called for now very frequently as a wider life and broader outlook is required in the Far East. Now in Japanese for the less learned classes a syllabary exists, of many characters as we should think, which greatly diminishes the burden laid on the memory, and last of all this syllabary has, not many decades ago, become Romanised. I was in the midst of such confusion as this complex system seems to inspire, and I was also engaged in adapting the Japanese native syllabary for the use of the blind. That system of mine, based on the Japanese syllabary, came into operation for a little while in the school for the blind, but it was found better to take advantage of the existing literature in other type even if English had to be learned by the Japanese blind people, and the decision was a good one. However, the study of this complex question helped me to face the not dissimilar problem of how to classify the "hieroglyphics" of the human fingers. Mr. Galton's ideas of the function

* "As the author investigated the subject originally from the anthropological point of view, and was chiefly interested in its bearings on questions of heredity and racial distinctions, the book is likely to give a somewhat exaggerated impression of the complexity and difficulty of the method as applied to purposes of criminal investigation." (p. 29.)

of a system of classification have certainly the merit of greater modesty than those entertained by myself, as regards a finger-print record. That eminent writer says:—"To aid in searching the registers of a criminal intelligence bureau, its proper work is probably a secondary one; the primary being some form of the already established Bertillon anthropometric method. Whatever power the latter gives of successfully searching registers, that power would be multiplied many hundredfold by the inclusion of finger-prints, because their peculiarities are entirely unconnected with other personal characteristics."—*Finger Prints*, p. 15. Now it is clear to me that if the patterns are really so numerous and varied as I suppose, it is possible and would be found easy to get at their true nature looked at as characters from which to print. Those who are acquainted with Indian languages based on Sanskrit know how the comparatively few characters, as compared with those of the Chinese system, are so blended and intertwined as type for printing from, that their number is almost indefinitely multiplied. To come back to finger-print patterns, therefore, view them as type to be placed in particular "founts." There is one important difference to be remembered, however, and it is that, outside of and around the form used as a basis of classification, the name of the letter or character, there are lines forming a complex framework which are not taken into account for primary *classification*. These finally betray the *individual* when we have reached the "fount" or pigeon-hole in which his register-card lies, along with perhaps a dozen or a score of others. With such a method of classification and arrangement no extraneous help is at all needed. The English system can stand alone. One of the qualities I have relied upon is that the system by means of its syllabic dictionary method can comprise and absorb all previous records built up on other systems, without any troublesome dislocation of record cases. There are also certain biological and other points of interest indicated by me in a way analogous to that of Pitman's system of phonography. These convey a great deal of meaning to the eye of an expert at a glance.

Even in 1880, while lecturing to medical students, I had begun to foresee and arrange for the need of a great cosmopolitan "clearing-house" for identifications, criminal, military and civil, and my efforts were consciously made to cope with so great a complexity. The one

or more scientific experts have to bear *this* burden. The ordinary reference to records can be done by any warder or typist. It involves no more knowledge than is required to turn up an unknown word in a rather copious English dictionary. It is as easy to invent a "system" as it would be to make a new celestial map. To carry out a good one practically into minute and vexatious detail involves a toil that not everyone would undertake without remuneration, official aid, or encouragement of any kind. Such systems as have hitherto been in official use cannot possibly, I believe, stand the strain that has to be put upon them, but by various devices their essential defects did not attract notice till very recently. As in botany, an artificial system may be a help for a time, but it must give place, with wider experience and larger demands, to a system based on the deeper qualities of the things to be classified.

The following consecutive arrangement of dates may aid the reader's comprehension of the steps which followed in the application of finger-print identification. Mr. Galton's imperfect and curiously distorted sketch has needlessly obscured the outlines of what, after all, is a very simple story:—

- 1880.—My article in *Nature* (Oct. 28th) contains the first published proposal of this method. Before and after that period I had been corresponding widely on the subject. Sir Wm. Herschel wrote to the same journal on Nov. 25th of the same year claiming to have been taking "sign-manuals" in India for twenty years. He speaks of identifying by a single "finger-print." I have never been able quite to understand the nature of Sir Wm. Herschel's claim. There was certainly no publication till my article had first appeared.
- 1881.—M. Alphonse Bertillon published his first pamphlet:—*Une application pratique de l'anthropométrie* [Extrait des Annales de Démographie Interne.] PARIS. His system was one of bodily measurements.
- 1882.—A single finger-print was used on a U.S. expedition.
- 1883.—"Mark Twain" published his *Life on the Mississippi*. It contains a story of an identification by means of a thumb-print on a system supposed to be invented by a French prison doctor,

- 1886.—I returned for good to England at Christmas and had many interviews with scientists in Glasgow and London in the following spring in reference to this project. Herbert Spencer wrote an account of the “Factors of Organic Evolution” (*Nineteenth Century*, May), in which an attempt is made to account for the ridges on the skin of the hands.
- 1888.—Mr. F. Galton began to study finger-prints. Mr. Charles Darwin, his cousin, had in 1880 promised me to lay this matter before Mr. Galton.
- 1889-90.—I made several attempts to interest Scotland Yard and the Home Office in the possibilities of the method. Inspector Tunbridge, after examining its working with me, reported to the authorities. The report has not been published. Mr. Tunbridge told me he thought the system too fine to be practical, that fresh legislation would be needed, etc.
- 1894.—“Mark Twain” in his “Pudd’n-head Wilson” made the method at once clear and fascinating to multitudes of readers. Its final acceptance owes much to that clever writer. In the same year Mr. Asquith’s Committee sat, publishing afterwards a Blue Book on the *Identification of Habitual Criminals*. Their information on finger-prints was exceedingly crude and defective, and their conclusions were not very business-like. This year also the finger-print system was tentatively adopted in the Bengal Presidency, and was *associated with* M. Bertillon’s system of measurements in Paris.
- 1897.—The system became adopted throughout India by a resolution of the Governor General in Council.
- 1900-1.—Lord Belper’s Committee sat to deal with the finger-print system, recommending its official adoption in England.
- 1902.—Mr. Brodrick’s Committee considered the same subject in regard to recruits, the Home Office being represented by an Under-Secretary. This was on May 9th, when I was examined as an expert. In July of the same year the finger-print system became established as the English official method of criminal identification.
- 1903.—Criminal cases began to be proved in England by evidence from smudges.



CHAPTER V.

PRESENTATION AND SCRUTINY OF CASES.

The New Method.

In the autumn of 1903 a burglary was committed near Windsor. Footprints, or rather bootprints, were found to have been left near the scene which corresponded with those made by the shoes or boots of two of the men accused of the crime. In this trial, however, a rather fresh kind of evidence was adduced which drew forth a loud protest from one of the prisoners. A finger-mark was found to have been imprinted on a dark lantern which had plainly been used during the robbery. The three prisoners were old men, of 65, 68 and 70 years respectively, and were all known to the police under different aliases—a pathetic fact for sociologists to consider. A report is given of the police proceedings in the *Daily Mail* of October 27th, 1903, from which I shall now quote:—"Detective-Sergeant Collins said the finger-print found on a dark lantern left on the premises was identical with the record kept of Wilson's fingers at Scotland Yard. Seven terminations and three bifurcations proved the identity. The chances against another man's lines showing the same points of similarity were only about one in ten millions."

It is not my intention here to criticise this curious statement, which may perhaps have been imperfectly reported. At this point, Wilson, who was said to be a man of considerable intelligence, made what is headed as a "Spirited protest against a modern innovation." He said: "I must challenge this evidence. It is fallacious. This system is an importation from France, and it will cause as much mischief here as it has done there, where many innocent men have been convicted because of it. It is not English. It is not evidence. There are too many decimals. It is too hazy. English people do not

like it." Possibly English people might in time get reconciled to the method if it could promise to do something to make property more secure, especially at night-time. What the finger-print system, carried out with scientific precision, claims to be is an essentially fair and English system, not at all hazy, and singularly free from any need of decimals to make it quite intelligible. It is, or ought easily to become, a method the strength or weakness of which as evidence in a particular case, ought to be quite clear and manifest to any prisoner in the dock and to every jurymen in the box. If this system is hazy or perplexed with decimals, as poor Wilson vainly urged, it ought not to belong to our good old English system of trial by a jury of plain men. To make the method intelligible from this standpoint; to show that it is a practical way of getting at simple facts that anyone can appreciate, and of presenting them in a clear and convincing way, is the main object of this chapter.

Early Identification of Smudges.

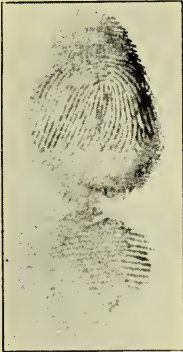
In paragraph 5 of my first contribution to *Nature* on this subject (1880) the following points were noted :—"When bloody finger-marks or impressions on clay, glass, etc., exist, they may lead to the scientific identification of criminals. Already I have had experience in two such cases, and found useful evidence from these marks. In one case greasy finger-marks revealed who had been drinking some rectified spirit. The pattern was unique, and fortunately I had previously obtained a copy of it. They agreed with microscopic fidelity. In another case sooty finger-marks of a person climbing a white wall were of great use as negative evidence." In that latter case it was clear that the person originally suspected was not the real offender, and indeed a single finger-print is capable of yielding very decisive evidence of a rebutting or negative kind. If one "finger" mark is characteristic in itself, as many are, and is clearly enough imprinted, it may be easy to determine that no part of the accused person's hands could give any such impression.

Classification of Smudges.

When a mark supposed to be, or to resemble, a finger-print is presented for scrutiny as evidence it would be well to have a recognised term to express the fact of its as yet unknown character



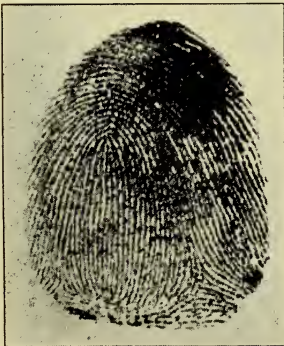
Young Sumatra Orang, "Delia."
Index toe of left foot.



Same animal, index finger of left
hand.



Chimpanzi, "Mickie" (8 years old).
Index toe of left foot.



Same animal, index finger of left
hand.

Fig. 14. Prints (enlarged) from Orang and Chimpanzi in the
Zoological Gardens, London, 1905.

and origin. Such blurs have been shown to a jury under a heading of "finger-print," and have been often referred to in court as a "thumb-print," evidently because a thumb-print of the accused man was thought to resemble it.

I suggest that the word "smudge" (= Lat. *Litura*; Fr. *Tâche*; Germ. *Makel*; Japan. *Shimi*) be adopted technically to describe generally, without prejudice, the patch, single, double or triple, to be compared, and if possible identified, with that of one or more particular finger-prints of the accused. Three compartments may (provisionally) be arranged for the classification of smudges as presenting evidence, and perhaps a fourth:—

- 1.—Smudges having no ridges or lineations shown quite clearly throughout their course in the field of observation. They might possibly sometimes assist in guiding suspicion but do not form good cases for presentation as evidence. They may not even be dermatographs or impressions from skin. If dermatographs, they may not be of human origin.
- 2.—Smudges which have, say, at least four good clearly printed central lineations occurring consecutively. Those are sure to be dermatographs, but may not be of human origin, similar prints being yielded by various kinds of apes, monkeys, etc. They may show very distinctive patterns, however, and it is rather rare to find complete agreement between two dermatographs up to the maximum in this class.
- 3.—Smudges which present ten or more good, clear, lineations arranged in some complex pattern. These might be considered to be human dermatographs though not easily definable as finger-prints. Complete coincidence of ten serial lineations is strong circumstantial evidence of identity.
- 4(?).—Can we make a fourth class consisting of good finger-prints only? I feel hopeful that it may be done now that so much attention is being given to the matter. For my own part I have as yet failed to find a single clear basis for definition of a finger-print which would exclude toe-prints or even some parts of the palm or sole. Many finger-patterns, however, rise quite above the level of ordinary dermatographs, by the concentration and com-

plexity of the core, or central patch of lineations. Several times have I hoped and believed that a net had been set which would secure such facts, but the next specimen considered would show that the meshes had been made too large, that that expression would not stand good for every case.

Now, if you consider carefully your own fore or little finger, there are seen to be flexures, like those considered by believers in palmistry, which correspond with the joints. Just below the first joint, again, but in the palm of an average hand, there is another flexure, formed when you bend the whole finger towards the palm. In the space between flexures like that of an average finger joint there is often a pattern similar to those called finger-patterns. Now, a dermatograph from the space marked off by this palmar flexure and the flexure at the beginning or root of the first finger should not be called a fingerprint, for it is not one. Yet it is often accidentally imprinted on tumblers, implements, etc. Where a dermatograph, shaped like a possible finger and containing two flexures apart proportionally to the apparent size of the finger, if it be one, contains a good pattern it may be this portion of the palmar surface. If another flexure still at a proportionate distance occurs, it cannot, I believe, be anything but a print from a human finger and the general shape, even if all the lineations but the proper finger-pattern, so-called, are dim, may give good evidence for identification.

Single Smudges.

Meanwhile I venture to suggest that no *single* smudge of the usual type should be spoken of too dogmatically as a finger- or thumb-print till it has been seen to coincide very completely with some genuine finger or thumb, or at least has flexures like those described. When there is a serial impression of two, or still better, of three fingers, the problem is placed in a different light altogether. We can say with certainty that if they are of class 3 they are from human digits, by which is now technically meant not the whole finger, but the small concentrated group of ridges and furrows in the lower part of the last joint. They are often most distinctive.

I was once asked by an intelligent young detective in Old Scotland Yard whether he was really required to believe that a tiny

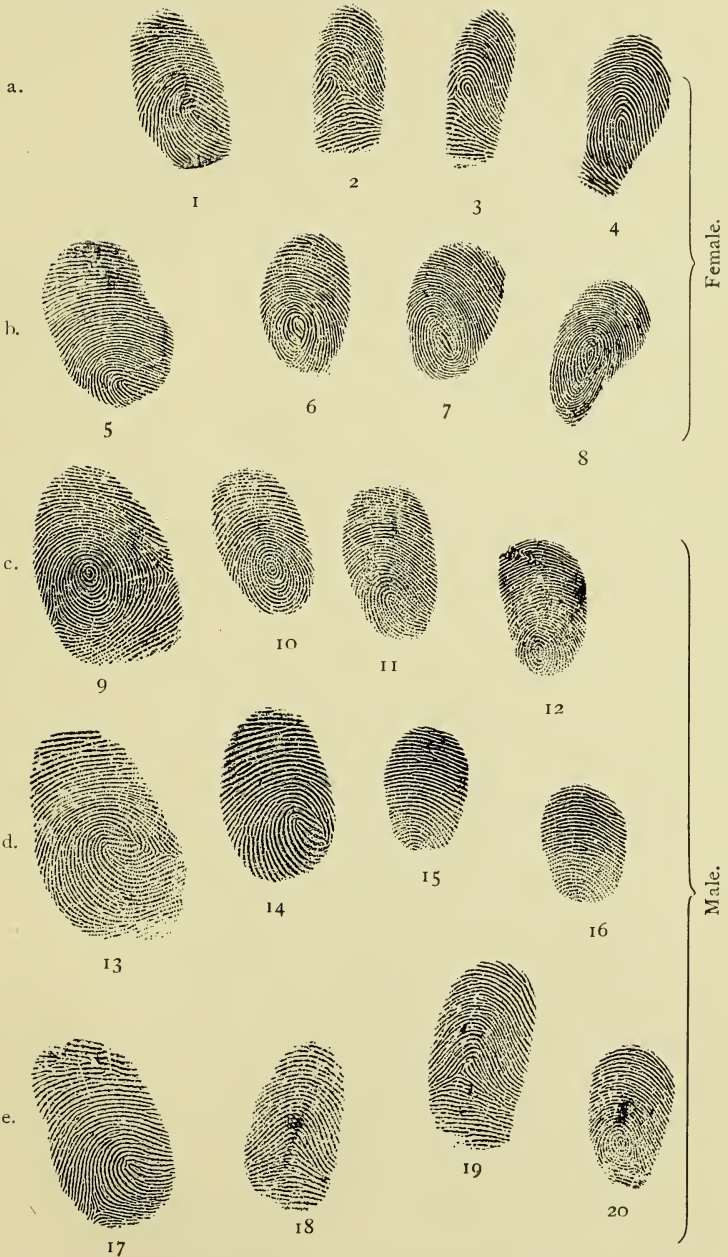


Fig. 15. Right thumb, fore, middle, and ring finger. Good smudges, done without supervision or training.

patch of skin like that of a finger-tip could contain a variety of lines enough to help in identification. This was about the year 1889. On the wall beside him hung a map of London. Pointing out a similar little patch on that map—New Cross Junction, in fact—where a close network of lines is shown, I convinced him and several others who had become keenly interested in the discussion that, if that little bit of paper were detached from its surroundings there would be within it enough evidence to indicate to what city it related. If one were to cut out as a silhouette the head of our gracious Sovereign from a penny postage stamp this would give some conception of the smallness of the space in a human finger into which so much significance is condensed. Counting from the centre of an average pattern, there may be some fifteen or more ridges running down on each side, but the spacing of those ridges and their thickness individually vary considerably. A single ridge is not even always of uniform thickness throughout its course. Apart from those actual variations the effects of “inking”—to use that as a general term—and of pressure have to be considered as part of the problem.

Views of “The Lancet.”

In *The Lancet* of May 13th, 1905, a thoughtful article appeared on *Identification by Finger-prints*, which contains some important reflections. Having dealt with the ordinary identification of recidivists, the writer goes on to say: “When a digital impression is discovered on some substance at the scene of a crime and comparison is made with the prints of the fingers of a person arrested on suspicion of being the perpetrator of the crime—a very different condition of affairs obtains. The prints of the person under arrest are made on paper from the fingers properly inked—that is to say, with the tops of the ridges covered with ink of an exact consistency and the furrows between them free from ink. But the impression of the digit found at the scene of the crime has been the result of the contact of a finger moistened by the natural excretions of the skin, or in some cases it may be by blood; dust or dirt of one kind or another will be on the surface of the finger; the surface on which the impression is found will vary and may not be of a nature suitable to record a satisfactory impression—all these things, which might be multiplied, make a fair comparison between such an impression and

what may be called an official impression difficult, while the pressure with which the impression may have been made introduces another complexity to the already unequal conditions. In fact, the widest possible range of variation may occur in casual finger imprints from a good clear impression of the whole, or part of it, as is sometimes found on glass or porcelain, to a blurred or imperfect print upon a poor medium, out of which it is well-nigh impossible to obtain any information. In such cases great skill and caution are necessary to read the imprints, and the ultimate certainty on which any statement as to identity can be based is enormously reduced, particularly if an impression of one finger only, presenting a few points of similarity, is available. In such a case the importance to be attached to the absence of clear points in the accidental impression corresponding to those in a carefully taken impression, even although the general pattern of the two prints corresponds, becomes very real, and for the due consideration of the matter it seems to us that the person called upon to examine and to advise as to identity or non-identity should possess thorough and practical knowledge, as well as trained mental powers of discrimination. To intrust the duty to partially-skilled persons is in the highest degree dangerous from a public point of view."

These views agree very completely for the most part with what I had verbally, and no doubt clumsily, expressed in an interview reported in *The Staffordshire Sentinel* a few weeks before, and may now be supposed to represent pretty fairly the value assigned by medical opinion to finger-print evidence in criminal trials. The ultimate facts to be scrutinized are simple enough in themselves, but cases require careful preparation before coming into court.

Dogmatism as to Repeat Patterns.

A West-end burglary in 1903 ended in two men being sent to prison. The experienced magistrate at Marlborough Police Court (Mr. Denman), according to the report in the *Standard* (Dec. 2nd, 1903), stated that "scientific inquiry had shown that no two persons bore the same marks on their fingers, and he was satisfied that Elliott had been on the roof on the night of the burglary." The *Daily Mail* of the same date, commenting on the case, says:—"These two men, Elliott and Smith, were detected upon no more apparently valid



evidence than the casual impression of Elliott's finger upon a pane of glass. . . . Other evidence, except such negative proof as was supplied by the fact of the two men being better supplied with cash than their lawful dealings seemed to justify, there was none. It is not too much to say that the case which was concluded yesterday may by its vindication of a delicate but exact method of identification do more to prevent the escape of the offender and ensure the release of an innocent man than half the rules of evidence which at the present day adorn our statutes and our text books of procedure."

No teaching could really be more dangerous than the above. The delicacy and exactness of the method is not illustrated by convicting a man on evidence that is in itself of doubtful scientific character. There is no miraculous efficacy in a single smudge which need lead us to sneer at old and well-tested rules of evidence or methods of procedure. The ordinary rules of evidence require to be even more diligently and methodically employed in the case of so delicate a method, which officials not scientifically trained are apt to misunderstand or overstrain, in their natural eagerness to secure convictions. "Repeat patterns" in single fingers are often found which come so near, the one to the other, that the least smudginess in the printing of them might easily veil important divergencies in one or two lineations, with appalling results. I can hardly emphasize this point too strongly. The *Daily Chronicle* (of the same date), after stating in a leaderette that "there was absolutely nothing to connect him (Elliott) with the theft but a finger-print of a middle finger on a skylight," goes on to make a cautious criticism which must to some extent commend itself to scientific readers who have studied this matter carefully:—"A detective officer who deals with finger-prints had no doubt that this was the imprint of a man who had been under notice—and another name. There are, we believe, several hundred thousand chances to one in favour of the detective. But in such cases one requires something a little nearer certainty." What is meant by "several hundred thousand chances" in this connection it is somewhat difficult to conjecture. It is alleged that there were—early in 1905—fully 900,000 imprints of fingers in the records of Scotland Yard. As the system of indexing does not—or did not at the time when the objection was raised—provide for a *comparison of finger with finger*, it is easy to perceive that reference must practically be made

only to the imprinted hands of a certain proportion of likely persons who are possibly incriminated. If the finger-smudge is really from the same finger as that on the record out of a limited choice it is no question of chance at all. Numbers have had little or nothing to do with it.

The imaginative journalist may contend that the popular,—once philosophic, fiction, that no two fingers can be alike (for purposes of identification) is a sober fact of the highest scientific certainty, but the only proof of it is seemingly the same “fact” repeated in other words—that Scotland Yard by its system of classification has never been able *to find* two fingers alike; or rather, when looked into, that the system does not permit them to be found even supposing them to be there. If it is otherwise, if it can really be claimed that no two fingers on the register are sufficiently alike to cause possible confusion and false identification, the fact must surely have been discovered by means of the method of classification now employed at Scotland Yard. But the system has been eloquently expounded and described by its official admirers as lacking a finger-index. You can compare each hand with each other hand that has a resemblance to it, but there seems to be no means of matching finger with finger individually. To do so mechanically, by one expert working eight hours a day and resting on Sundays, would take millions of years. Now, suppose the smudge on a bottle is quite unknown as regards its owner and that there is no particular suspicion against any old criminal, it is manifestly impossible to compare each of the 900,000 fingers on record with all the others individually. If this is not done, and all fingers—regardless of their serial order—are not separately indexed how can anyone seriously contend that no two fingers in the collection are alike? This question in itself is a very serious one, although it does not seem yet to have been apprehended in all its simplicity. The only reply yet vouchsafed to the objection now expressed—and not for the first time by me—is that, “Oh! the system of classification gives us the power to reach such a conclusion.” I have already, in addition to this uncertainty as to numerical data, pointed out that as a skin smudge or dermatograph is not necessarily a finger-print at all no numerical probability or improbability can be directly deduced from the fact that a human finger resembles it. If it can be made clear that the smudge is from a genuine human finger and from

nothing else than the evidence increases in value. Smudges from other parts of the palmar surface than the fingers are in my experience exceedingly common, as anyone may perceive on a little reflection as to the various uses to which the human hand is put daily by everyone. But, on the other hand, a smudge may be deposited in a place which nothing but a finger could reach, as inside the neck of a bottle. If again we are to argue on Leibnizian principles—and the belief can be traced, as I have suggested, to the teaching of Leibniz badly understood—that no two human fingers can ever be the same, it follows on the same principles, that no two prints from the same finger can be identical. Of what value, as evidence then, can they be?

I hold very firmly that all that can safely be contended for in such kind of evidence is a high degree of probability—amounting no doubt in some cases to as much certainty perhaps as we require for many of the ordinary usages of daily life.

Patterns Veiled by Bad Printing.

The difference between any two fingers in one man's hands, it is true, are usually marked and numerous, but it is not very rare to find such correspondences between left and right that reversal by photography would be quite misleading. There are also some very simple patterns that are found of frequent occurrence. Coincidences of these might occur in two individual fingers. They would very rarely indeed be found to coincide in a series of three. I think no such case has yet been noted by any one, but then the scientific workers have been few. Certainly no such case has come within my own extensive experience, spreading over more than a quarter of a century.

The legal question as to the personal origin of a given smudge is, however, hardly so simple as all this. Usually a smudge is hazy, limited in area, blurred in some parts, though clear perhaps in some others. Now the clear part may contain commonplace lineations of no particular evidential value, of no peculiar character. The blurred portions, again, may just happen to veil some very decidedly distinguishing element which would be of strong negative value as evidence. In this part of the problem lie many dangerous pitfalls, as I have not only tested by long and rigid experiment and scrutiny, but have witnessed in actual legal procedure.

Spatial Conformity.

Again, it is said, that even when two patterns derived from different fingers agree as patterns they will be found to diverge as regards size. We must remember, however, that pressure and other conditions, such as age in its hot and cold stages, may cause a noticeable discrepancy as to size, width of lineations, and so on, and that the *process of photographic enlargement* may introduce a new and very decided source of error. It is necessary, therefore, to secure not only that the enlargements should be made uniform with every precaution that science can supply, but also that the means of verifying this uniformity, or of adjusting the exhibits into spatial conformity when uniformity has not after all been attained, should be afforded in every case. The method I adopt is this: In a given smudge thought suitable for presentation as evidence some point must be taken approximately central. The analogous point in the pattern contained in the official finger-print of the accused having been provisionally determined, similar visible circles are to be made with drawing compasses round that supposed common point in the two exhibits. When the corresponding photographic enlargements are compared, the visible circles inclosing the patterns will show whether there is spatial conformity or not.

If it is not quite perfect for the practical comparison now in view, an adjustment can be made by measurement, and a simple calculation by the "rule of three" will enable the spatial relationship to be determined. The other lineations should then either actually conform, or conform in due proportion if the origins are identical.

To find a practical or provisional centre for the enclosing circle is not usually difficult. The very core of the pattern may contain an isolated dot surrounded by a ring, as in fig. 8. This dot, or its centre, would usually be precise enough. Again, the inner or outer angle of a gothic arched loop may be found in good position for the purpose. Sometimes two such loops may induce perplexity. If so, a straight line connecting their apices may be bisected, and the centre formed at the point of bisection. The most troublesome cases occur in patterns consisting of a series of almost parallel lineations, like fig. 3 r. The inner angle of a junction, however, may often be found in a fairly central situation in such a pattern. The present work



Fig. 17. Smudge encircled for presentation (afterwards enlarged).

contains variety of examples enough to furnish good exercises. In a doubtful or perplexing case, where perhaps two or three different points might in turn provisionally be assumed as centre in the smudge, several photographs should be taken and a provisional centre made of each of those points in different photographs. Possibly one might be found to conform exactly to that of prisoner's resembling finger-print. If the other lineations are congruous in a clearly-printed and complex pattern good evidence of identification might be obtained. Care is required in making the circles not to injure the print, and a little practice ought to be obtained before dealing with a legal case. In examining finger-prints which have been officially printed the hand is known to be right or left, and each finger occurs in its natural or serial order from thumb to little finger. When we come, however, to examine a presumptive "finger-print" which is only a smear or smudge with blurred lineations, we must not assume that we know to which hand it belongs, nor to which finger in any hand, or, whether after all it may not be a smudge from some other part of the palmar surface, or even in tropical or sub-tropical countries from some part of the feet. We are, in short, like aerial explorers of an unknown territory, or seamen without a compass, and must seek some fixed height or steeple or lighthouse, so as to find our latitude and longitude—so as to find, as it were, a base for a further triangular survey. The possibility has been mentioned that a print might have been impressed from the paw of some animal of the monkey tribe. Those who appeal to "chances" with such mathematical complacency might say that the proportion of monkeys to men in a given community must always be very slight. I cannot conjecture what returns a world census of monkeys might yield, but a good portion of my life was spent in an Indian hamlet in Sikkim where monkeys far exceeded men in number. Many profitable hours have I spent in watching the antics of a large and organised tribe of those nimble garden and field robbers. Their chief had much in common with the late lamented Professor Moriarty. I suppose he never suspected the invisible foe who defeated his sagacious strategy. I am aware the law views with suspicion evidence of what has been seen through a telescope, but an exception should be made in the case of travellers relating their experiences.

There are other ways by which photographers obtain some approach to spatial agreement in enlargements besides that which has just been indicated, but for legal investigation my method will, I believe, be found most suitable. Sometimes it may be desirable to rule each exhibit into similar squares, but even in a genuine identification some difference is apt to arise as to direction of the lines—to the *orientation* of the pattern to be tested. Concentric circles, as in some maps of London giving the mileage, would, I believe, be found better in most cases likely to occur.

Exploration of Unknown Smudges.

In dealing generally with the examination of photographic enlargements of rather dull smudges, the principles appealed to are much like those employed in testing the authenticity of old editions of books or maps or engravings. Suppose the problem to be whether a faded print is an old map of London: we may come to agree that one spot lies just where St. Paul's ought to be, a similar lineation may represent the Thames and another the Serpentine. In such a case the Crystal Palace and Westminster Abbey will naturally fall into their proper places in the map, if the induction is good. Some assumption must obviously be made at the starting of the investigation or no clear result will follow from the comparison either in a negative or in a positive direction. No better model, perhaps, could be followed in the subsequent reasoning than the Euclid of the schools, although the facts we are concerned with are not of the same precise quality as the abstract conceptions belonging to mathematics. Still we can either reduce the proposition to a visible absurdity, or prove in a fairly practical way, that X can be nothing else than A . If the plans are ideally superposed all the parts will fairly well correspond if the patterns are the same with the same enlargement. In this mode of comparison also it is clear that the photographic enlargement must correspond in magnification, or fine measurements will be of no avail whatever.

Application of Measurements.

Here it may be well to utter a caution in regard to the application of fine measurements to *enlarged* finger-print patterns. Amongst

beginners in the study there is a tendency somewhat to exaggerate the definiteness of lineations both as to length and breadth, and this may become a nuisance and a genuine danger when extremely fine measurements are used and insisted upon. Human flesh is not like lithographic stone, boxwood, or steel. These materials are practically incompressible in ordinary processes of printing. Yet, nevertheless, as every art connoisseur knows, the prints from the same hard steel-plate vary widely in a way that can only be expressed in money values. Now two prints taken from the same living man's fleshy finger will often give somewhat divergent results. It may be the effect of over, or of defective inking, of the quality of the ink itself which has been used, of the texture, smoothness, or moisture of the paper on which the pattern has been impressed, or of the degree of pressure or stretching to which the finger may have been submitted in the process. The lines may be smudgy, some elements may be left out for want of ink, or may have been obliterated by too much of it, and so on; while ridges may have been slightly flattened out although both pictures are on the same scale. See figs. 2 and 6 from same finger.

Discontinuity of Enlarged Patterns.

It is also worthy of note that in photographic enlargements some lineations which in the original unenlarged imprint look continuous and perfect are really broken up into isolated dots or patches. Those dots in different impressions from the same finger often differ in shape and size. This is sometimes clearly due to defective inking or varying pressure; but I am inclined to believe one chief cause is a kind of suction which takes place when the finger is being withdrawn from the paper, glass, or other substance in contact with the moist or greasy skin. Now there is a certain psychological effect involved in the reading of such imperfect imprints, which lies behind the whole art industry of impressionism. An artist of this modern school does not attempt exhaustively to limn the objects he desires to set before the mind's eye. He knows that by a kind of pointer, so to speak, he can set the conceptual faculty of the observer at work, who will then finish the pictured idea the limner has only hinted at in fragments. The danger of all impressionism in art or literature is that the

observer does not always bring exactly the same traditions, or prepossessions, or culture to bear on the art creation that were present to the mind of the "maker." Now the same principles hold good in viewing imperfect finger-prints as evidence for identification. One is too apt to fill in by an act of imagination those slight and seemingly insignificant gaps with the lineations that fall in best with one's own private prepossessions. Such prepossessions may not be quite apparent to oneself nor may they even be mixed up with one's attitude legally towards the accused. The unbiassed witness may feel and believe quite simply that a broken line points—or ought to point—one way, when a better and more exact knowledge of the ridges themselves would show quite another direction to be the true one. Every expert should be familiar with the natural ridges as well as with the dactylographs. A common little trick in a Chinese or Japanese printing office, when one of the 100,000 or so of type characters is not at hand, is to file off a line or dot in some closely resembling letter. The reader hardly notices the defect and supplies by his educated imagination the full shape of the character required in the sentence. Thus a smudged letter as in the middle figure of this diagram might be read either B or E.



Fig. 18.

Comparison of Curves.

In an earlier chapter of this guide mention was made of the sweep of the lines following a common curve, as in a ploughed field. It is sometimes important in comparing exhibits to test the concurrence of those curved lines. This may be done conveniently in an enlarged photographic reproduction by straight cut ribbons of plumber's lead (such as is used for roofing) placed edgewise against the curve. A stiff bit of copper wire is also useful, but is too apt to twist out of the correct plane. Either of these appliances should be adjusted to the leading lineation of one exhibit and then, taking care to maintain the adjustment, apply it to the other.

Instruments are now used by engineers and others for drawing curves which I have found to serve this purpose very well. They are called "flexible curves." They are self-clamping and are made

in various sizes by Mr. Wm. J. Brooks, scientific instrument maker, 33, Fitzroy Street, Tottenham Court Road, W. Pattern B (self-clamping) is the form which I recommend for the above purpose. The twelve inch size is sufficiently large. They are also made in sizes of nine, and of eighteen, inches. This pattern has a steel strip, like the lead ribbon already mentioned, and by means of a stiff-hinged linkwork attached to tabs the shape of any curve given to it is retained as long as may be wanted. The strip of steel should not be pressed between the tabs, and when bending or straightening the apparatus that should be done bit by bit, beginning at one end.

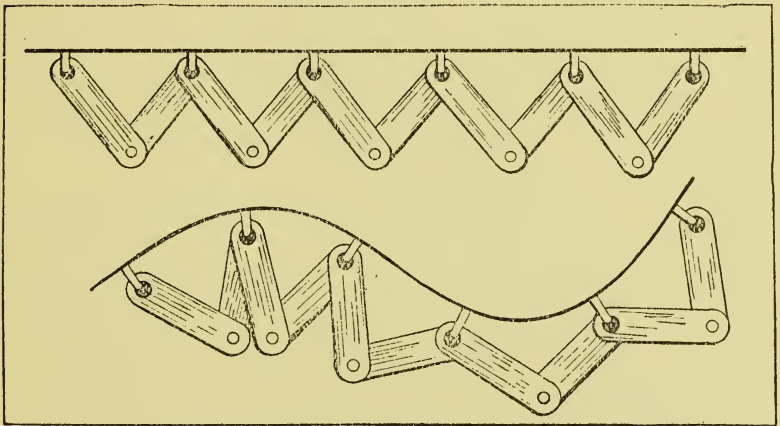


Fig. 19. Pattern B (self-clamping). 9 in. size.

In dealing with approximate curves which occur amongst the lineations of finger-prints, it would of course be quite absurd to attempt to apply the principles of conic sections. These concrete, slightly irregular forms cannot admit of rigid methods of mathematical reasoning applicable to ideal concepts. The simpler terms used in mathematical drawing, however, with such restrictions as have been mentioned, may often be very helpfully employed in describing or referring to particular finger-patterns before a magistrate or a jury.

The Use of Lenses, Compasses, etc.

When examining a direct nature-print without enlargement an ordinary botanical lens gives much assistance in distinguishing minute details. A lens with a two inch focus I have found very pleasant to

work with, but one must naturally suit one's own eyesight. For my own part I can easily write the Lord's prayer three times within the circle covered by a sixpence, but to focus long for so short a distance is trying. A blunt ivory or bone pointer is useful and is less liable to injure the prints than are needles.

It is a good plan to plot down one's mental impressions as to any rather intricate pattern. I find it useful to draw on old newspapers or sheets of brown or whitey-grey paper, using broad, soft red and blue pencils for alternate lineations. It is remarkable how puzzling it is sometimes to get a particular pattern clearly envisaged till something like that has been done to assist one's own perception.

A sheet of glazed tissue paper, such as is now used for wrapping up butter, marked regularly with concentric circles, or squares, or with both combined, gives much assistance in making clear the relationships of the different lines and terminations, forks or junctions, etc., in the pattern.

Dots of red or green ink may be placed along the boundary of the pattern, and these again, after a trial or two, may be carefully lettered or numbered for comparison. One may use letters on one side of the usual loop and numbers on the other. Lineations, too, can be more easily counted in this way. Great care must be taken in doing so to be sure in crossing near a "junction" whether you have counted one line or two. To secure correctness a ruler may be laid across the pattern, or if duplicate exhibits exist thin lines may be drawn across the figure.

We are told that "the exact measure of a finger-print is arrived at by counting the number of ridges which cross a line joining the core and the delta." There are, however, multitudes of good finger-prints which do not show any very decided core or any decided delta. This latter term is taken from the triangular shape of the Greek capital letter of that name and represents correctly enough the general arrangement of a part of the linings where three sets of lineations form something like a triangle in their centre as seen in figs. 13 and 14. *The method I have suggested is applicable to all cases, even if no delta or core can be determined.* If such precautions as I have suggested are not adopted ambiguous results may be expected.

Ordinary compasses or callipers may be used for taking measurements of enlarged photographs, when comparing particular elements

in the pattern. I have found Sir John Hooker's little pocket instrument called the "Kew Micrometer" very suitable for such measurements. It is made by Mr. Andrew Baird, scientific instrument maker, 33-39, Lothian Street, Edinburgh, who supplied me with the one I use. It does away with the inconvenience of double measurements with compasses and a measuring rule. The length of an object can be read off to a fraction of an inch or millimeter. One side of the scale being graduated to inches and fractions, the other to millimeters, the instrument not only gives measurements in both scales,

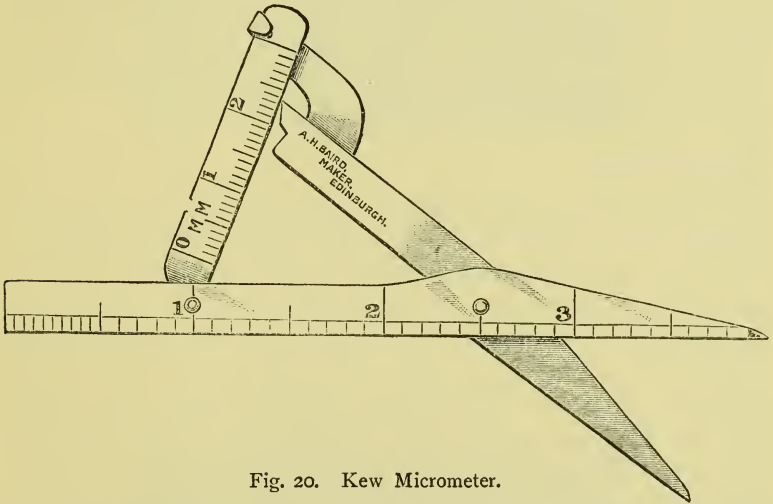


Fig. 20. Kew Micrometer.

but it also furnishes a ready means of turning the one scale into the other without calculation—a matter of great moment at the present time when two scales are in use in several countries. The instrument is four inches in length, and the long arm is graduated to tenths of an inch, and can therefore be used for larger measurements. It is very useful for a variety of purposes in scientific work, and does not take up much room. In dealing with photographic enlargements of twenty diameters delicate and expensive instruments are unnecessary for ordinary demonstration, but for the preliminary scrutiny of smudges and for purposes of classification of ordinary registers fine instruments are indispensable to the expert.

When a portion of any pattern leads to dispute as to evidence of identification, the remainder of the pattern may be shut out from the rest of the imprint, making the disputed portion easier to understand.

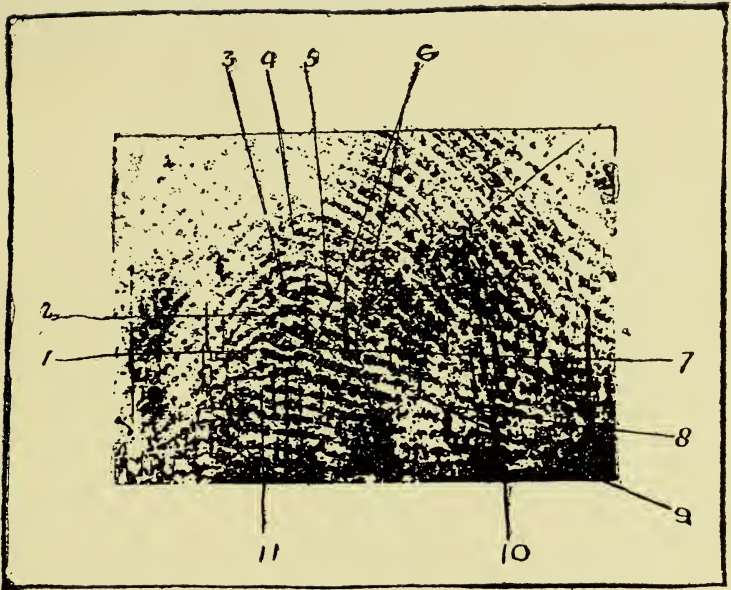
This can be done by punching or cutting out small openings of suitable size in a piece of cardboard or thin sheet of metal. I have found the stiff kind of foil on which mother-of-pearl buttons are usually mounted on cards for sale very convenient for the purpose. These minute apertures or windows, lineal, oval, round, etc., as required, are really of great service in visually isolating elements in the patterns to be scrutinised, especially when the object has not been enlarged. It will be found advisable in English courts to use ordinary English terms in referring to measurements. Nothing can be more serviceable in science generally than the metrical system, but it sometimes irritates and confuses an ordinary English jurymen. I am accustomed to use an English-made ivory scale, with measurements to $\frac{1}{64}$ th of an inch.

Enlargements.

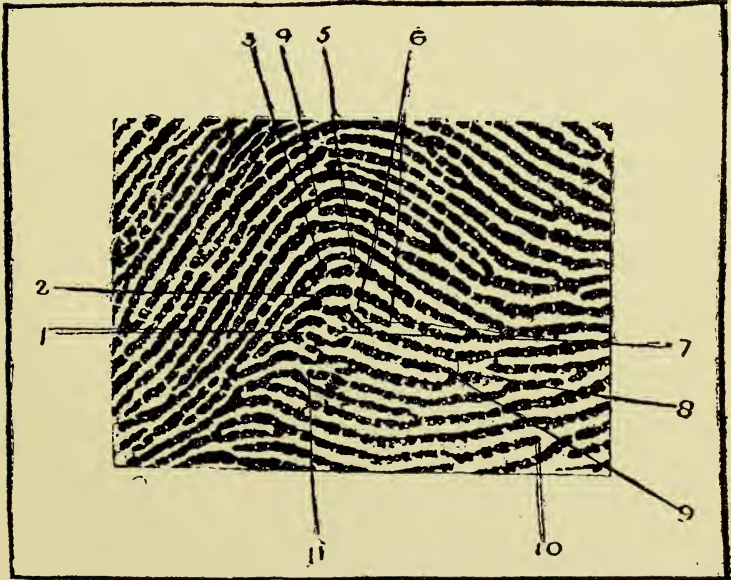
In any serious case photographic enlargements ought to be provided. Here the "decimal" or metrical system can be utilised in securing an enlargement of ten, twenty or thirty diameters. Some may prefer eight diameters, and such enlargement can be very well followed and used for reference in court, but it is too small for the eyes of most elderly people. When an enlargement of about twenty or twenty-four diameters is employed, as it is sometimes, such a scale as I use gives results far beyond anything likely to be practically required or to be specially convincing in evidence from enlarged finger-prints. The scale of twenty or thirty diameters would probably be most acceptable on the Continent, and uniformity for the purposes of international identification of important criminals would certainly be desirable, nor would the expense of a conference be wasted. The objection that a jury might have to measurements of lines, etc., being expressed in metrical terms would not necessarily apply to the one international scale of enlargement which a jury would not require to be perplexed with at all. Their observation would be as to the likeness of *two figures admittedly enlarged on the same scale.*

Qualities of Smudges.

In estimating the value of a given smudge as evidence before enlargement and presentation, it must be remembered that smudges not unlike finger-prints may be accidentally made by a variety of objects in a variety of ways. I have seen a fairly good one produced



Print found on Cash-box (enlarged).



Thumb-print of Alfred Stratton (enlarged).

Fig. 21. Deptford "Mask" Murders.

by a twisting movement of a bit of morocco bookbinding. A half-decayed branch of oak, cut in oval section, may make a mark not at all unlike a badly-printed human finger-print. During the period of the Whitechapel murders (1888-9) a post card with a reddish smudge was received by the authorities at Scotland Yard, which purported to come from "Jack the Ripper." It was printed in alleged *fac simile* by some colour process, and copies were posted up at the doors of each police station in London. The suggestion seemed almost to be that someone would recognise the miscreant by his finger-print, the value of which kind of evidence had begun then dimly to dawn upon the official mind. The imprint supposed to be a bloody finger-print—*if correctly reproduced*—seemed to my poor judgment to be a smear from some kind of twilled or ribbed fabric, like the sleeve of a coat. I ventured to approach an august department of the Circumlocution Office with a request to see the original, so as to have a better judgment of the fact, but was informed that that could not be permitted. In that case, supposing the marks to have been actually imprinted from human skin, there was no good *pattern* that could have been in the least degree useful for identification, even if the ten fingers of the culprit had been on the official records, which did not then exist. Again, as has been pointed out, there are certain simple and limited patterns that cannot certainly be said to be of human origin. One of Edgar A. Poe's finest detective stories is concerned with the doings of a monstrous monkey or orang.

Mounted Exhibits.

In each photographic enlargement there should be displayed an original, direct, unenlarged photograph of the smudge, along with its enlargement; and a nature print of the accused's resembling finger, along with the enlargement of that. By taking this precaution any mischance from reversed mirror patterns, or accidental substitution of a wrong enlargement, will be guarded against, and the fact can be tested at once and conclusively in the presence of the court.

Objections to Mere Diagrams.

The use of a large hand-made *diagram* by the prosecution, as in the case of the King *v.* Strattons, in the spring of 1905, seemed

to me objectionable, as violating the law of fair play supposed to govern all judicial procedure in England, by serving to bias the minds of the jury in favour of a particular pattern—the thumb of the accused person. Many years' constant study of "smudges," natural and enlarged, has firmly convinced me that the hazy cloud thus aided soon brings forth a weasel or even a whale. A few hours' study of puzzle pictures or *vexirbilden* would enable the legal mind to perceive the unwisdom of assisting unscientific imaginations in this way, which are usually active enough in wrong directions without any such inspiration from without. Diagrams, however, sworn to by expert draughtsmen might have some value as corroborative evidence when the smudge could not be photographed or enlarged. Such diagrams might even now be photo-telegraphed to a distance and lead to arrest. Diagrams are also very helpful in the study of a complex print. Smudges may be caused by a variety of materials, some of which might require identification or analysis by physiological or chemical experts, a subject which lies rather outside the scope of this work.

Blood usually gives rather bad impressions, tiny clots blocking up the furrows, but watery blood may often give very good ones, as when a culprit has been attempting to wash his hands. It is not correct to say that "sweat" gives impressions on glass, metal and the like. *Sweat*, which was recently sworn to as the usual cause of smudges, is a watery fluid which evaporates quickly, leaving no residue but a little saline material, which is usually quite invisible. Mr. Justice Channell referred to the unsatisfactory character of a smudge so originated from sweat. The human finger, however, is often greasy from *oily sebaceous matter*, naturally exuded from the skin, and this on glass, japanned ware, and polished metal gives most excellent marks, which can be well photographed by good management, and show up well in an enlargement. The perspiratory or sweat glands and the sebaceous glands of the skin are different in position, structure and function, the sweat glands lying much deeper than the others in the cutaneous structure. Sweat would not cause a permanent finger-mark, but if at all profuse would tend to hinder one from being made, and its presence in quantity makes the pore-holes more conspicuous than usual in a clear imprint.

Coloured Sweat.

There is, however, a curious affection called *Chromidrosis*, in which the sweat is coloured. A blackish ooze takes place in some hysterical cases. More striking is the class of cases in which the colouring matter is derived, like the bright colours in the plumage of parrots, from copper, and in some cases from iron. Workers in copper have been found subject to it. The sweat is generally of a bluish colour in those cases. Red sweat has been observed in lock-jaw. A kind of saffron colour I have found to be not very uncommon in some classes of malarious cases. One lady I attended had an extraordinary temperature during some of the attacks, the thermometer recording 110° Fahrenheit. With a temperature of about 104° F. she did not seem to be really unwell. I took good impressions at one of those times with the yellow-coloured sweat. Ordinarily, however, sweat does not help, but hinder, impressions from being made. A case of blue sweat came under my treatment quite recently. There was no history of copper poisoning..

Greasy and Chemical Smudges.

When Jude the Obscure quarrelled with his uninteresting young wife after the tragic slaughter of a fat pig, Mr. Thomas Hardy tells us that "in the operation of making lard Arabella's hands had become smeared with hot grease, and her fingers consequently left very perceptible imprints on the book covers." When a smudge made by some portion of greasy skin, or oily with the natural sebaceous secretion of the epidermis, cannot be photographed effectively, efforts may be made to heighten the visibility of the pattern by chemical and other means. Suppose the imprint to have been found on a pane of glass; when the portion has been carefully removed with every precaution to prevent effacement or to add fresh smudges, a fine light black powder has in my hands given beautifully vivid results. It is sold in the colour shops of the Potteries under the appetising title of *Velours à sauce*, and is marked *Conté à Paris, France*. It can be dusted lightly on, or blown over the smudge by an insufflator, such as is used in medical practice, but the best results are yielded by brushing very lightly over the pattern with a soft camel hair brush. The more expensive sable brushes are rather too stiff and do not carry the powder so well in their texture. The brush

should be examined before using. It must be soft and dry. A little practice soon makes one nearly perfect and the resulting mark is wonderfully effective for photographic enlargement. In this case the lines become dark—it is a *positive* print. In the case of an obscure greasy smudge upon an enamelled or japanned cash box the lines must be made to show up white on the dark background—a *negative* effect. This may be done in the same way as in the last example, but by using a white powder. Ordinary chalk tooth powder of smooth quality does very well for the purpose—giving as good an image as may be required if the smudge is clear and from a good pattern originally. I now use light carbonate of magnesia. Slight elements may be effaced, the pore marks may be obliterated, but the main features become very intelligible. See fig. 6.

I have found that very faint stains from a solution of gallic acid, oak bark, tea and the like, made by fingers, yield good discernable bluish-black pictures of the patterns, when treated with a weak solution of perchloride of iron.

In the reverse way, when a solution of iron perchloride has made a finger stain it is brought out very vividly in all its lineations when treated with solution of gallic acid. A smudge from a chemist's finger who had been handling syrup of tannin yielded a beautiful impression by this means. Sometimes the safest way is to approach the pattern from behind, by repeated slight "glazes," as artists would say, of the revivifying solution. This I have found less apt to disturb the characteristics of the pattern to be restored. When greasy finger marks have been made on paper the image is often rather difficult to follow or to photograph. Fortunately there are now effective ways of bringing out such dimly visible markings. A French writer, Dr. Forgeot, found a method of rendering those faint impressions more vivid by brushing them over with ordinary writing ink. The ink leaves the greasy lines alone and stains the untouched places where the furrows of the pattern lay during the imprint. The result would then be what I have called a *negative* impression, in which the summits of the ridges appear white in the pattern, while the furrows or grooves are coloured black. The image can then be enlarged by photography in the ordinary way. In comparing the smudge with an officially printed finger of an accused person it must be remembered the latter is a *positive* print, in which ridges are black and furrows white. See figs. 22a, 22b, 23a and 23b.

After a good many experiments with Dr. Forgeot's method I found there was some tendency to blur or render hazy the greasy lineations while brushing, however lightly, with the ink over the face of the imprint. By floating the paper on to a saucer partly filled with ink, face downwards, I obtained better results than before.

Now, Mendeléeff in a foot-note to p. 52 of the first volume of his splendid *Principles of Chemistry*, says:—"Of all known liquids, water exhibits the greatest *cohesion* of particles. Indeed, it ascends to a greater height in capillary tubes than other liquids; for instance, two and a half times as high as alcohol, nearly three times as high as ether, and to a much greater height than oil of vitriol, etc. . . . Only certain solutions (sal ammoniac and lithium chloride), and these only with a great excess of water, rise higher than pure water in capillary tubes. The great cohesion of water doubtless determines many of both its physical and chemical properties."

Bearing this property of water in mind it struck me that writing ink diluted with water might perhaps give better results than ink of ordinary thickness. I tried this carefully, floating the greasy finger-marked paper as before, but on diluted ink, and found that the patterns certainly often came out somewhat more clearly than before. I got still better results by drying the ink-stained paper and then floating it again over the same solution. By adding finally a very little sal ammoniac to the diluted ink the result in many instances was improved. Pressure, quality of grease, of ink and of paper, all varied the effects. Strangely, I got the best effect by the use of copying ink. I also found that by adding a very minute quantity of creosote to ordinary ink excellent results were obtained, making the ink run as into blotting paper except where protected by the greasy smudge. I found this out accidentally by using creosote to prevent fermentation of ink in hot weather. The *recency* of a greasy smudge may to some extent be determined by an expert in this method.

The results of many experiments in all these methods were a little variable, as the amount of grease or sebaceous matter on the smudges under natural conditions was variable, and paper of various qualities was used. The main result was, however, in favour of Dr. Forgeot's general method and greatly in favour of the modifications I have suggested. Specimens which were quite invisible to most eyes not knowing what to look for made excellent cases for evidence and

would show very well in photographic enlargement, as in the specimen shown, which was quite invisible as a natural greasy smudge. Hydrofluoric acid etches out the pattern of a greasy smudge on glass, but the original smudge generally makes a better photograph, and the acid, in my experience, alters or effaces minor details so much as to be a rather dangerous auxiliary. The figure, too, seems to be greatly affected by the kind of suction already referred to. I have got some good results by smoking greasy smudges on glass.

One vital point to be remembered and acted upon is that in real cases involving prosecution fresh experiments should not be tried on the proposed exhibits. My own experience shows how easy it would be by a rash "improvement" in method to destroy a valuable bit of evidence which could never be replaced. Any fresh idea can be carried out on smudges made for the purpose under as close an assimilation to the conditions of the genuine exhibit, as the scientific imagination aided by observation and experience can concoct.

Varnish which is nearly set takes on very good impressions in relief. So with paraffin and similar substances. Those casts can be most successfully photographed by dexterous management of light and shade. They give a partially negative or positive effect according to the angle of the light falling upon them—a matter demanding some vigilance when an important clue might be some really minor detail in the pattern. Too much stress, however, may be laid upon a characteristic which cannot be determined with precision in such an exhibit. Indeed a great field for scientific exploration lies spread before those who may feel inclined to pursue this study even as a fascinating pastime.

Prison officials are the only persons who are authorised by the Prevention of Crimes Act, 1891, Section 8, to take photographs, measurements, and finger-prints, whether of convicted or unconvicted prisoners, and in the latter case this permission is subject to the following regulation made by the Secretary of State for Home Affairs and sanctioned by Parliament:—"An untried prisoner shall not be photographed or measured while in prison save by order of the Secretary of State or upon an application in writing signed by an officer of police of not lower rank than superintendent, and approved by a justice of the peace, or in the Metropolitan Police District by the Commissioner or Assistant Commissioner of Police, and all such



Fig. 22a.



Fig 22b.

Fig. 22. Greasy smudges brought out with ink.



Fig. 23a. Greasy smudge vivified by floating on copying ink.



Fig. 23b. Invisible smudge brought out by applications of diluted ink.

applications shall set forth that from the character of the offence with which the prisoner is charged, or for other reasons, there are grounds for suspecting that he has been previously engaged in crime ; or that from any other cause his photograph and measurements are required for the purposes of justice."

It is easy, however, for the scientific amateur to obtain patterns from friends and relatives, and even a few well printed specimens will often be found to yield much food for observation and analysis.

A suitable quality of ink for printing finger patterns is supplied in artist's tubes by Reeves Ltd., 53, Moorgate Street, London, E.C.

CHAPTER VI.

SUMMARY AND CONCLUSIONS.

The system of identification persistently advocated by me for a quarter of a century is based on the incalculable variety and practical permanence of finger-patterns as revealed by ink impressions made on paper from them.

If imprints of the whole ten fingers (in the limited technical sense now in use) of convicted criminals are kept on official record, as in England they now are, any system of indexing them, however crude and imperfect, which enables the fresh imprint of a suspect to be confronted with that of his actual former record, must inevitably lead to prompt and unerring recognition, however large the number of resembling cases that may be classed along with it.

When fewer than ten fingers are on record, and even with the present system some convicts may not possess the full complement of fingers, the question descends to a problem of probabilities. It is still very unlikely that any serial set of three fingers will be found alike in any one collection, but when we arrive at the proposition to prove identification by a single finger-mark we have already crossed the margin of dogmatic certainty and must be content to rest upon the common sense estimate of probabilities. If the one print is clearly printed in all its fulness, the evidence afforded may still be both extensive and convincing. Smudges of this nature are often encountered, as illustrated by figs. 13 and 15.

If the particular pattern in question has also some striking arrangement in itself of unusual occurrence the evidence to the expert at least, is immensely increased in value, but such cases are not very common. There is often in a good finger-print a strong and haunting expression which I sometimes find difficult to expel from the

mental vision, reminding one of Dickens' powerful description of Bradley Headstone, the schoolmaster in *Our Mutual Friend*, who passed people on the street "like a haggard head suspended in the air: so completely did the force of his expression cancel his figure."

Now that the system is no longer the fad of scientific monomaniacs, as it was supposed to be a few years ago, it has succeeded far beyond official anticipation, giving the police effective control of the great and dangerous class of professional criminals such as had never been dreamed of before the advent of finger-prints. Its institution has cost the country nothing—not even a word of thanks—and even in local police districts it has effected much saving of time and money.

Out of this marked success and as a result of its efficacy, exaggerated or erroneous notions of its potency have begun already to ensnare the officials in control, who have shown a most curious and reprehensible ignorance of its quality and principles.

It has been laid down with every superfluity of emphasis that—not one finger-print, but—four points of agreement in a possible forty or so which an average single finger-print contains, is enough to secure an infallible identification by the "experts" of Scotland Yard. Three points, it is said, may be found to agree in two finger-prints taken from different persons, but never can there be found a case with four. This, however, is absolute and utter nonsense. Either those who use such language are unacquainted with the elements of dactylography or have a strong and unwholesome bias towards the reconviction of old criminals whatever the nature of the evidence may be which is alleged in the case.

The remainder of this chapter contains a brief summary of the procedure recommended in dealing with criminal cases of identification by means of finger-prints.

1. When a smudge has been discovered at a scene of crime which seems to give promise of being useful for evidence, great care must be taken that no other finger-prints or other marks be added thereafter. Clean paper should be used when handling the object and it should at once after examination be placed in some secure receptacle where destructive friction is impossible. Wooden pincers, tipped with india-rubber, are useful for manipulating finger-marked wine glasses or the like.

2. The smudge should as soon as possible be photographed of the natural size, or as nearly so as may be. If there is any prospect of a comparison being required in an important affair several copies should be obtained, noting at the time any peculiarities in the method employed.

3. A smudge may often be well and vividly brought out by a skilful photographer versed in light and shade, even though it was originally faint and obscure.

4. On a curved surface such as a cup, tumbler, or bottle, care must be taken in focussing the most significant part of the pattern. Even at the best the distortion may lead to unsatisfactory results for fine measurements.

5. If fragments of paper are found which might have been touched by an offender an attempt should be made to discover even the faintest trace of a greasy or chemical smudge, which might be revived in one or other of the methods described in Chapter V.

6. The original direct photograph of the smudge should be surrounded with a thin circle drawn from some point which forms a convenient and approximate centre of the pattern. If there seem to be more than one such point presenting in an irregular pattern it may be advisable to prepare two such differently encircled photographs for enlargement, or three if three likely points indicate practical possibilities in an important case, and so on. The circle may be drawn after enlargement if the centre and radius have been marked beforehand in the original. This gives a better appearance. A circle enlarged by photography looks rough and clumsy. The inner edge should uniformly be followed in such a case. See figs. 17 and 24.

7. The photographic enlargements should preferably be made on paper without glaze. It is often necessary to make slight pencil or other marks for the purpose of a "survey."

8. Such marks should be very slight and of a different colour from the photographic enlargement, so as not to blend with and confuse the lineations of the pattern itself. Aniline colours are convenient, but are apt to smear the exhibit if moisture touches the marks. Finely-pointed red or blue crayon pencils of good quality may be used, or an ordinary hard graphite or "lead" pencil.

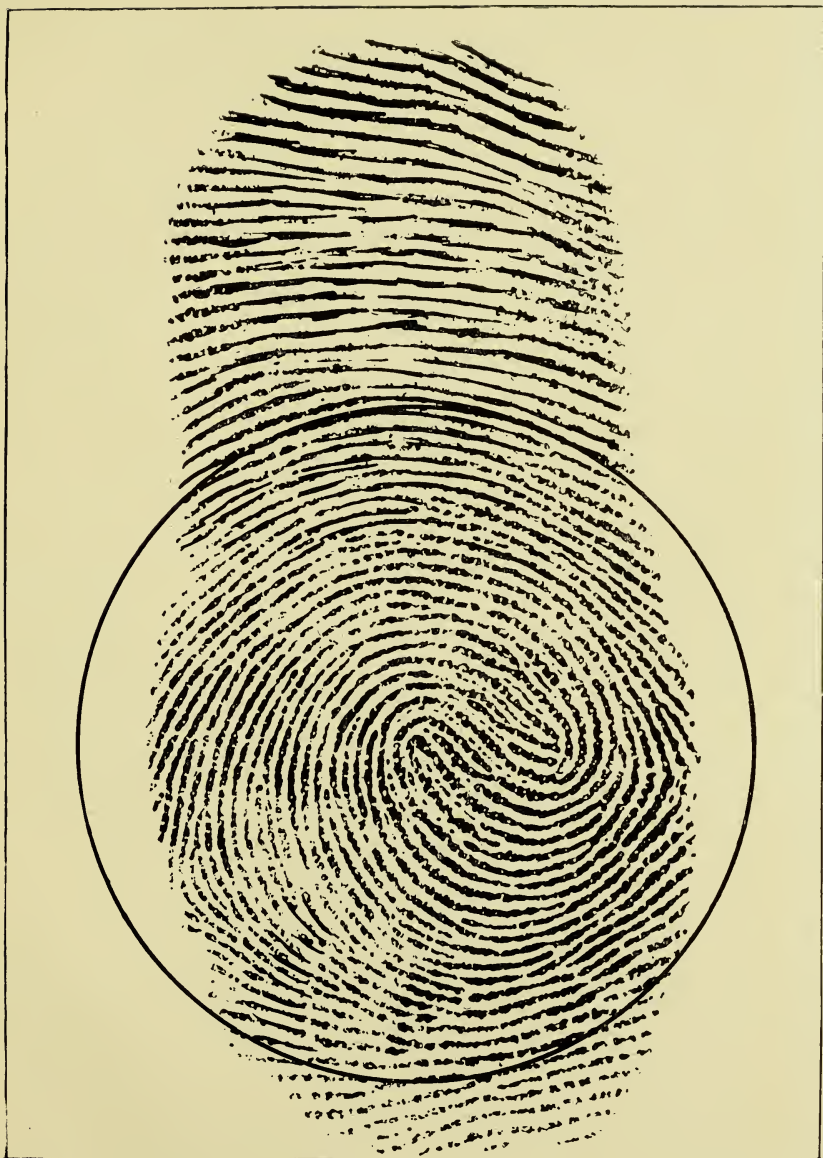


Fig. 24. Smudge :—Encircled for presentation after enlargement.

9. The enlargements should, as a rule, be made on a scale fixed officially, following either the metric or the English system. If the metric system is followed, enlargements of 20 diameters give very good results for putting before a jury. Uniformity is desirable for international use. Twenty-four diameters would be a good medium if the English measurements must be followed throughout. For petty trials enlargements may not be necessary in some cases where the pattern is somewhat complex and clear.

10. If a person suspected is in custody and his finger-prints can be legally secured, these should, if possible, be taken by some one experienced in official finger-printing. If that cannot be done, care must be taken to have the finger-prints of each hand in their natural order and to have available records or other evidence of the fact at the trial, together with the adhibited signature of the prisoner. [The question of cautioning the prisoner is a legal point which may arise].

11. If any one finger-print of the accused or suspected person is deemed to afford evidence of identity with the originator of the smudge at the scene of crime, this should be photographically enlarged to the same scale as the enlarged smudge in question. The enlargement should also have attached to it a direct nature-print of the accused person's corresponding finger for verification.

12. After the suspect's finger-print has been examined by an expert it should have a fine circle drawn around it, similar to that with which the smudge has been surrounded. If other somewhat central points suggest themselves, other finger-prints (or *direct* photographs) may be encircled in the same way as in the case of the smudge, so that an ultimate comparison may be made on the same area and scale. The centre and one radius may be marked and the circle drawn after enlargement. If direct photographs are used, they must, if possible, be produced in the same size as the original object, or evidence from agreement of measurements will be defeated.

13. The two enlargements may conveniently be mounted on stiff millboard, either side by side, or above and below. Uniformity in official procedure is desirable. When more than one suspect finger is in question, the enlarged smudge should be mounted alongside on each separate exhibit, for easy comparison.

14. The smudge may conveniently be marked X, as suggesting a problem to be solved. The particular finger-prints to be compared and identified if possible with X may be marked A, B, etc.

15. The smudge should not be headed "Finger-print," for the reasons stated in Chapter IV. The term "Dermatograph" would be safe, with provisos mentioned, or "Dactyloid smudge," *i.e.*, a smudge like a finger-print.

16. If an expert witness has come to the conclusion that the original of X is identical with that of A he must be prepared to satisfy a magistrate or the jury that he has sufficient reasons for saying so. If his conclusion is negative or adverse his grounds for that belief must be clearly stated in simple language. In any case the prisoner or his counsel ought to be enabled to criticise intelligently the points of the evidence adduced against him.

17. The pattern of the smudge may be clearly printed and complex in its qualities as a pattern. To bring such points out vividly is the function of an expert witness. The smudge may be hazy and the finger-print clear. The smudge may have a strikingly characteristic pattern of rare occurrence. The finger-print, again, may simply contain a pattern as meagre and commonplace as any to be found. Coincidences are not so convincing in such a case. The converse occurs perhaps rather more frequently. Thus: A smudge without much character as such somewhat resembles a given finger-print with strong evidential qualities in itself. It is apt to be supposed and argued that unfortunately the smudge has been badly imprinted just where its distinctive features would have presented themselves if they had been really present. The danger of this contention has to be watched and guarded against carefully by the defence.

18. When an expert is under examination as a witness, the general style or character of the patterns may have to be indicated; the direction of loops, etc., in the core; the possibility or otherwise of a mirror-pattern causing perplexity through photographic or primary reversal; and the agreement or disagreement in breadth or length of lines. Again, the location of spots, lakes, islands, deltas, loops, arches, whorls, spurs, and the like can be demonstrated by measurements; while the congruousness or otherwise of curves may be shown

in the ways set forth in the previous chapter. It is desirable to practise verbal description of such points as an illiterate jury might find hard to grasp without some explanation in plain terms.

19. Instruments, such as have been described in the previous chapter, ought to be at hand in an important case, lest any disagreement should arise as to curves, lineations, and so forth. It is not desirable to make a parade of them unless they are actually required.

Deptford "Mask Murders" Case.

There is no safer way of testing identity in the source of two finger-prints than by a careful analysis and comparison of the consecutive elements composing them. Let us take, for example, the dull smudge on the one hand and the clearly printed thumb-print of Stratton in the Deptford "Mask Murders" (fig. 25). Assuming meanwhile the truth of the case for the prosecution that the two prints were from the same finger, it is obvious that either their areas were not co-extensive in the exhibits, or that the photographic enlargements (again considerably *reduced* in this work) had not been made in the same proportion. The latter position was indeed conceded by the chief witness for the prosecution, who said "that could not be helped." It was also pointed out for the defence that the curves on the right side of the thumb-print were not congruous with those in the similar region of the smudge. Inspector Collins contended that this was the result of unequal pressure in the two cases. Here then the main problem was reduced to this,—Are there certain clear lineations or unequivocal elements in the two imprints, apart from size or curvature, to prove identification in the grave charge of murder? Scotland Yard says: "Yes, there are."

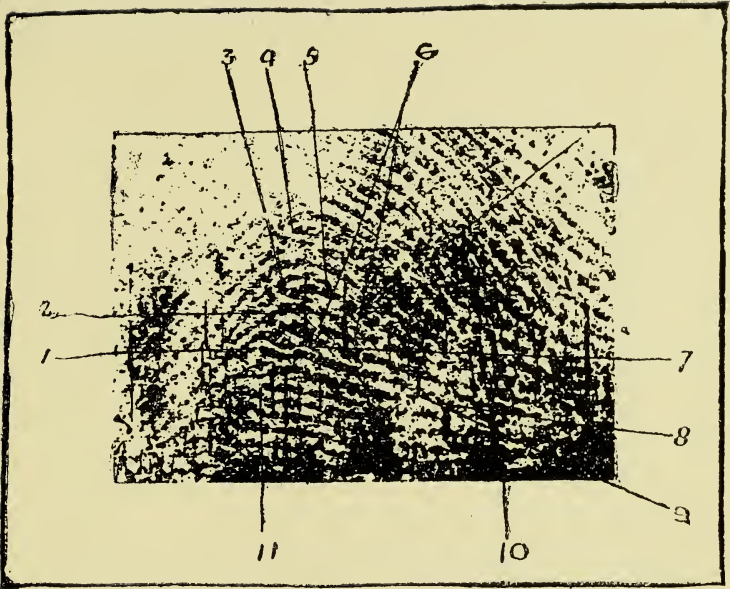
I have already given reasons for maintaining that such a low class, hazy smudge as that in question cannot in any case whatever be relied on to yield good evidence for identification. Those elements that are at all visible are not clearly enough printed to prevent different "readings" of the text. Indeed no single lineation is shown in its entirety throughout the area of the exhibit. Any change as the effect of re-copying by photographic methods equally affects both exhibits, and I think may in this case safely be ignored. There may be—there are some two or perhaps three—points of coincidence or

agreement of X with A, but they are not in this case of such a nature as to yield satisfactory measurements, even if the photographic enlargements had been commensurate. Now quite a number of accidental, unpremeditated smudges are both clear and measurable. The slight agreements noted are common in multitudes of this arched pattern without any hint of identity being conveyed.

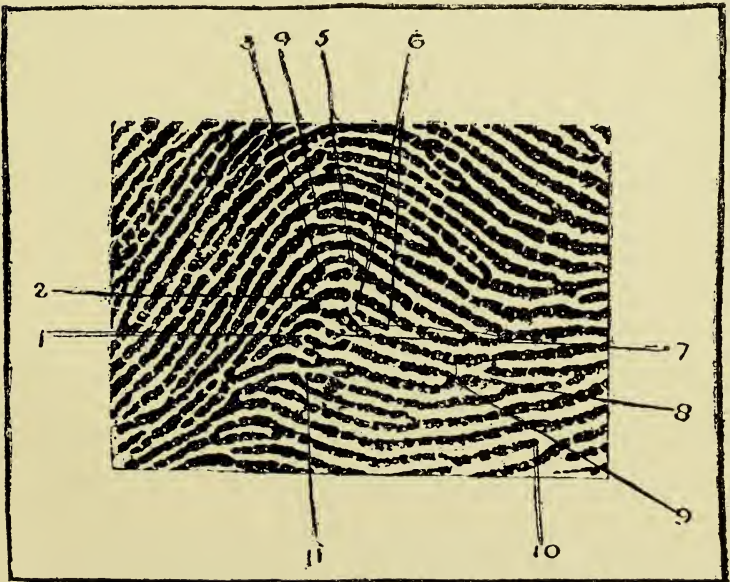
Again, the question has to be met,—How many consecutive points of agreement in two prints ought to secure belief in the identity of their source? Inspector Collins and his colleagues have said that when four characteristics are found to agree that is conclusive evidence of identity. It is not even said that those four points must occur in consecutive order, a distinction of the utmost importance. Out of some forty possible coincidences surely four might easily be picked out at random in a pattern which would not yield four consecutive points of resemblance. We must surely be expected to assume that Scotland Yard means four serial agreements, but this matter should now be brought out quite clearly and in unequivocal language.

Well, supposing that this matter has been comfortably settled and that four serial elements in the two patterns being found to agree, identity is proved, from what point in the figure are we to begin to count? In the case now before us the official numbering reproduced in the reduced figures suggests that the left side of the centre or core of the pattern has been the point of departure. Why should we begin there? Why should the defence be handicapped by the methods of the prosecution? Suppose in this instance we begin at the right side from the top of the patterns, we shall find element after element of a clear and vigorous type in the thumb-print which cannot be traced in the cash-box smudge.

Again, suppose we find at the beginning of our explanation so many successive points of actual disagreement, how many of those divergences constitute a sure and certain refutation or disproof of identity? If, for example, we discover four successive disagreements of pattern need we go any further in our researches? Are goose and gander not to be served with the same sauce? Is the defence to have a different measure meted out to it from that given to the prosecution? If again, we find the first four elements examined to prove infallibly that the source of the two prints is one and the same, and the



Print found on Cash-box (enlarged).



Thumb-print of Alfred Stratton (enlarged).

Fig. 25. Deptford "Mask" Murders.

defence thereafter has the audacity to go on and find that the fifth and sixth elements in succession are quite discrepant, what is to be our final deduction in the case?

Taking the matter up in a severely practical way let us now in imagination divide the two imprints vertically in the middle. Then supposing the patterns to be composed of flexible twigs which can be straightened out into a kind of runic alphabet, let us arrange them thus in serial order.



Fig. 26. Analytic diagram of an important pattern.

Those to the right represent diagrammatically the lineations at the right upper side of the thumb-print, counting towards the bottom of the figure. Compare these straightened lines with the curved lineations of the patterns and dismissing all thought of the alleged incongruousness of the curves from the problem, do we then find a successive coincidence of the lines in the two patterns? Points officially marked 8, 9 and 10 are alleged so to agree. These points are not serially successive, however, as the numbers would seem to suggest. The lack of coincidence is not officially noted. The alleged coincidences of 8, 9 and 10 I cannot at all discover in the patterns themselves. I have already given reasons for believing that a smudge of this quality should not be presented in court as evidence. The results are necessarily ambiguous or equivocal. It would be quite easy to find thousands of innocent men in whose finger patterns a few apparent coincidences could be read into such a hazy smudge as the one in fig 25.

In this instance, however, something more precise can be added. The real thumb-print contains a series of forked lines arranged in a most distinctive and unusual manner. I confess that I, at least, cannot find any of these distinctive elements in the right-hand half of the smudge. But if finger-print evidence is to be used in English courts of justice at all—and I believe it offers the fairest and most trustworthy method of identification the world has yet seen—the benefit of doubt must be fairly divided with the accused. If the

smudge was really left by the condemned man, who died for the crime, in old Mr. Farrow's cash-box tray the culprit must have moved his finger curiously during the imprint, or the smudge is a complex palimpsest which no expert could interpret with decision. There are a few—a very few—elements quite common to thousands of finger patterns left just barely discernable amidst a network of smears and scratches. This clever criminal also succeeded in carefully obliterating that half of the pattern which contained a complexity of special characters powerful enough to prove identity if one finger can do so. None of these particular lineations were betrayed in the smudge brought as evidence against him. Fortunately, perhaps, for society, there was other evidence which did not leave the jury in doubt as to the man's guilt. It is likely that in an old man's well fingered cash-box—the scratches betray this fact—there were more than one smudge to be found. Scotland Yard possibly got hold of the wrong one. It served a purpose and may for a time at least be the standard example of a "Fatal Finger-print." Fatal, I fondly trust it may prove to be to the fallacious and unfair application of a system that in this stage of its history demands not a little of that cautious common sense which is really science in the best sense of the word.

THE END.

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