

# ON CRIMINAL ANTHROPOMETRY AND THE IDENTIFICATION OF CRIMINALS.

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## PART I.

## MATERIAL AND METHODS.

(1) The object of this memoir is threefold :

(i) To test to what extent the criminal classes diverge in physical characters from other classes of the community.

(ii) To consider how far the shorter methods recently proposed by Professor Karl Pearson for finding the variability and correlation of characters in the case of normal frequency may be applied to some of the chief anthropometric measurements now customarily made, and

(iii) To determine what is the best manner in which these measurements can be applied to the identification of criminals.

I shall first consider the material I have had at my disposal ; I shall then indicate the methods I have used for the determination of its metrical constants, and finally apply my results to the consideration of the above three problems. In the course of my work I shall have to consider the important point of the homogeneity and normality of my material, and apply three separate tests :

(i) If broken up into groups, the statistical constants of a sub-group ought to remain, within the limits of random sampling, the same as the bulk of the observations.

(ii) Frequency distributions, if plotted and fitted with frequency curves, ought to give nearly normal distributions.

(iii) The regression lines in type cases ought to be closely represented by straight lines.

(2) *Nature of material used.* The data on which the memoir is based were obtained, through the kindness of Dr Garson, from the Central Metric Office, New Scotland Yard, where the register of habitual criminals is kept, and their identification effected. In an interesting paper published in the *Journal of the Anthropological Institute*, Vol. xxx. 1900, July—Dec., Dr Garson has explained in detail the metric system of identification in force in England, and the sort of prisoners whose metric description is registered at the Central Office, and whom we may call briefly "habitual" criminals.

But in addition to the official forms on which the descriptions of habitual criminals are recorded, the Central Office possesses a number of "practice" forms which record the metric description of a less pronounced type of criminal than the "habituals"—prisoners whose crimes and sentences are comparatively slight, and who may be called "non-habitual." These practice forms are filled up by warders

on probation, and as their advancement in the Service depends on the accuracy with which they measure and describe the prisoners, they may be expected to do so with the utmost care. Indeed, I understand from Dr Garson that these "practice" forms may be accepted with as much confidence as the official forms for habitual criminals.

It is with these non-habitual criminals that we are concerned. Obviously, the larger the number of individuals we include, the better will be the results; on the other hand, the number must not be extremely large, otherwise the investigation becomes too laborious. Accordingly a group of 3000 was decided on as likely to give good results, while still keeping the work within manageable compass. Three thousand metric forms were thereupon obtained from Scotland Yard, containing particulars of 3000 male prisoners undergoing their sentences in the chief prisons of England and Wales. The majority of the prisoners were English and Welsh, many were Irish, and only a few Scotch; no foreigners or youths under 21 were included. The forms were drawn at random from the mass on the office shelves; we are therefore dealing with a random sampling.

The metric description recorded on the forms includes (*inter alia*) certain physical measurements, viz., those of the Head Length, Head Breadth, Face Breadth, Left Middle Finger, Left Cubit, Left Foot, and Height, of each individual. These measurements are taken, in the case of height, to the nearest  $\frac{1}{8}$  of an inch, in the case of the other characters, to the nearest millimetre; thus, Head Length of 19·2 centimetres includes all head lengths from 19·15 cm. to 19·25 cm.; Height of 5 ft. 5 $\frac{1}{8}$  in. includes all heights from 5 ft. 5 $\frac{1}{8}$  in. to 5 ft. 5 $\frac{3}{8}$  in. These characters form the subject of the present memoir, and will be studied from the anthropometrical point of view in the earlier part of the paper; the problem of identification, with which Scotland Yard is concerned, will be discussed in the latter part.

(3) *Methods employed.* In dealing with this large mass of observations, I propose to apply the methods explained in Professor Karl Pearson's memoirs in the *Philosophical Transactions*, Vol. 195, A., pp. 1—47, 79—150, in order to calculate the Means, Standard Deviations, and Coefficients of Correlation, with their probable errors, for the above seven characters. These methods were devised by Professor Pearson to deal with characters not quantitatively measureable, but they are used here with the object of saving much of the labour involved in making these calculations in the ordinary way from the usual elaborate correlation tables. It will be seen later on that the saving of time and labour is very considerable.

To obtain the coefficients of correlation Professor Pearson shows (*loc. cit.* p. 2) that a 4-fold table is required; to find standard deviations and means, and probable errors and error correlations of all the quantities involved, a 9-fold table is required (*loc. cit.* pp. 82, 84). If a 16-fold table is formed, it will give the required 4-fold and 9-fold tables, as is shown in the following example, which is a frequency correlation table for the Head Length and Face Breadth of the 3000 criminals.

in Mr G. Udny Yule's paper "On the Theory of Correlation" in the *Journal of the Royal Statistical Society*, Vol. LX., Part IV., December 1897. We have modified Mr Yule's formula for the square of the standard deviation by diminishing it by the quantity  $\frac{1}{12}$ , in accordance with Mr W. F. Sheppard's paper in the *Proceedings of the London Mathematical Society*, Vol. XXIX., Nos. 634/5.

The results are as follows :

TABLE 1.  
3000 *Criminals*.

	Standard Deviation	Mean
Head Length (cm.) ...	$\cdot6046 \pm \cdot0053$	$19\cdot1663 \pm \cdot0075$
Head Breadth (cm.)...	$\cdot5014 \pm \cdot0044$	$15\cdot0442 \pm \cdot0062$
L. M. Finger (cm.) ...	$\cdot5479 \pm \cdot0048$	$11\cdot5474 \pm \cdot0068$
Height (ins.) ...	$2\cdot5410 \pm \cdot0221$	$65\cdot5355 \pm \cdot0313$

TABLE 2.  
3000 *Criminals*.

	Coefficient of Correlation
Head Length and Head Breadth	$\cdot4016 \pm \cdot0103$
Head Breadth and Height ...	$\cdot1831 \pm \cdot0119$
L. M. Finger and Height ...	$\cdot6608 \pm \cdot0069$

(5) *Tests of Normality.* At the foot of Tables II. and III. (see pp. 215, 216) are shown the mean Finger Length and mean Head Breadth of each column array; these means are plotted on Figs. 1 and 2, and the lines are drawn which show the theoretical regression of Finger on Height, and Head Breadth on Height. The slope of these lines is calculated from the formula  $\tan \theta = \frac{r\sigma_2}{\sigma_1}$ , where  $r$  is the coefficient of correlation, and  $\sigma_1, \sigma_2$ , the standard deviations of the correlated organs. (See Yule, *loc. cit.*) The means of the column arrays at the extremities of the tables are not included, as they are based on such small frequencies.

It will be observed that the regression lines fit the observations very well, i.e., the regression is very closely linear.

*On Criminal Anthropometry*

FIG. 1. Line of Regression: Left Middle Finger on Height. 3000 Criminals.  
 Mean Height 65.5. Mean Finger 115.5.  $\tan \theta = 1.425$ .

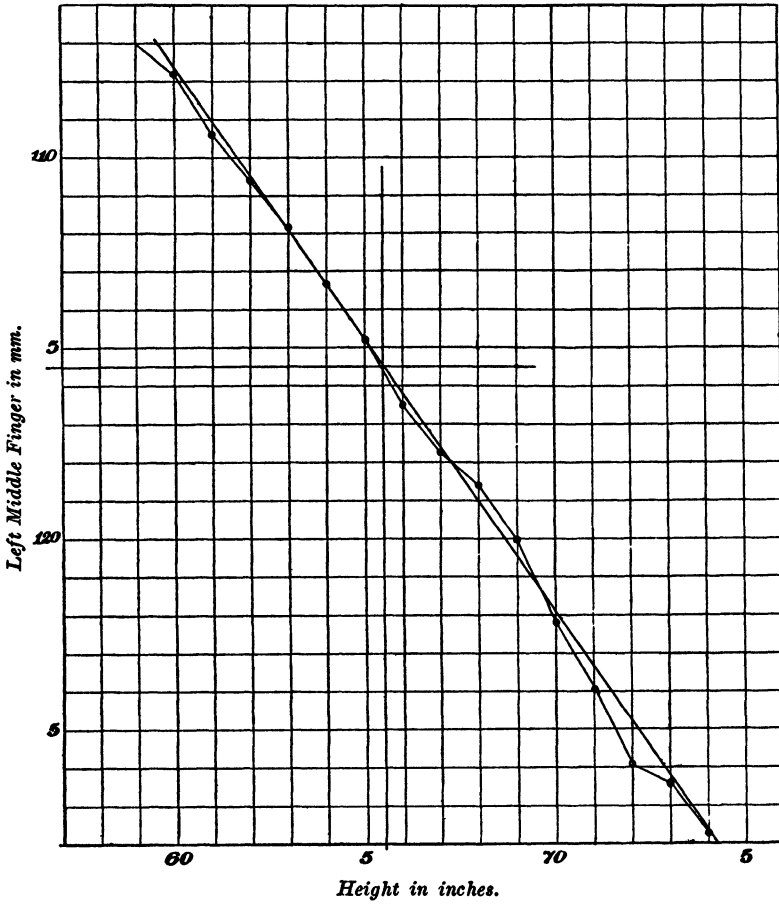


FIG. 2. Line of Regression: Head Breadth on Height. 3000 Criminals.  
 Mean Height 65.5. Mean Breadth 150.4.  $\tan \theta = .3612$ .

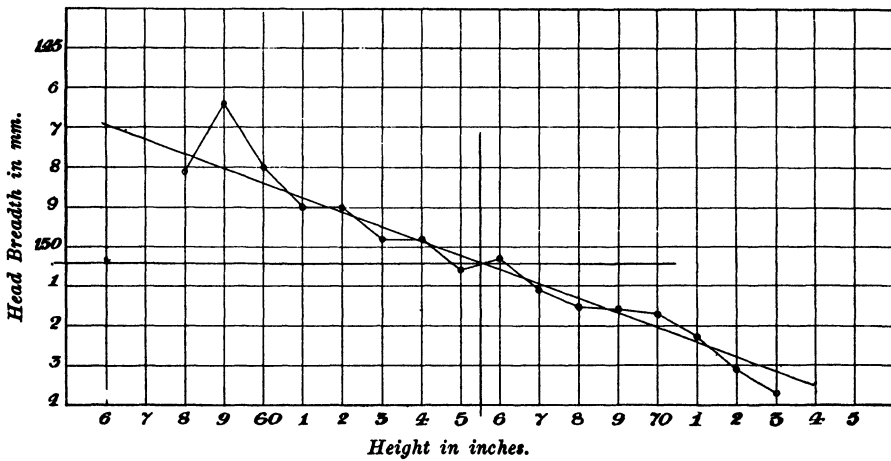


TABLE III. 3000 *Criminals*. Height (feet and inches).

	Left Middle Finger (millimetres).																			Totals			
	4' 7" 1 <sup>8</sup> / <sub>16</sub>	8" 1 <sup>8</sup> / <sub>16</sub>	9" 1 <sup>8</sup> / <sub>16</sub>	10" 1 <sup>8</sup> / <sub>16</sub>	11" 1 <sup>8</sup> / <sub>16</sub>	0" 1 <sup>8</sup> / <sub>16</sub>	1" 1 <sup>8</sup> / <sub>16</sub>	2" 1 <sup>8</sup> / <sub>16</sub>	3" 1 <sup>8</sup> / <sub>16</sub>	4" 1 <sup>8</sup> / <sub>16</sub>	5" 1 <sup>8</sup> / <sub>16</sub>	6" 1 <sup>8</sup> / <sub>16</sub>	7" 1 <sup>8</sup> / <sub>16</sub>	8" 1 <sup>8</sup> / <sub>16</sub>	9" 1 <sup>8</sup> / <sub>16</sub>	10" 1 <sup>8</sup> / <sub>16</sub>	11" 1 <sup>8</sup> / <sub>16</sub>	12" 1 <sup>8</sup> / <sub>16</sub>	13" 1 <sup>8</sup> / <sub>16</sub>				
9.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
10.0	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
3	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
4	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
7	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
11.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
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12.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
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6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
13.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
Totals	1	1	6	23	48	90	175	317	393	462	458	413	264	177	97	46	17	7	4	0	0	1	3000
Means	100	103	102.8	107.0	107.8	109.4	110.6	111.8	113.3	114.8	116.5	117.7	118.6	120.1	122.2	123.9	125.9	126.4	127.7	—	—	112	