ANTHROPOMETRY,

AS APPLIED TO THE

IDENTIFICATION OF CRIMINALS.

BEING AN ADAPTATION FOR INDIA OF THE SYSTEM OF
M. ALPHONSE BERTILLON, CHEF DU SERVICE D'IDENTIFICATION
PRÉFECTURE DE POLICE, PARIS.

By

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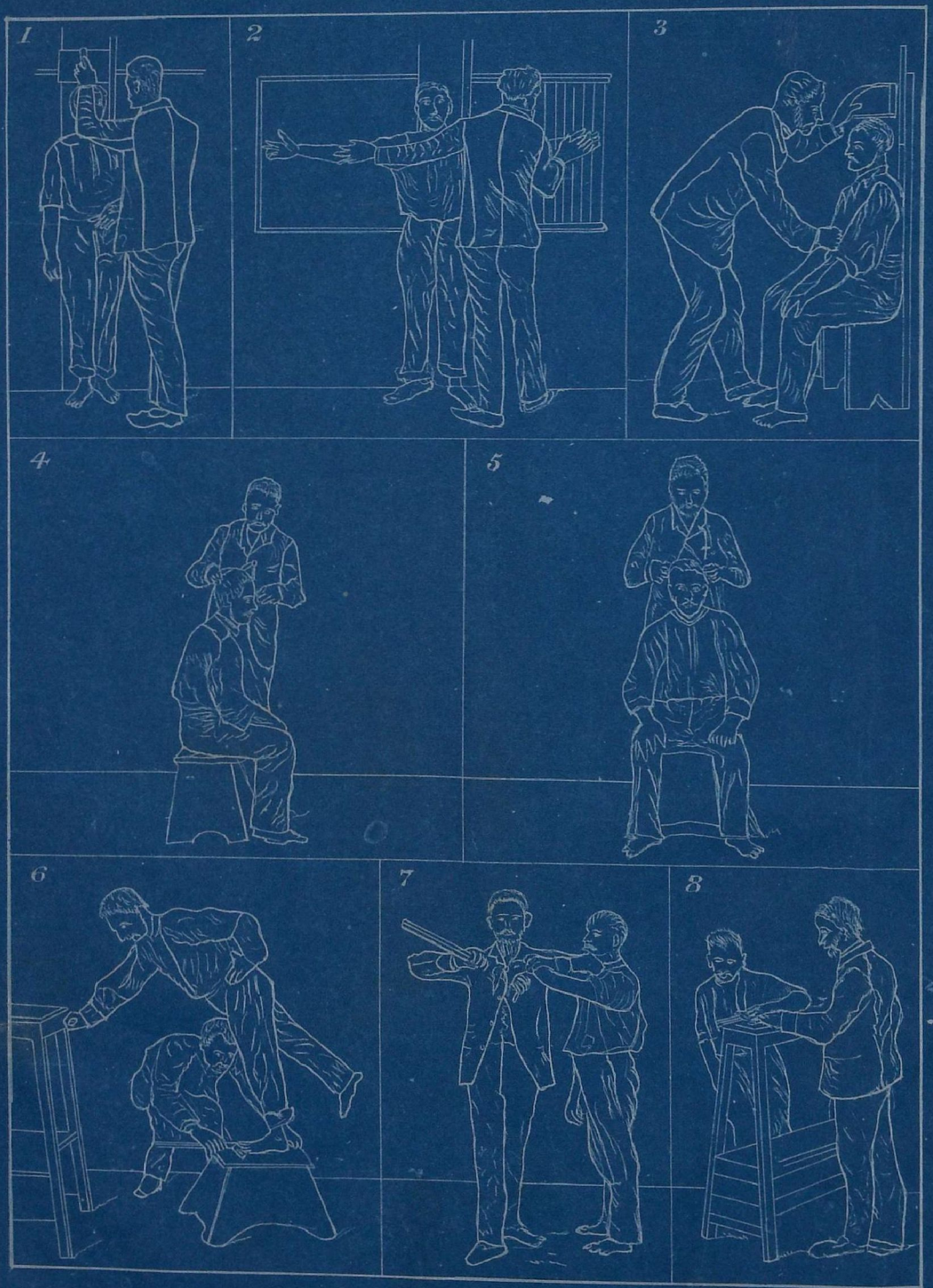
ILLUSTRATION I



1 Height Standing
2 Stretch of arms
3 Height of bust
4 Head length
5 Head breadth
6 Left foot
7 Middle and little finger
8 Cubit

ANTHROPOMETRY

AS APPLIED TO THE

Identification of Criminals.

In most of the countries composing the Continent of Europe, the Heads of the Departments of State responsible for the suppression of crime, have recognized for some years the importance, as a repressive measure, and as an auxiliary aid to criminal investigation, of a means whereby persons who have once transgressed the laws of their country, and again brought themselves within the purview of the authorities of the peace, even after a lengthy interval, can be easily and accurately identified.

Adoption of fictitious names by habitual criminals.

It is a common subterfuge of habitual criminals, and of many of those who, after an initial offence, and aided by birth, training and surroundings, are on the road to become such, to assume a false or fictitious name with a view to hide their identity from the police.

The reason is not far to seek. Either by law or custom almost universal in civilised nations, enhanced punishment is involved by a second conviction. It may also be the case that a professional criminal is "wanted" by the police for some offence other than the one for which he is in custody; or having previously committed an offence, which has hitherto been a secret between him and his associates, he may imagine he is wanted by the police, and therefore feels safer in assuming a name other than that by which he is generally known.

It would not be difficult to multiply the reasons for the assumption of *aliases* by confirmed offenders. Instances have been known of the name of a brother criminal being appropriated with a view to putting the police on a wrong scent. The name may be on the criminal register, but it by no means proves that it is the name of the person who has given it as his own.

Admitted value of a system of identification.

It is admitted in Europe that a system, by means of which the executive are enabled with rapidity and certainty to identify a person who has once passed through the hands of the police, is a most valuable aid in the repression of crime; and what is true in Europe, is equally true in India.

Owing to a multitude of causes, *inter alia* facility in overcoming distance due to increased railway communication, opportunities of refuge in Native States, &c., the area of operations of habitual criminals, in this country of huge distances, has become much augmented of late years. Offences are committed, of the identity of the perpetrators of which the police have

no clue. Is it an unwarrantable presumption that some of these at any rate might be traced home, were the police in possession of the real identity and previous history of the numerous persons who pass through their hands, and some of whom, though habitual criminals, are treated as first offenders, solely owing to the fact that there are no means at hand of finding out who they really are?

Pathans, Beluchis, Mekranis, and an infinite number of others, whose reputations, as a people, are none of the whitest, wander over the country, are here to-day, and gone to-morrow. Is it not of importance that these persons, if they commit an offence in one part of the Indian Empire, should be recognizable when they repeat it in another?

Descriptive roll of convicted prisoners kept in jails.

As a matter of fact, the value of identification in the case of convicted criminals is admitted in principle, for a descriptive roll of each prisoner is to be found in the jail registers; but the question arises, has any criminal at large ever been identified by his descriptive roll alone? The same description will apply to hundreds in the same district. Take, for instance, an ordinary case. Complexion, wheat color; face; oval, pitted with small-pox; tattoo marks on left forearm; scar, burn on abdomen. The only difficulty would be to select from the numbers who would fulfil these conditions.

System in force in France.

The principle being admitted, it only remains to be seen whether it is possible to perfect a system of what I may call descriptive data which, while having the advantage of absolute accuracy and facility of working, admits at the same time of a classification of the descriptions in such a manner, that a suspected person, having once been measured, may, at any time, have his measurements readily found amongst tens of thousands. Such a system is in force in France at the present day, and has been found to work with most admirable results.

The system is the invention of M. Alphonse Bertillon, Chef du Service d'Identification, in Paris, and is called after him "Bertillonage." The information regarding statistics and the results obtained by his department that I am enabled to give in these pages is gathered from his published works marginally noted. To him personally I am indebted for my knowledge of the practical details of the working of the system, gained during a visit to Paris in October 1892, when I had the advantage of attending the Prefecture of Police, seeing the daily batch of prisoners measured and classified, and having the entire scheme minutely explained to me by M. Bertillon himself.

Extrait de l'Annuaire Statisque de la ville de Paris, pour l'anneé 1887.
Notice sur le fonctionnement du Service d'Identification de la Préfecture de Police.

Bibliotheque d'Anthropologie criminelle et des Sciences Pénales, 1888.
Sur le fonctionnement du Service des Signalements Anthropometriques.

L'Anthropométrie Judiciaire à Paris en 1889.
Installations et plans de locaux récents perfectionnements. Une expérience de sociologie bureaucratique.

The identification of the Criminal classes by the Anthropometrical system. An address delivered by M. A. Bertillon at the International Penitentiary Congress at Rome on 22nd November 1885.
Translated by E. R. Spearman.

J. P.

System one of anthropometry.

The system is one of anthropometrical description, and consists of the accurate measurements of the lengths of various bony substances, always the same in each individual, and taken in a regular order. To these M. Bertillon adds photographs (full face and profile) to be attached to the record of measurements; but this adjunct, I shall show later on, is unnecessary, and may be entirely dispensed with as costly and unsatisfactory.

I speak of photography as an adjunct, for it does not lend itself to classification, and in Bertillonage is only turned to as a final, and to some extent more conclusive proof of a subject's identity when this has been established by the measurements.

Photography only an adjunct.

Measurements taken.

The measurements taken in France are :—

1. Length of head.
2. Breadth of head.
3. Length of middle finger, left hand.
4. Length of left foot.
5. Length of left cubit (from elbow to end of middle finger).
6. Length of ear.
7. Breadth of ear.
8. Height, standing.
9. Height of bust, sitting.
10. Stretch of arms.

To these are added the color of the eyes, which are divided into seven categories according to the intensity of the pigmentation of the iris.

Each of the measurements is sub-divided into three classes, according to whether they come under the head of large, medium, or small. The data from which these sub-divisions are obtained are acquired from experience, and would probably vary very little in India from what has been established in France. The object to be held in view is that, in a large number of cases, no class should unduly preponderate. It will be easily seen what an enormous number of permutations and combinations arise from these ten measurements thus sub-divided, and what an infinitesimal chance there is of any two subjects having the whole series in common.

Sub-division for purposes of classification.

Premising that the measurements are accurately taken—and to this subject I shall again refer later on—it will be useful here to illustrate the system of classification. We will suppose that 50,000 persons have been measured. Of these, probably 5,000 will be women and boys of immature age—say, under 20—who will have a classification to themselves. The remaining 45,000 are divided according to the length of the head, thus :—

System of classification.

Long heads	15,000
Heads of medium length...	15,000
Short heads	15,000

In order that these three classes may be approximately equal, it is evident that the class of men of medium head length must be confined within somewhat narrower limits than the other two, and must comprise only those whose heads measure from 18·4 centimetres* to 18·9 centimetres inclusive, whereas the class of men of long heads should comprise those of 19·0 centimetres and upwards (19·0—x), and the class of short heads those of 18·3 centimetres and under (a—18·3).

* Although the metrical system is not in use in the British Empire, I am of opinion that it should be used in anthropometry, not only for the purposes of international exchange, but because it is more accurate and easier of computation by the average operator ; it is, moreover, the system adopted by science. As M. Bertillon observed in his address to the Penitentiary Congress, " It is quite sufficient in countries where the metre system is not in use that the figures on our instruments should be regarded not as measurements of length, but as figure signs, indices of a particular sort. It is not the length quâ lengththat we require, but it is a figure quâ figure that shall always represent the same measures."

Each of these primary divisions will now again be divided on the same principle, without any reference to the head lengths, according to the breadth of the head of each individual. Each of these sub-divisions, amounting in all to 9, will then contain—

Wide heads...	5,000
Heads of medium width	5,000
Narrow heads	5,000

Each of these three classes will again be sub-divided into three divisions according to the length of the middle finger of the left hand, and will contain—

Long fingers	1,700 About
Medium length	1,700 „
Short fingers	1,700 „

The length of the foot will give a fourth indication, which will divide again into three each one of the packets of cards of measurement, and will reduce them to a series of, say, 570 ; and these may, in their turn, be sub-divided according to the length of the cubit, reducing the number to 190, reduced by the length and breadth of the ear and the height (sitting) to 63, 21 and 7, respectively.

50,000 cards by elimination reduced to packets of 7 each.

Thus by a few extra anthropometric indications beyond the usual ones of sex, age, and height, the collection of 50,000 measurements has been divided up into groups of 7 each, which can be easily and rapidly examined.

Now if we wish to ascertain if a man has already been measured, the process is simple and quick. But before proceeding to explain it, it is necessary to make clear the order and disposition observed in the cupboards or presses of anthropometric classification.

Arrangement of the presses in which the cards are kept.

In the Bureau at Paris, each individual's measurements are recorded in duplicate. For their reception there are two presses of pigeon-holes ; in the one they are arranged according to the alphabetical order of the subjects' names, in the other according to the system of classification now about to be explained. This cupboard or press contains 243 drawers, the whole being divided and sub-divided in the following manner :—

1st. Horizontally, into three large series of 81 drawers each, A, A1, A2 (see drawing), containing all the cards with head lengths classified as large, medium, and small, respectively.

2nd. Vertically, B, B1, B2, for the cards, having head breadths large, medium, and small.

3rd. Each of the large horizontal divisions of 81 drawers is then again sub-divided horizontally into three more series of drawers for a long, medium, and short middle finger (*a*, *b*, *c*).

4th. Each of these sub-divisions is further sub-divided into three series of drawers horizontally, for the three classes of foot (*aa*, *bb*, *cc*).

5th. Lastly, each of the large vertical divisions is sub-divided into three series of drawers for the classes of measurement of the cubit (*x*, *y*, *z*).

Method of search illustrated.

Let us now take the case of a man in custody who declines to give his name, or who has given, what we imagine to be, a false one. How shall we find his measurement card, supposing that he has passed through the hands of the police on some former occasion, and has been measured ?

ORDER AND DISPOSITION OBSERVED IN THE PRESSES OF ANTHROPOMETRICAL CLASSIFICATION.

B. 2. B. 1. B.

NARROW HEADS. HEADS OF MEDIUM WIDTH. BROAD HEADS.

Z Y X

1st Press of short (a—183) heads.

aa
I a—18·3 IV 26·5—x II a—15·2 III 11·4—x V a—46·0 | I a—18·3 IV 26·5—x II a—15·2 III 11·4—x V 46·1—47·0 | I a—18·3 IV 26·5—x II a—15·2 III 11·4—x V 47·1—x | I a—18·3 IV 26·8—x II 15·3—19·7 III 11·5—x V a—46·8 | I a—18·3 IV 26·8—x II 15·3—19·7 III 11·6—x V 46·9—47·7 | I a—18·3 IV 26·8—x II 15·3—19·7 III 11·6—x V 47·8—x | I a—18·3 IV 27·2—x II 15·8—x III 11·6—x V a—47·0 | I a—18·3 IV 27·2—x II 15·8—x III 11·6—x V 47·1—47·9 | I a—18·3 IV 27·2—x II 15·8—x III 11·6—x V 45—x

a bb
I a—18·3 IV 25·8—26·4 II a—15·2 III 11·4—x V a—45·0 | I a—18·3 IV 25·8—26·4 II a—15·2 III 11·4—x V 45·1—45·9 | I a—18·3 IV 25·8—26·4 II a—15·2 III 11·4—x V 46·0—x | I a—18·3 IV 26·1—26·7 II 15·3—19·7 III 11·5—x V a—45·6 | I a—18·3 IV 26·1—26·7 II 15·3—19·7 III 11·5—x V 45·7—46·5 | I a—18·3 IV 26·1—26·7 II 15·3—19·7 III 11·5—x V 46·6—x | I a—18·3 IV 26·4—27·1 II 15·8—x III 11·6—x V a—45·7 | I a—18·3 IV 26·4—27·1 II 15·8—x III 11·6—x V 45·8—46·6 | I a—18·3 IV 26·4—27·1 II 15·8—x III 11·6—x V 46·7—x

cc
I a—18·3 IV a—25·7 II a—15·2 III 11·4—x V a—44·4 | I a—18·3 IV a—25·7 II a—15·2 III 11·4—x V 44·5—45·3 | I a—18·3 IV a—25·7 II a—15·2 III 11·4—x V 45·4—x | I a—18·3 IV a—26·0 II 15·3—19·7 III 11·5—x V a—44·9 | I a—18·3 IV a—26·0 II 15·3—19·7 III 11·5—x V 45·0—45·8 | I a—18·3 IV a—26·0 II 15·3—19·7 III 11·5—x V 45·9—x | I a—18·3 IV a—26·3 II 15·8—x III 11·6—x V a—45·0 | I a—18·3 IV a—26·3 II 15·8—x III 11·6—x V 45·1—45·9 | I a—18·3 IV a—26·3 II 15·8—x III 11·6—x V 46·0—x

b

aa
I a—18·3 IV 25·6—x II a—15·2 III 10·9—11·3 V a—42·9 | I a—18·3 IV 25·6—x II a—15·2 III 10·9—11·3 V 44·0—44·8 | I a—18·3 IV 25·6—x II a—15·2 III 10·9—11·3 V 44·3—x | I a—18·3 IV 25·9—x II 15·3—19·7 III 11·0—11·4 V a—44·2 | I a—18·3 IV 25·9—x II 15·3—19·7 III 11·0—11·4 V 44·3—45·1 | I a—18·3 IV 25·9—x II 15·3—19·7 III 11·0—11·4 V 45·2—x | I a—18·3 IV 26·4—x II 15·8—x III 11·1—11·5 V a—44·0 | I a—18·3 IV 26·4—x II 15·8—x III 11·1—11·5 V 45·1—45·9 | I a—18·3 IV 26·4—x II 15·8—x III 11·1—11·5 V 46·0—x

bb
I a—18·3 IV 24·8—25·5 II a—15·2 III 10·9—11·3 V a—43·3 | I a—18·3 IV 24·8—25·5 II a—15·2 III 10·9—11·3 V 43·4—44·2 | I a—18·3 IV 24·8—25·5 II a—15·2 III 10·9—11·3 V 44·3—x | I a—18·3 IV 25·2—25·8 II 15·3—19·7 III 11·0—11·4 V a—43·9 | I a—18·3 IV 25·2—25·8 II 15·3—19·7 III 11·0—11·4 V 44·0—44·8 | I a—18·3 IV 25·2—25·8 II 15·3—19·7 III 11·0—11·4 V 44·9—x | I a—18·3 IV 25·7—26·3 II 15·8—x III 11·1—11·5 V a—44·0 | I a—18·3 IV 25·7—26·3 II 15·8—x III 11·1—11·5 V 44·1—45·0 | I a—18·3 IV 25·7—26·3 II 15·8—x III 11·1—11·5 V 45·1—x

cc
I a—18·3 IV a—24·7 II a—15·2 III 10·9—11·3 V a—42·6 | I a—18·3 IV a—24·7 II a—15·2 III 10·9—11·3 V 42·7—43·5 | I a—18·3 IV a—24·7 II a—15·2 III 10·9—11·3 V 43·6—x | I a—18·2 IV a—25·1 II 15·3—19·7 III 11·0—11·4 V a—43·3 | I a—18·3 IV a—25·1 II 15·3—19·7 III 11·0—11·4 V 43·4—44·2 | I a—18·3 IV a—25·1 II 15·3—19·7 III 11·0—11·4 V 44·3—x | I a—18·3 IV a—25·6 II 15·8—x III 11·1—11·5 V a—43·5 | I a—18·3 IV a—25·6 II 15·8—x III 11·1—11·5 V 43·6—44·4 | I a—18·3 IV a—25·6 II 15·8—x III 11·1—11·5 V 44·5—x

aa
I a—18·3 IV 24·7—x II a—15·2 III a—10·8 V a—42·4 | I a—18·3 IV 24·7—x II a—15·2 III a—10·8 V 42·5—43·3 | I a—18·3 IV 24·7—x II a—15·2 III a—10·8 V 43·4—x | I a—18·3 IV 25·0—x II 15·3—19·7 III a—10·9 V a—42·9 | I a—18·3 IV 25·0—x II 15·3—19·7 III a—10·9 V 43·0—43·8 | I a—18·3 IV 25·0—x II 15·3—19·7 III a—10·9 V 43·9—x | I a—18·3 IV 25·2—x II 15·8—x III a—11·0 V a—43·1 | I a—18·3 IV 25·2—x II 15·8—x III a—11·0 V 43·2—44·0 | I a—18·3 IV 25·2—x II 15·8—x III a—11·0 V 44·1—x

bb
I a—18·3 IV 23·9—24·6 II a—15·2 III a—10·8 V a—41·8 | I a—18·3 IV 23·9—24·6 II a—15·2 III a—10·8 V 41·9—42·7 | I a—18·3 IV 23·9—24·6 II a—15·2 III a—10·8 V 42·8—x | I a—18·3 IV 24·2—24·9 II 15·3—19·7 III a—10·9 V a—42·3 | I a—18·3 IV 24·2—24·9 II 15·3—19·7 III a—10·9 V 42·4—43·2 | I a—18·3 IV 24·2—24·9 II 15·3—19·7 III a—10·9 V 43·3—x | I a—18·3 IV 24·5—25·1 II 15·8—x III a—11·0 V a—42·2 | I a—18·3 IV 24·5—25·1 II 15·8—x III a—11·0 V 42·3—43·1 | I a—18·3 IV 24·5—25·1 II 15·8—x III a—11·0 V 43·2—x

cc
I a—18·3 IV a—23·8 II a—15·2 III a—10·8 V a—40·9 | I a—18·3 IV a—23·8 II a—15·2 III a—10·8 V 41·0—41·8 | I a—18·3 IV a—23·8 II a—15·2 III a—10·8 V 41·9—x | I a—18·3 IV a—24·1 II 15·3—19·7 III a—10·9 V a—41·2 | I a—18·3 IV a—24·1 II 15·3—19·7 III a—10·9 V 41·3—42·2 | I a—18·3 IV a—24·1 II 15·3—19·7 III a—10·9 V 42·3—x | I a—18·3 IV a—24·4 II 15·8—x III a—11·0 V a—41·9 | I a—18·3 IV a—24·4 II 15·8—x III a—11·0 V 42·0—42·8 | I a—18·3 IV a—24·4 II 15·8—x III a—11·0 V 42·9—x

2nd Press of heads of medium length (184—189)

aa
I 18·4—18·9 IV 26·8—x II a—15·3 III 11·5—x V a—46·8 | I 18·4—18·9 IV 26·8—x II a—15·3 III 11·5—x V 46·9—47·7 | I 18·4—18·9 IV 26·8—x II a—15·3 III 11·5—x V 47·8—x | I 18·4—18·9 IV 27·1—x II 15·4—15·8 III 11·6—x V a—46·5 | I 18·4—18·9 IV 27·1—x II 15·4—15·8 III 11·6—x V 46·6—47·4 | I 18·4—18·9 IV 27·1—x II 15·4—15·8 III 11·6—x V 47·5—x | I 18·4—18·9 IV 27·4—x II 15·3—x III 11·7—x V a—47·5 | I 18·4—18·9 IV 27·4—x II 15·9—x III 11·7—x V 47·6—48·4 | I 18·4—18·9 IV 27·4—x II 15·9—x III 11·7—x V 48·5—x

a bb
I 18·4—18·9 IV 26·1—26·7 II a—15·3 III 11·5—x V a—45·5 | I 18·4—18·9 IV 26·1—26·7 II a—15·3 III 11·5—x V 45·6—46·4 | I 18·4—18·9 IV 26·1—26·7 II a—15·3 III 11·5—x V 46·5—x | I 18·4—18·9 IV 26·3—27·0 II 15·4—15·8 III 11·6—x V a—46·0 | I 18·4—18·9 IV 26·3—27·0 II 15·4—15·8 III 11·6—x V 46·1—46·9 | I 18·4—18·9 IV 26·3—27·0 II 15·4—15·8 III 11·6—x V 47·0—x | I 18·4—18·9 IV 26·6—27·3 II 15·9—x III 11·7—x V a—46·4 | I 18·4—18·9 IV 26·6—27·3 II 15·9—x III 11·7—x V 46·5—47·3 | I 18·4—18·9 IV 26·6—27·3 II 15·9—x III 11·7—x V 47·4—x

cc
I 18·4—18·9 IV a—26·0 II a—15·3 III 11·5—x V a—44·7 | I 18·4—18·9 IV a—26·0 II a—15·3 III 11·5—x V 44·8—45·6 | I 18·4—18·9 IV a—26·0 II a—15·3 III 11·5—x V 45·7—x | I 18·4—18·9 IV a—26·2 II 15·4—15·8 III 11·6—x V a—45·2 | I 18·4—18·9 IV a—26·2 II 15·4—15·8 III 11·6—x V 45·3—46·1 | I 18·4—18·9 IV a—26·2 II 15·4—15·8 III 11·6—x V 46·2—x | I 18·4—18·9 IV a—26·5 II 15·9—x III 11·7—x V a—45·5 | I 18·4—18·9 IV a—26·5 II 15·9—x III 11·7—x V 45·6—46·4 | I 18·4—18·9 IV a—26·5 II 15·9—x III 11·7—x V 46·5—x

b

aa
I 18·4—18·9 IV 25·8—x II a—15·3 III 11·0—11·4 V a—44·4 | I 18·4—18·9 IV 25·8—x II a—15·3 III 11·0—11·4 V 44·5—45·3 | I 18·4—18·9 IV 25·8—x II a—15·3 III 11·0—11·4 V 45·4—x | I 18·4—18·9 IV 26·2—x II 15·4—15·8 III 11·1—11·5 V a—44·9 | I 18·4—18·9 IV 26·2—x II 15·4—15·8 III 11·1—11·5 V 45·0—45·8 | I 18·4—18·9 IV 26·2—x II 15·4—15·8 III 11·1—11·5 V 45·9—x | I 18·4—18·9 IV 26·4—x II 15·9—x III 11·2—11·6 V a—45·2 | I 18·4—18·9 IV 26·4—x II 15·9—x III 11·2—11·6 V 45·3—46·1 | I 18·4—18·9 IV 26·4—x II 15·9—x III 11·2—11·6 V 46·2—x

bb
I 18·4—18·9 IV 25·1—25·7 II a—15·3 III 11·0—11·4 V a—43·6 | I 18·4—18·9 IV 25·1—25·7 II a—15·3 III 11·0—11·4 V 43·7—44·5 | I 18·4—18·9 IV 25·1—25·7 II a—15·3 III 11·0—11·4 V 44·6—x | I 18·4—18·9 IV 25·5—26·1 II 15·4—15·8 III 11·1—11·5 V a—44·4 | I 18·4—18·9 IV 25·5—26·1 II 15·4—15·8 III 11·1—11·5 V 44·5—45·3 | I 18·4—18·9 IV 25·5—26·1 II 15·4—15·8 III 11·1—11·5 V 45·4—x | I 18·4—18·9 IV 25·7—26·3 II 15·9—x III 11·2—11·6 V a—44·4 | I 18·4—18·9 IV 25·7—26·3 II 15·9—x III 11·2—11·6 V 44·5—46·1 | I 18·4—18·9 IV 25·7—26·3 II 15·9—x III 11·2—11·6 V 45·4—x

cc
I 18·4—18·9 IV a—25·0 II a—15·3 III 11·0—11·4 V a—43·5 | I 18·4—18·9 IV a—25·0 II a—15·3 III 11·0—11·4 V 43·6—44·3 | I 18·4—18·9 IV a—25·0 II a—15·3 III 11·0—11·4 V 44·5—x | I 18·4—18·9 IV a—25·4 II 15·4—15·8 III 11·1—11·5 V a—43·7 | I 18·4—18·9 IV a—25·4 II 15·4—15·8 III 11·1—11·5 V 43·8—44·6 | I 18·4—18·9 IV a—25·4 II 15·4—15·8 III 11·1—11·5 V 44·7—x | I 18·4—18·9 IV a—25·6 II 15·9—x III 11·2—11·6 V a—44·2 | I 18·4—18·9 IV a—25·6 II 15·9—x III 11·2—11·6 V 44·3—45·1 | I 18·4—18·9 IV a—25·6 II 15·9—x III 11·2—11·6 V 45·2—x

aa
I 18·4—18·9 IV 25·0—x II a—15·3 III a—10·9 V a—42·8 | I 18·4—18·9 IV 25·0—x II a—15·3 III a—10·9 V 42·9—43·7 | I 18·4—18·9 IV 25·0—x II a—15·3 III a—10·9 V 43·8—x | I 18·4—18·9 IV 25·2—x II 15·4—15·8 III a—11·0 V a—43·4 | I 18·4—18·9 IV 25·2—x II 15·4—15·8 III a—11·0 V 43·5—44·3 | I 18·4—18·9 IV 25·2—x II 15·4—15·8 III a—11·0 V 44·4—x | I 18·4—18·9 IV 25·5—x II 15·9—x III a—11·1 V a—43·8 | I 18·4—18·9 IV 25·5—x II 15·9—x III a—11·1 V 43·9—44·7 | I 18·4—18·9 IV 25·5—x II 15·9—x III a—11·1 V 44·8—x

bb
I 18·4—18·9 IV 24·2—24·9 II a—15·3 III a—10·9 V a—41·9 | I 18·4—18·9 IV 24·2—24·9 II a—15·3 III a—10·9 V 42·0—42·8 | I 18·4—18·9 IV 24·2—24·9 II a—15·3 III a—10·9 V 42·9—x | I 18·4—18·9 IV 24·5—25·1 II 15·4—15·8 III a—11·0 V a—42·5 | I 18·4—18·9 IV 24·5—25·1 II 15·4—15·8 III a—11·0 V 42·6—43·4 | I 18·4—18·9 IV 24·5—25·1 II 15·4—15·8 III a—11·0 V 43·5—x | I 18·4—18·9 IV 24·8—25·4 II 15·9—x III a—11·1 V a—42·8 | I 18·4—18·9 IV 24·8—25·4 II 15·9—x III a—11·1 V 42·9—43·7 | I 18·4—18·9 IV 24·8—25·4 II 15·9—x III a—11·1 V 43·8—x

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I 18·4—18·9 IV a—24·1 II a—15·3 III a—10·9 V a—41·4 | I 18·4—18·9 IV a—24·1 II a—15·3 III a—10·9 V 41·5—42·3 | I 18·4—18·9 IV a—24·1 II a—15·3 III a—10·9 V 42·4—x | I 18·4—18·9 IV a—24·4 II 15·4—15·8 III a—11·0 V a—41·4 | I 18·4—18·9 IV a—24·4 II 15·4—15·8 III a—11·0 V 41·5—42·3 | I 18·4—18·9 IV a—24·4 II 15·4—15·8 III a—11·0 V 42·4—x | I 18·4—18·9 IV a—24·7 II 15·9—x III a—11·1 V a—42·0 | I 18·4—18·9 IV a—24·7 II 15·9—x III a—11·1 V 42·1—42·9 | I 18·4—18·9 IV a—24·7 II 15·9—x III a—11·1 V 43·0—x

3rd Press of long heads (190—x)

aa
I 19·0—x IV 27·3—x II a—15·4 III 11·7—x V a—47·3 | I 19·0—x IV 27·3—x II a—15·4 III 11·7—x V 47·6—48·4 | I 19·0—x IV 27·3—x II a—15·4 III 11·7—x V 48·3—x | I 19·0—x IV 27·4—x II 15·5—15·9 III 11·7—x V a—47·4 | I 19·0—x IV 27·4—x II 15·5—15·9 III 11·7—x V 47·5—48·3 | I 19·0—x IV 27·4—x II 15·5—15·9 III 11·7—x V 48·4—x | I 19·0—x IV 27·8—x II 16·0—x III 11·8—x V a—43·3 | I 19·0—x IV 27·8—x II 16·0—x III 11·8—x V 48·4—49·2 | I 19·0—x IV 27·8—x II 16·0—x III 11·8—x V 49·3—x

a bb
I 19·0—x IV 26·6—27·2 II a—15·4 III 11·7—x V a—46·3 | I 19·0—x IV 26·6—27·2 II a—15·4 III 11·7—x V 46·4—47·2 | I 19·0—x IV 26·6—27·2 II a—15·4 III 11·7—x V 47·3—x | I 19·0—x IV 26·6—27·3 II 15·5—15·9 III 11·7—x V a—46·4 | I 19·0—x IV 26·6—27·3 II 15·5—15·9 III 11·7—x V 46·5—47·3 | I 19·0—x IV 26·6—27·3 II 15·5—15·9 III 11·7—x V 47·4—x | I 19·0—x IV 27·1—27·7 II 16·0—x III 11·8—x V a—46·9 | I 19·0—x IV 27·1—27·7 II 16·0—x III 11·8—x V 47·0—47·8 | I 19·0—x IV 27·1—27·7 II 16·0—x III 11·8—x V 47·9—x

cc
I 19·0—x IV a—26·5 II a—15·4 III 11·7—x V a—45·1 | I 19·0—x IV a—26·5 II a—15·4 III 11·7—x V 45·2—46·0 | I 19·0—x IV a—26·5 II a—15·4 III 11·7—x V 46·1—x | I 19·0—x IV a—26·5 II 15·5—15·9 III 11·7—x V a—45·4 | I 19·0—x IV a—26·5 II 15·5—15·9 III 11·7—x V 45·5—46·3 | I 19·0—x IV a—26·5 II 15·5—15·9 III 11·7—x V 46·4—x | I 19·0—x IV a—27·0 II 16·0—x III 11·8—x V a—46·2 | I 19·0—x IV a—27·0 II 16·0—x III 11·8—x V 46·3—47·1 | I 19·0—x IV a—27·0 II 16·0—x III 11·8—x V 47·2—x

b

aa
I 19·0—x IV 26·4—x II a—15·4 III 11·2—11·6 V a—44·9 | I 19·0—x IV 26·4—x II a—15·4 III 11·2—11·6 V 45·0—45·8 | I 19·0—x IV 26·4—x II a—15·4 III 11·2—11·6 V 45·9—x | I 19·0—x IV 26·5—x II 15·5—15·9 III 11·3—11·6 V a—45·6 | I 19·0—x IV 26·5—x II 15·5—15·9 III 11·3—11·6 V 45·7—46·5 | I 19·0—x IV 26·5—x II 15·5—15·9 III 11·3—11·6 V 46·6—x | I 19·0—x IV 26·6—x II 16·0—x III 11·3—11·7 V a—45·4 | I 19·0—x IV 26·6—x II 16·0—x III 11·3—11·7 V 45·5—46·3 | I 19·0—x IV 26·6—x II 16·0—x III 11·3—11·7 V 46·4—x

bb
I 19·0—x IV 25·6—26·3 II a—15·4 III 11·2—11·6 V a—44·6 | I 19·0—x IV 25·6—26·3 II a—15·4 III 11·2—11·6 V 44·7—45·5 | I 19·0—x IV 25·6—26·3 II a—15·4 III 11·2—11·6 V 45·6—x | I 19·0—x IV 25·9—26·4 II 15·5—15·9 III 11·3—11·6 V a—44·7 | I 19·0—x IV 25·9—26·4 II 15·5—15·9 III 11·3—11·6 V 44·8—45·6 | I 19·0—x IV 25·9—26·4 II 15·5—15·9 III 11·3—11·6 V 45·7—x | I 19·0—x IV 26·3—26·8 II 16·0—x III 11·3—11·7 V a—44·9 | I 19·0—x IV 26·3—26·8 II 16·0—x III 11·3—11·7 V 45·0—45·8 | I 19·0—x IV 26·3—26·8 II 16·0—x III 11·3—11·7 V 45·9—x

aa
I 19·0—x IV a—25·5 II a—15·4 III 11·2—11·6 V a—43·3 | I 19·0—x IV a—25·5 II a—15·4 III 11·2—11·6 V 44·0—44·8 | I 19·0—x IV a—25·5 II a—15·4 III 11·2—11·6 V 44·9—x | I 19·0—x IV a—25·7 II 15·5—15·9 III 11·3—11·6 V a—44·2 | I 19·0—x IV a—25·7 II 15·5—15·9 III 11·3—11·6 V 44·3—45·1 | I 19·0—x IV a—25·7 II 15·5—15·9 III 11·3—11·6 V 45·2—x | I 19·0—x IV a—25·7 II 16·0—x III 11·3—11·7 V a—44·1 | I 19·0—x IV a—25·7 II 16·0—x III 11·3—11·7 V 44·2—45·0 | I 19·0—x IV a—25·7 II 16·0—x III 11·3—11·7 V 45·1—x

bb
I 19·0—x IV 25·4—x II a—15·4 III a—11·1 V a—43·4 | I 19·0—x IV 25·4—x II a—15·4 III a—11·1 V 43·5—44·3 | I 19·0—x IV 25·4—x II a—15·4 III a—11·1 V 44·4—x | I 19·0—x IV 25·6—x II 15·5—15·9 III a—11·2 V a—43·8 | I 19·0—x IV 25·6—x II 15·5—15·9 III a—11·2 V 43·9—44·7 | I 19·0—x IV 25·6—x II 15·5—15·9 III a—11·2 V 44·8—x | I 19·0—x IV 25·8—x II 16·0—x III a—11·2 V a—44·0 | I 19·0—x IV 25·8—x II 16·0—x III a—11·2 V 44·1—44·9 | I 19·0—x IV 25·8—x II 16·0—x III a—11·2 V 45·0—x

cc
I 19·0—x IV 24·7—25·3 II a—15·4 III a—11·1 V a—42·7 | I 19·0—x IV 24·7—25·3 II a—15·4 III a—11·1 V 42·8—43·6 | I 19·0—x IV 24·7—25·3 II a—15·4 III a—11·1 V 43·7—x | I 19·0—x IV 24·8—25·5 II 15·5—15·9 III a—11·2 V a—43·1 | I 19·0—x IV 24·8—25·5 II 15·5—15·9 III a—11·2 V 43·2—44·0 | I 19·0—x IV 24·8—25·5 II 15·5—15·9 III a—11·2 V 44·1—x | I 19·0—x IV 25·0—25·7 II 16·0—x III a—11·2 V a—43·5 | I 19·0—x IV 25·0—25·7 II 16·0—x III a—11·2 V 43·6—44·4 | I 19·0—x IV 25·0—25·7 II 16·0—x III a—11·2 V 44·5—x

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I 19·0—x IV a—24·6 II a—15·4 III a—11·1 V a—42·0 | I 19·0—x IV a—24·6 II a—15·4 III a—11·1 V 42·1—42·9 | I 19·0—x IV a—24·6 II a—15·4 III a—11·1 V 43·—x | I 19·0—x IV a—24·7 II 15·5—15·9 III a—11·2 V a—42·1 | I 19·0—x IV a—24·7 II 15·5—15·9 III a—11·2 V 42·2—43·0 | I 19·0—x IV a—24·7 II 15·5—15·9 III a—11·2 V 43·1—x | I 19·0—x IV a—24·9 II 16·0—x III a—11·2 V a—42·2 | I 19·0—x IV a—24·9 II 16·0—x III a—11·2 V 42·3—43·1 | I 19·0—x IV a—24·9 II 16·0—x III a—11·2 V 43·2—x

Our first step will be to take all his measurements accurately. We find that the length of his head is 17·6 centimetres, the breadth 14·6 centimetres, middle finger 12·3 centimetres, foot 27·2 centimetres, and cubit 50·7 centimetres.

Assuming that the averages arrived at by continental experience are applicable to India, we find that short heads are classed from *a*—18·3. We know, therefore, that our card is in the top series of 81 drawers. Narrow heads are classed as *a*—15·2. We can thus eliminate vertical series, broad and medium, and reduce our search to the 27 drawers in the top left-hand corner. We can again reduce these to 9 by ignoring the two lower horizontal sub-divisions of 9 each, for large middle fingers are classed as 11·4—*x*, and our subject's is 12·3. The top row of this sub-division contains the large feet 26·5—*x*, and it is consequently here that we must seek for our measurement of 27·2 ; and, lastly, the third drawer in that row must contain the card we are looking for, as the measurement of our subject's cubit, 50·7, is to be found under the head of large (47·1—*x*).

We have thus, in considerably less time than it has taken to explain the process, found the drawer in which is the card of measurements we have been seeking. In these drawers, again, the remaining measurements are sub-divided according to the same classification, so that eventually we reduce the compass of our search to two or three cards in a press containing perhaps a hundred to a hundred and fifty thousand.

Where measurements coincide with the limits of classes.

It may be objected that instances will arise where measurements exactly coincide with one of the limits of the classes, and that when you measure a person again after a lapse of time, the measurements may be found somewhat different ; were this difference only to the extent of a millimetre, it would involve search among the medium sizes instead of among the large or small, as the case may be.

So far as the head and finger measurements are concerned, these are so accurate, as I shall show later on, that any difference in the indications taken at different times is more than improbable ; but should such a difference be found, it would be necessary—as, indeed, in all cases where measurement approaches near enough to the limits of a class to give rise to any subsequent error—that search should be made in each of the adjoining divisions, precisely as you search for a word in a dictionary when you are not quite certain of the spelling.

Accuracy of measurements.

Measurements are rapidly and easily taken, and the operation is within the intellectual capacity of any ordinary native clerk. With the instruments and the method employed, mistakes are almost impossible ; and so far as bone measurements are concerned, the person operated on is quite incapable of deceiving the operator.

Measurements of ear not applicable to India. Little finger and zygomatic arch substituted.

Before proceeding to describe the instruments and the manner of using them, it will be as well to state that there are two measurements taken in France, *viz.*, the length and breadth of the ear, which I do not think at all applicable to India. These I propose to replace by that of the little finger of the left hand and the zygomatic arch or width across the zygomatic processes. The ear, both in the male and female, is so mutilated in this country, and the shape is so altered by the insertion, in all parts, of ornaments of a weight proportionate to the degree of prosperity of the individual, that the measurements, not being constant, would be valueless. On the other hand, the little finger and zygomatic arch are bony and capable of having their proportions accurately determined.

The little finger bears no relation to the middle finger in anthropometry, it being quite possible to find in the same subject one abnormally long and the other unusually short. As regards the zygomatic arch, I have not as yet had opportunity to measure a sufficient number of persons to determine with certainty whether the range is large enough to afford valuable results. From a couple of dozen taken at random, I find that the variation is from 12·7 to 14·7 centimetres, or 20 millimetres; while the range of head breadths, which is admittedly valuable, is found in the same number to be 18 millimetres.

I have been to some extent induced to adopt the zygomatic indication from the fact of there being almost an entire absence of flesh over these processes, and measurements can accordingly be taken with an extraordinary degree of accuracy. I may also note the possibility of its affording interesting information from an ethnological point of view.

Classification of eyes omitted.

The classification of the eyes is also inapplicable to India. The seven categories based on the pigmentation of the iris do not exist among the dark races, and such assortments as there are would be difficult for an inexperienced man to record.

Finger tip impressions substituted for photography.

Finally, I propose to eliminate photography entirely from the system, and to adopt in its place the impressions of the ten finger tips, which, I shall show later on, have been proved by experience to be peculiar to each individual, constant through life, of infinite variety, and easily recognizable.

Instruments required.

The instruments used are a compass or craniometer (compas de péseur) for length and breadth of head, &c., and a sliding measure (compas glissier) for the fingers, foot, &c. These instruments, made in France at a cost of 13 francs apiece, are extremely accurate.

HEAD LENGTH.

Method of taking measurements.

M. Bertillon, in describing the method of taking this measurement, says :—"The subject being seated on a stool, one point of the compass is placed in the hollow above the bridge of the nose, while the other is used to find out the greatest length to the back of the head. By means of a small screw, the opening in the compass is fixed at that length, and, as a check, the operation of measuring is recommenced. The instrument is so accurate that should a mistake of only one millimetre too little have been made on the first measurement, the points will not pass; if, on the contrary, the compass has been opened one millimetre too much, the points will not touch the skin of the head. It will, therefore, be seen, extraordinary as it may appear, that, without the slightest difficulty, the length of the head can be measured to within *one millimetre*."

"It has been found by experience that the lengths of the heads of different individuals differ more than 3 centimetres (say, 30 millimetres). It is admitted that we have no power to lengthen our heads, and it is well known that the skull develops but very little after we have attained 20 years of age. With our stature it is not the same, for, as years pass by, we get bent, and our stature becomes less; besides, as to our height, it is possible to cheat to the extent of 3 centimetres, without its being discovered by the operator. The differences in height, moreover, between individuals do not commonly vary more than 30 centimetres (from 1·50—1·80). The result is, therefore, if we admit that we can only measure the height to within 3 centimetres that we can only establish the different classes of heights progressing by 3 centimetres ($10 \times 3 = 30$); whereas with the head, which we can measure to 1 millimetre, and which

varies 30 millimetres in different individuals, we are enabled to establish 30 classes. The length of the head, therefore, differing three times more than the height, it follows that it is three times more advantageous for anthropometrical purposes than the height. The same calculations might be made for all the other measurements, to which we shall refer hereafter."

"In this matter, as in all others, we must take care to distinguish between quantity and quality. Height varies considerably in actual figures, but it is difficult to measure accurately. The diameters of the head, length of middle finger, foot, &c., varying only a few centimetres in different individuals, can be accurately measured. The above was necessary to show how it is always possible for us to establish our divisions, small, medium, and large."

Proposed alteration in mode of measuring head length.

I have quoted M. Bertillon *in extenso*, because he shows very clearly here the value of bone measurements and their preference over others that are only used as later checks. I may here note that in the head lengths I have taken, I have adopted, in preference, the system of Professor Galton, in force at his Anthropometric Laboratory in the South Kensington Museum, and taken the greatest length of the cranium proper, that is, from the projection between the eyebrows, instead of the hollow above the bridge of the nose. It appears to me that it is just as possible to be accurate by this method as by that of M. Bertillon, and it has the additional advantage of securing data for craniology, anthropology, &c.

MAXIMUM HEAD BREADTH.

This measurement is taken from one parietal bone to the other, in the same manner as the head length.

ZYGOMATIC ARCH.

The extreme breadth between the zygomatic processes at the swelling in front of the ears.

LENGTH OF MIDDLE FINGER.

M. Bertillon considers this the best indication, as it can be measured to a millimetre. I do not think, however, in this respect that it is superior to head and face measurements. Great care must be observed when measuring both this and the little finger, that they are exactly at right angles to the hand, and that any undue length of nail is pared away. The left hand is selected as being more easily operated on. The length of the finger never alters from adult to old age.

MAXIMUM LENGTH OF LEFT FOOT.

The subject stands on a low platform, the left knee bent, and the right hand supporting the weight of the body by being rested on a table standing at a short distance. The foot must be bare. M. Bertillon finds that this indication can always be measured to within two millimetres.

HEIGHT SITTING AND STANDING AND MAXIMUM STRETCH OF THE ARMS.

The two last-named cannot be measured with the same accuracy as the other indications, as it is within the power of a subject to extend or cramp himself without the operator being able to detect him. In the case of height, moreover, the figure becomes more or less bent with age. The measurements, nevertheless, are very useful aids to classification.

Appliances for measuring height and stretch.

In Paris pieces of oil cloth, accurately ruled with white lines at one centimetre distance, can be purchased for about half a franc the metre. These are nailed to the wall at convenient heights from the ground, the lines being perfectly horizontal for height and vertical for stretch of the arms. For

the bust measurement it is always 70 centimetres above the stool on which the subject sits. A strip of wood, vertical to the ground, is affixed to the wall adjoining the oil cloth, and a bracket with two flat sides at right angles to each other, and one of which rests against the wall, slides easily up and down, guided by the strip of wood, until it rests on the subject's head. In this way a very accurate measurement is obtained.

No relation between measurements of various parts of the human body.

It has been ascertained, after taking a very large number of measurements in Paris and other parts of France, that there is practically no relation between the sizes of the various parts of the human frame. A short man may have a large head and large feet, while a tall man has small feet and a medium sized head. And the differences between individuals are so numerous, while the system of anthropometry is so accurate, that even in a very large number (say 100,000) of subjects, there are not more than half a dozen whose measurements are at all approximate.

Instance of identification in Paris.

I may here give an instance of this, and, at the same time, illustrate the ease with which a beginner, made acquainted with the details of classification for the first time, can find the card of measurements of any given individual who has once passed through the bureau.

In 1892 I was in Paris, and, on the first day of my attending the Prefecture of Police to see "Bertillonage" carried into practice, I was asked by the principal Inspector if I would like myself to search for the photograph of an individual giving the name of Benoit, and hailing from Alsace, but whose état civil could not be found in the alphabetical collection. Benoit was in the hands of the police on a charge of house-breaking by night. I had carefully watched the operations of search in other cases that morning, and was astonished at the rapidity with which they were carried out, so that I was only too glad to accept the Inspector's offer, and try my hand at it. Benoit's measurements, just taken, were given to me, and with them in my hand I proceeded to search as described on page 5, and in less than four minutes I had three cards in my hand, in two of which the measurements closely approximated, and in one were exact in all but the height and the span with the indications of Benoit. This last card I decided to be the one, and drawing it forth, there was the photograph of the man, bearing however the name of Bernard of the Quartier Latin, Paris. He had been measured before in 1887 when he was in custody also for house-breaking, and probably imagined that his identity would be untraceable after five years. That he was not an ardent supporter of the anthropometric system, his face betrayed.

I may mention that my search was made from among 150,000 photographs.

Objections to photographs.

I have already mentioned the fact that, in Paris, the final proof of the identity of a person sought for is in the photographs, full face and profile, that are pasted on the backs of the cards of measurements. These photographs are in no way relied upon except as an ultimate check, so fearful are the searchers of being misled by a fancied resemblance. The principal objection to photographs as a supplementary check, is the cost, not only original, but recurring. This of itself, in India, would probably prove an insurmountable obstacle to the introduction of any extended system of identification requiring its aid.

But there are other arguments against them. Photographs are unreliable and their results not constant. Even under similar conditions of light and locality, there is frequently a want of resemblance between the likeness of the same person taken at different periods.

Then again faces alter, whether by the ravages of age or disease, or by the growth or removal of hirsute appendages in men.

A photograph, therefore, as a means of recognition, cannot be rated at a high value. M. Bertillon admits this, and consequently photography is not had recourse to in the provinces, but as a substitute he introduces an increased number of measurements.

If then an efficient substitute for photography, without any of its drawbacks, can be found, its application in lieu of an augmentation of the number of measurements, is very much to be preferred. Such a substitute can be found in finger tip impressions, and I trust I shall be able to show that while the cost of taking them is practically nothing, and of multiplication when necessary, very little, the patterns are constant, ineradicable and easily recognized, and the variations sufficiently numerous to admit of a large number of combinations in the 10 digits.

Finger tip impressions an efficient substitute for photography.

Before proceeding further, it is necessary to state that all my information on this subject is derived from Francis Galton, Esq., F. R. S., who has made it a deep study. He has placed me under an obligation for much information acquired during personal interviews. In his books, marginally noted, will be found detailed arguments establishing the truth of the various attributes I have claimed for finger prints, and to which, in the compass of this pamphlet, I have only space to refer.

"Personal Identification. Journal Royal Inst., 25th May 1888.

"Patterns in Thumb and Finger Marks." Phil. Trans. Royal Society, Vol. clxxxii (1891.)

Method of Indexing Finger Marks. Proc. Royal Society, Vol. xlix, 1891.

"Identification by Finger Tips." XIXth Century, August 1891.

"Finger Prints." Macmillan & Co., 1892.

For the constancy and permanency of the patterns on the tips of the fingers, Professor Galton is able to vouch from a comparison between a number of prints taken by him, and those of the same persons taken by Sir William Herschel, Bart., late Bengal C.S., thirty years before. He found by the scientific resolving of the patterns into elements, that absolutely no changes had occurred during this lengthened period, save, as he describes it, such as would be found in lace, which after being washed and stretched, will show the same pattern and number of meshes, although they may be somewhat distorted in shape.

Constancy and permanency of patterns.

Sir William Herschel, when Collector of Hoogli in the fifties, had occasion to give a contract to a native. As a means of guarding against a possible subsequent repudiation, he made the contractor mark the impressions of some of his finger tips on the document. Looking at these afterwards, he was much impressed with the valuable evidence of identity thus obtained, as compared with an ordinary signature. He introduced into his revenue charge a system of finger prints in addition to signatures, and found that it met with no opposition from the people themselves, but produced most admirable results. He brought the matter to the notice of the then Inspector-General of Jails, and suggested the adoption of the system in the prisons, but the reference went no further. Sir William Herschel, however, continued his method for nearly 20 years, applying it in various practical ways, and found that attempts to repudiate signatures were abandoned as hopeless, while false impersonations by pensioners and others was quite discontinued. An account of his work is to be found in "Nature," XXIII, p. 23 (Nov. 25, 1880).

Practical use of impressions by Sir W. Herschel.

Every individual in this world has patterns on his finger tips absolutely different from those of the rest of mankind ; these patterns are present from birth to extreme old age and death. Their individuality has been tested by Mr. Galton in his laboratory at the South Kensington Museum, where over 4,000 impressions have been taken. In each of these an average of 25 or 30 points of dissimilarity are found to each of the others, and it is these points of dissimilarity that form the bases of differentiation for the purposes of establishing identity.

Individuality of impressions.

The surface of the hands are covered with a system of minute ridges studded with papillæ through which the sweat exudes. On the fingers, these papillary ridges run more or less parallel with the creases at the bends of the joints until they reach the top phalange ; here the nail forms an obstacle to the continuation of the parallels, and the ridges gradually form themselves into a series of arches.

Papillary ridges.

This is the most elementary or primary formation. More frequently, however, one of the ridges abruptly breaks away into a most pronounced arch, and then succeeding ones follow it in more or less parallel lines until the top of the finger is reached. When this occurs there is an interspace left between the upper and the lower systems of ridges, in which is found the pattern of the finger. (See Illustration II, Fig. I.)

Formation of finger pattern.

These patterns Mr. Galton has divided into Arches, Loops and Whorls, their distinctive appearance is patent to the most ordinary observer, and it is to them we should turn in the first instance for evidence of identity. (See Illustration III.)

Patterns divided into Arches, Loops and Whorls.

It will be seen at a glance that taking these three classes of A., L., W., alone, the permutations and combinations possible with 10 digits is very large. But a little examination will take us further. In order to create an interspace, two ridges must have diverged, and such divergence may have occurred on one or both sides of the interspace and give us thus nine variations, exclusive of arches. (See Illustration II, Fig. III.)

Each pattern has a core. It is not necessary here to describe these cores of patterns in detail, it will suffice to say that they occur in very extensive variety and afford a ready means of distinguishing one finger print from another at sight, even though the two may come under the same generic class of loops or whorls.

Arches are where the ridges run from one side to the other. Loops, where the diverging ridge makes a single curve backward to the side whence it commenced. Whorls, where a ridge has described at least one complete circle. (Illustration III.)

Description of A., L., W.

After a finger print has been taken the pattern is emphasized and rendered striking to the casual glance, by tracing over in ink the divergent ridges and the outline of the pattern of the interspace.

Accentuation of patterns in prints.

When ridges diverge, whether on the inner or the outer side of the finger, there is at the point of divergence a small triangular space, which is utilized by Mr. Galton as a point of departure for dividing up the pattern so as to permit of the ridges being methodically counted and any special feature accurately allocated. When there is a divergence on both sides, as in the case of whorls, the two triangular spaces

Division of patterns for examination.

(A & B. Illustration III) are joined, the line bisected and a perpendicular dropped meeting the outer boundaries of the interspace at C and D.

In the case of a loop, when the divergence is from one side only, a line is drawn along and in the direction of the core meeting the boundaries of the interspace at C and D, and a perpendicular is let fall on this from the triangle at the point of divergence and continued to the opposite boundary. (A, B.)

Minutiæ of the ridges.

I have shown that, at a glance, a finger print can be recognized as an arch, a loop, or a whorl, and by a little closer examination the different varieties of each class can, as a rule, be easily distinguished. But it is to the *minutiæ* of the ridges that we must look for absolutely conclusive proof in matters of identification, and these minutiæ occur all over the bulb of the finger, outside as well as inside the interspace. They consist of bifurcations, interpolated ridges, islands and craters. (Illustration II, Fig. II.)

Their great number and extent.

These are to be found existing all over the field of each finger tip, and afford an unparallelled means of identification that is impossible to be got rid of in any way short of amputation, for they are numerous and disseminated, so that an injury caused by a cut, a burn or an abscess, only obliterates a certain proportion, still leaving sufficient for identification.

Recognizable with the naked eye.

These *minutiæ* can be detected with the naked eye on an ordinary print, but with a glass of even small magnifying power they can be traced with the greatest facility, while with the patterns divided up, as already described, the points of identification can be allocated for comparison with mathematical accuracy.

Apparatus for taking finger prints.

The apparatus for taking impressions is simple and cheap. It consists of a slab, a small roller and some printer's ink. The slab I use is 10 in. × 5 in. × $\frac{1}{4}$ in. made of ordinary wood with a strip of sheet zinc nailed over it. The roller consists of a hollow brass cylinder 5 inches long by $\frac{3}{4}$ inch in diameter, and over it is stretched India rubber tubing. In India I imagine some substitute for India rubber, in the form of a composition that is not affected by the climate, is used by printers. The cylinder revolves on an axis attached by a frame to a wooden handle.

Mode of taking the print.

A drop or two of ink is placed on the slab and spread into a thin even layer by the roller. Each finger of the person operated on is then taken, and after having first been rolled from one side to the other on the inked slab, the operation is repeated in a similar manner on the paper or card to which the impression is to be transferred. By this means a larger field is obtained, and consequently more points of identification secured than by merely dabbing the finger on the paper. The inked finger tip should only be rolled once from one side to the other, and then removed cleanly without smudging the pattern.

For criminal identification all ten digits should be taken.

In any system for the identification of criminals it will be advantageous to take prints of the whole ten digits. There can be no doubt that if they lent themselves to classification on a large scale, finger prints would suffice for the purpose without any assistance from anthropometry.

Nothing repugnant to natives in finger prints.

There is nothing repugnant to the native mind or religion in the process, in fact such impressions are taken for chiromantic purposes when horoscopes are being cast. In my own operations even among the higher orders, such as

Brahmins, &c., I have never had any hesitation shown; on the contrary great interest is invariably displayed.

Facility of multiplying impressions.

If it be necessary to multiply the impressions of any particular print for transmission by post, a photographic enlargement on a ½ plate can be taken, and the required number of copies printed off by the Ferro-prussiate process on the blue paper, which is now so largely used in Engineers' and Architects' offices. This is a cheap and rapid* process requiring no chemicals. (Illus. III.)

Forgery impossible.

It is as impossible to forge a finger print as a photograph; while the former has this advantage over the latter, that it possesses salient and tangible points for identification.

Anthropometric Department only an office for information.

I have endeavoured to show that by a certain number of anthropometrical indications, supplemented by impressions of the finger tips, an absolutely reliable system of identification can be introduced, whereby criminals, having once passed through the hands of the police, can, to use a vulgar but expressive term, be "spotted" again without fail. It must not be supposed that it is a question of convicting a man, because it happens that the size of his head or the patterns of his finger tips are the same as those of another. In the words of M. Bertillon, "We are simply an office for information, we furnish a name, that is to say, a thread to the investigation. It is for the police, thanks to the information we enable them to put their hands on, to verify the correctness of it by obtaining the evidence of the persons who have had dealings with the accused, his relations, former landlords, or the former victims of his anterior misdoings, or the warders of the prisons who have had him under their charge, etc. It will be readily admitted, however, that if our anthropometrical work is confirmed *à posteriori* by such evidence, the result is an absolute certainty for justice."

No adequate means at present in India of recording and disseminating descriptions of criminals.

In our Indian Criminal Investigation Department there is no adequate means for recording and disseminating the descriptions of persons "wanted" by the police. At the present moment there are outlaws and dacoits at large in Kathiavad, who owe their immunity to capture, in a great measure, to the fact that there is no means of identifying them in the various States in which they temporarily seek rest, other than the State against which they have gone into outlawry. Were the anthropometric system in force, the descriptions of these men might be in the hands of the police of each State and taluka of Kathiavad, and the unerring test applied to any person upon whom suspicion rested, but against whom no evidence was locally obtainable.

Feasibility of transmitting anthropometrical descriptions by telegram.

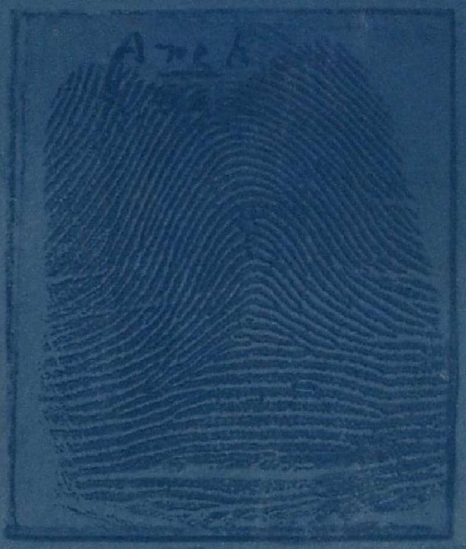
In extreme cases anthropometric descriptions, including finger tip impressions, could be sent by telegram. It would merely be necessary to wire the figures in the order in which the measurements are always taken, and the patterns (according to A., L., W.) on the fingers of right and left hands.

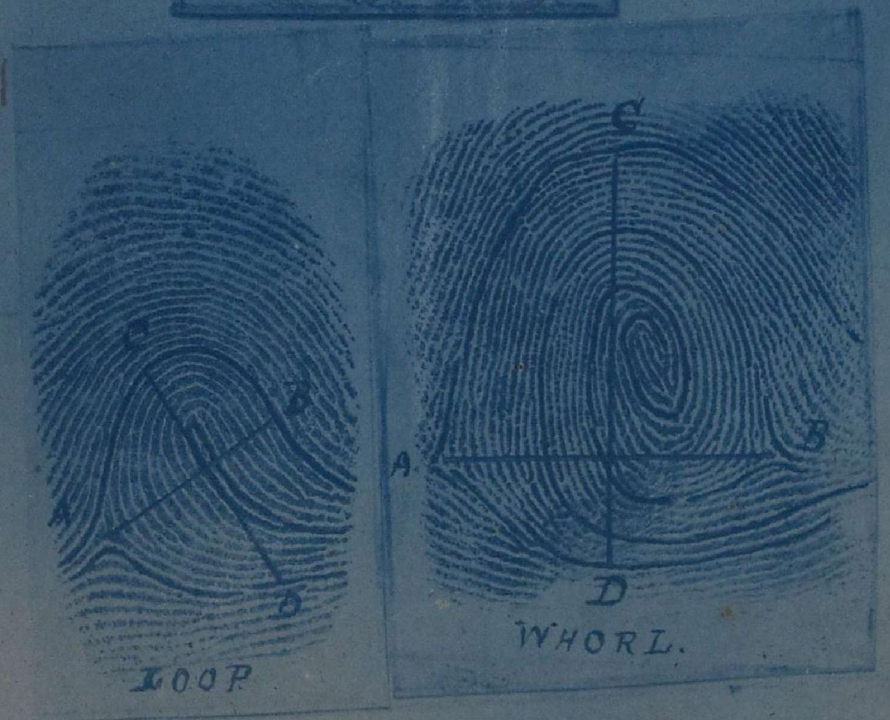
Record of scars and other indelible marks.

It will not be out of place here to remark that every individual measured has also recorded on his card any scars, moles, or natural marks that he may have upon his person. These, as M. Bertillon points out, must be described with accuracy. "Toutes les cicatrices, marques particulieres, ou

* I regret I am unable to show a finger print of the natural size, but in this country it is difficult to get an accurate and clear engraving.

ILLUSTRATION III.





simples coupures que presente l'individu examiné, avec l'indication rigoureusé de leurs dimensions et situation, etc., sont relevées." That is to say, that the ordinary method of description—scar on forehead, mole on left cheek, cicatrix on left thumb, etc., will not suffice. The exact position of these marks by measurement and with detail must be denoted, *e. g.*, scar 15 mm. in length on upper eyelid of right eye, commencing at outer corner and sloping obliquely upward and inward. Two small black moles situated in a vertical line 12 mm. apart, 22 mm. left, of the spinal column and 20c. below prominent vertebra.

These marks afford a last check after an individual's measurements have been found. Three or four, provided they have been accurately described, would suffice to identify a man out of a million. It is very seldom that one finds on an individual precisely the same mark that one has already previously noticed on another, but that second persons should be found who bear three or four scars exactly similar, would be a coincidence which appears almost impossible.

A criminal therefore attempting to escape justice by false impersonation, is first of all traced by his measurements, and then has his identity infallibly established by his finger prints, scars, etc.

Infinite extension of classification.

It may possibly be objected that with the large population we have to deal with in India, the measurements taken will not suffice for classification, and that the number of cards will increase so enormously that the difficulties of search will be greatly multiplied. Paris has a collection of 150,000. In 1882 when the system was started, the number measured was 225 ; it is now 35,000 a year, or say 100 per diem. At this rate it would seem that the collection must soon become too numerous to classify. The remedy is not far to seek, instead of commencing the classification by length of head, nothing would be more simple than to begin from the date of birth to about ten years, without varying the plan in any other way. In one collection would be placed the people born from the beginning of the century to 1829, in the next from 1830 to 1839, then 1840 to 1849, 1850 to 1859, and so on. This arrangement would give an endless classification. Thirty years hence three new generations of 10 years each would have succeeded to the category of 1860 to 1889, and the earliest, 1800 to 1829, would have been put away amongst the archives. M. Bertillon points out that a slight inconvenience might arise in the necessity for a double search when there was reason to suspect that a false age had been given, and perhaps this would be enhanced in a country where among the uneducated classes, such as mostly recruit the criminal population, ages can only be stated approximately ; but the inconvenience is after all slight and considerably overbalanced by the advantages of the plan.

Small cost of working the system.

The most important consideration, and that to which regard must be had before it can be hoped to introduce any system of scientific identification into our criminal administration, is the cost.

I have shown that the initial expenditure on apparatus and instruments, both for taking the anthropometric indications and the finger prints, is very small indeed, one entire set costing fifteen or sixteen rupees. For the rest there are the cards.*

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* I annex a pattern of the card that I have designed. I have only been able to use it on such occasions as the local authorities have been good enough to send me up criminals. In all other cases I use a different form, omitting particular marks and scars, and allusion to crime.

Personnel for working the system.

M. Bertillon divides his department of Identification into two sections ; 1st, that of anthropometry, 2nd, that of photography, and the personnel of each consists of eight persons. As in the present system photography is eliminated and the finger prints can be taken by the measurers, the entire establishment is reduced by one-half.

For the purposes of rapid work, it is indispensable that the official who measures should be assisted by one to whom he can dictate the indications, without having to quit his instruments. Working in this manner the complete measurements of an individual were found to take 2 minutes ; examining and allocating cicatrices and particular marks, 3 minutes ; recording of name, date of birth and other particulars, 2 minutes ; and to this I may add taking of the finger tip impressions, 1 minute ; total 8 minutes ; or, say, eight persons examined per hour. Thus from 7 to 10 a. m., two persons could take the indications of 24 individuals. In Paris the number operated on is, roughly speaking, 100 per diem, four pairs of persons, therefore, carry on the measurements simultaneously in the same room. Accuracy in taking these indications becomes in a short time mechanical, so that the persons employed would not necessarily require to be of high education, and consequently would not receive large salaries.

Question of opposition to being measured.

It may possibly be argued that persons arrested by the Police in cognizable cases may oppose any attempt to take their anthropometric indications before they are tried and convicted, and that it would be illegal to force their compliance. In answer to this, I would say that, in the first place, such opposition is exceedingly improbable, there is nothing in the operation, *per se*, repugnant to any man's feelings, and the native of this country is unlikely to raise obstruction where it has been found that his brother criminal of Europe does not. M. Bertillon records that, since the anthropometrical descriptions have been made compulsory in France, criminals submit themselves willingly, and not one has yet, after a few hours' reflection, persisted in a refusal to allow himself to be measured. He accounts for this, to some extent, by the fact that the most dangerous as well as the most quiet habitual criminals, are always convinced that it is the last time that they will be caught, and they are therefore full of contempt for the system. When, therefore, they are again arrested after an interval, short or long, as the case may be, and they give a false name, their only anxiety is to call as little attention to themselves as possible, and, above all, as to their identity.

If then opposition is almost non-existent among habitual criminals, it is scarcely likely to be experienced in an individual transgressing for the first time.

Procedure in case of opposition.

But be this as it may, should measurements not be made legally compulsory, then the trial of the refractory one would have to be proceeded with. In the case of acquittal, a knowledge of the description loses much of its interest. In the more probable event of a conviction, the fact of his being legally convicted obliges him to submit absolutely to all prison regulations, and his anthropometric description can therefore be taken at once. Should search lead to any discovery of a different identity, or of former convictions, although the superior Courts could not be moved to enhance the punishment, yet the knowledge would be of value to the prison authorities and to the police, after his release.

Necessity for a system.

In the interests of justice and the civil rights of the people, some system, such as is in force in France, will have to be introduced sooner or later into the various countries forming the Great British Empire,—a system which

will fix the human personality, and give to each criminal a certain individuality, lasting, unchangeable, always recognizable, easily proved. Indications are not wanting that in the United Kingdom there is an awakening to this necessity, a recognition of the want, for when I was in Paris in October 1892, a requisition from the British Home Office for a dozen sets of measuring instruments had been received.

Objections formerly raised by the Home Office.

The question has from time to time been raised in the House of Commons, notably in 1888 and 1889. The objections then raised were—

1st. That the system was costly, while the present arrangement of taking photographs was found sufficient.

2nd. That with the present system in force the number of prisoners not recognized was so small, being estimated at 2½ per cent. as to show no necessity for change.

Home Secretary in reply to Mr. Salt, Feb. 29, 1888.

3rd. It was doubtful whether better results would be obtained under the French system.

Answers thereto.

As regards cost it is only necessary to point out that it is photography which costs money, and if the system I advocate were adopted, there would be an actual saving, that is presuming the comparison to be with a method under which all persons passing through the hands of the police are photographed. As a matter of fact I believe that no such arrangement is in force, and only known habitual criminals have their photographs taken. What is required is a system by which it can be discovered whether a man is a habitual criminal or not. Anthropometric indications can, however, be used at any time for identifying the same individual should he be fleeing from justice.

It is difficult to understand how a proportion of prisoners *unrecognized* is arrived at. Statistics may and do show the number of recognitions in our jails of individuals feigning another personality, but when it comes to the number of prisoners who have successfully concealed their identity, and passed through the hands of justice without being recognized, it would be as easy to tabulate the number of undiscovered crimes. The only possible proof of the merits of the anthropometrical system is a comparison of the results obtained under it with those before its introduction.

Statistical results in Paris.

From the figures furnished by M. Bertillon in his report for 1889, we have the results obtained during 8 years from the establishment of his system.

Years.	No. of subjects examined.	No. of habitual criminals recognized under false name.
1882	225	.....
1883	7,336	49
1884	10,398	241
1885	14,965	424
1886	15,703	352
1887	19,150	472
1888	31,849	615

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And the numbers have continued to increase yearly. It may now be said without exaggeration

that over 70 recognitions are effected each month in Paris alone by the Department of Identification.*

Undoubtedly there used to be a certain number of recognitions in the prisons, but these would naturally be dependent, to some extent, on the length of interval between the incarcerations of the individual, and on his undergoing his sentence in the same prison as before. Such recognitions are always after conviction and so lose much of their value. Moreover when a convict has put in his term, he is free to commence operations again in another part of the country where he is not known, and thus secure all the benefit accruing to a first offender.

During the years 1884-85, the number of post conviction recognitions in the jails of Paris rose to between 200 and 300 per annum, but in 1888 they dwindled down to 14, of which 10 were individuals who had never been measured at the Anthropometrical Department. The net result shows therefore that out of 31,000 examined, there were only four cases in which identification was evaded.

The system of interest to reformatory science.

Finally, it is claimed for the system that it is of interest from the point of view of reformatory science. The officials of prisons are something more than turnkeys responsible only for the custody of their prisoners. It is of great importance that the antecedents of a convict should be known, if only to allow of discrimination in the treatment of habitual criminals and those who have fallen for the first time. But it should not be left to the prison authorities to discover the information after conviction and by the chance recognition of an official.

The Department should be one of Police administration.

The duty, properly speaking, belongs to the police : by them it can be worked economically and satisfactorily ; their hands will be strengthened for exercising the powers conferred on them by section 55 of the Criminal Procedure Code, and the chances of an habitual offender escaping the penalty prescribed under section 348 of the Criminal Procedure Code, will be considerably diminished.

There is nothing costly, difficult or apparently objectionable in the working of the system, and if it once be admitted that there is a substantial advantage to be gained by acquiring the power of distinguishing and identifying habitual criminals, its introduction will be, I venture to believe, only a question of time.

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* In 1888 it was 40 per month, and M. Bertillon says, "On peut dire que les 40 reconnaissances faites chaque mois par le service d'Identification n'auraient pu être faites par un autre procédé et correspondent au nombre din'dividus qui, avant l'etablissement du systeme, reussissaient à passer devant les tribunaux sous leur faux état civil (défalcation faite des rectifications qui de tout temps ont été suscitées par les magistrats instructeurs, mais les enquêtes de ce genre ne pouvaient se faire antérieurement sans dépenses pécuniaires, et sans allonger considérablement le temps de l'instruction)."