

From the SOCIETY.—Bulletin de la Société d'Anthropologie de Paris. Vol. IX. No. 4. Vol. X. No. 1.
 From the EDITOR.—Revue Scientifique, Nos. 42 and 43, 1875.
 From the EDITOR.—Nature (to date).

The following paper was read by the author :

On the HEIGHT and WEIGHT of BOYS aged 14, in TOWN and COUNTRY PUBLIC SCHOOLS. By FRANCIS GALTON, F.R.S.

My principal results may be briefly stated. They show the comparative heights and weights of those boys who were 14 on their last birthday, in two groups of public schools. The one group is composed of schools situated in the country, and comprises Marlborough, Clifton, and Haileybury, together with the boys of the ages of 13 and 14 at Wellington, and those of the fourth form at Eton. The other group consists of schools situated in large towns, and comprises the City of London School, Christ's Hospital, King Edward's School at Birmingham, and Liverpool College. It appears that the boys of the above-mentioned ages in the country group are about $1\frac{1}{2}$ inch taller than those in the town group, and 7 lbs. heavier; also that this difference of height is due, in about equal degrees, to retardation and to total suppression of growth; and, lastly, that the distribution of heights in both cases conforms well to the results of the "Law of Error."

There remains, however, more to say which cannot be dealt with so concisely. I have to show that these results, scanty as they are, may be depended on, and to point out the reason which compelled me, and will, I fear, compel others who may work on these school statistics, to limit their inquiry to the age of 14. I also desire to illustrate by this memoir a method I have lately proposed ("Philosoph. Magazine," Jan. 1875) for dealing with statistics of the present kind, and which appears to me far more satisfactory, and which is much more natural, so to speak, than those hitherto in use.

My data are given in Table I., and are of the form: so many boys between 51 and 52 inches, so many between 52 and 53, so many between 53 and 54, and so on, giving a total of so many. I reduce all these figures to per centages, to the nearest integer, in order that we may in each case be supposed to be dealing with exactly 100 boys. For further explanation, let us refer to the line B in the data of heights of town public school boys, where we shall see what would take place supposing we had arranged 100 of them, in the strict order of their heights, at equal distances apart, along the side of a wall 100

TABLE I.—NUMBER OF BOYS AGED FOURTEEN ON THEIR LAST BIRTHDAY, IN THE COUNTRY AND TOWN PUBLIC SCHOOLS, WHOSE HEIGHTS AND WEIGHTS LIE BETWEEN THE LIMITS MENTIONED BELOW.

HEIGHTS IN INCHES.		49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	72 and above	TOTAL
IN COUNTRY SCHOOLS.	A. As observed .....	...	1	2	1	1	9	10	6	21	24	40	34	35	29	23	19	19	11	5	5	1	0	1	...	296
	B. As reduced to per cents. ....	...	0	1	0	3	3	2	7	8	14	11	12	10	8	7	6	4	2	2	0	0	0	...	100	
	C. Sums of figures in B, from beginning. }	...	0	1	...	4	7	9	16	24	38	49	61	71	79	86	92	96	98	100	...	...	...	...	...	...
IN TOWN SCHOOLS.	A. As observed	1	0	2	6	13	14	37	39	45	54	57	60	52	48	29	17	15	4	5	5	...	...	...	...	509
	B. As reduced to per cents.	0	0	0	1	2	3	8	8	9	11	11	12	10	10	6	3	3	1	1	1	...	...	...	...	100
	C. Sums of figures in B, from beginning. }	...	...	...	1	3	6	14	22	31	42	53	65	75	85	91	94	97	98	99	100	...	...	...	...	...
WEIGHTS IN POUNDS.		56	63	70	77	84	91	98	105	112	119	126	133	140	147	154											
IN COUNTRY SCHOOLS.	A. As observed .....	...	2	9	18	44	62	61	38	22	25	12	1	5	2	...	...	...	...	...	...	...	...	...	...	296
	B. As reduced to per cents. ....	...	1	3	6	15	21	21	11	7	8	4	0	2	1	...	...	...	...	...	...	...	...	...	...	100
	C. Sums of figures in B, from beginning. }	...	1	4	10	25	46	67	78	85	93	97	...	99	100	...	...	...	...	...	...	...	...	...	...	...
IN TOWN SCHOOLS.	A. As observed	1	18	60	83	99	89	65	39	32	9	10	2	3	...	...	...	...	...	...	...	...	...	...	...	510
	B. As reduced to per cents.	0	3	12	16	19	13	13	8	6	2	2	0	1	...	...	...	...	...	...	...	...	...	...	...	100
	C. Sums of figures in B, from beginning. }	...	3	15	31	50	63	81	89	95	97	99	...	100	...	...	...	...	...	...	...	...	...	...	...	...

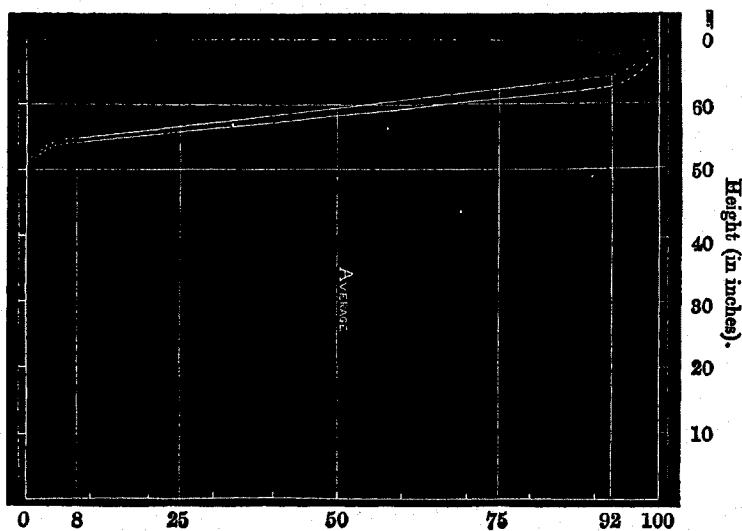
yards, or other divisions, long. A rod at the end of the first division would divide the boy under 53 inches from the 99 boys who were above 53 inches; another rod placed two divisions further (or three divisions in all from the beginning, as is shown compendiously in line C), would divide the 3 boys under 54 inches from the 97 above 54; another at the 6th division from the beginning would divide those under 55 from those above 55, and so on. Let, then, marks be put on the successive rods, at the several heights of 53, 54, 55, &c., inches, and draw upon the wall with a piece of chalk a flowing line joining those marks. This line or curve would just touch the heads of all the 100 boys, and would give an exact, *natural*,* and permanent record of the distribution of heights throughout the school. I draw such a line, not on the face of a wall 100 yards long, but within the compressed limits of a piece of ruled paper, in which each boy is represented by the narrow interspace between two lines. "Sectional" paper, divided into inches and tenths, is more than sufficient for the purpose, and, by its use, the curve which we had supposed to extend over 100 yards, is most easily compressed into 10 inches, as in the diagrams I submit for inspection. (*See fig. page 177.*)

On precisely the same principle can the distribution of weights or any other quality be protracted.

It remains to record these curves in a way that shall admit of their being compared arithmetically, and shall at the same time give us the usual objects of statistical inquiry, such as the "Average," and the "Probable Error." This is done by measuring a few appropriate ordinates, the same in every case, as I proceed to show. First, let us consider the peculiar shape of all such curves. There must of necessity be a remarkable similarity between them, due to the general fact, that in every group of objects that statisticians deal with, those of medium value are more numerous than those which are either large or small, and that, as the deviation from the mean value increases, the rarity of objects characterised by that degree of deviation increases with still greater rapidity, consequently the curves of which I speak must always have a long, steady slope about their middle; they must bend downwards with increasing curvature at one end and upwards at the other. They are therefore, of a necessity, curves of contrary flexure, such as are known in the idiom of architects as "ogives." Owing to their general shape as thus described, it would be a misdirection of labour to measure many ordinates about their middle. All that is really necessary, in such an instance as we are considering,

* Compare with Quetelet's method, as described and figured in his "Anthropometrie," p. 266.

is (1) the middle ordinate, which gives directly the *average* value, in the sense that as many cases fall short of it as exceed it; (2) and (3), ordinates at the 25th and 75th divisions. The latter divide the group into three parts, small, medium, and large, the medium being as numerous as the other two put together. Also, wherever the Law of Error applies, the difference between either of these ordinates and that at the 50th division, is identical with the well known quantity called the "Probable Error." I take the 4th and 5th ordinates at the 8th and 92nd divisions: they are those which, when the Law of Error applies, differ from the 25th and the 75th, by exactly the same amount as either of these differs from the 50th. Such is approximately the case in the instances of height before us, when the common difference, as shown in Table II., is about 2.35 inches. These ordinates can readily be protracted (*see fig.*) to form



a diagram, and their tops joined with a flowing line, which will reproduce the original curve in a more regular form; or they can be treated arithmetically, as in Table II., whence those conclusions were drawn which were stated at the beginning of this memoir. I should add, that the precise mean difference of stature, &c., in the two groups of schools, is given by the units of area of the interval between the collated curves, divided by the units of length in its base, and that this area may be measured readily and accurately by the ingenious little instrument called a planimeter.

TABLE II.—COMPARATIVE HEIGHT AND WEIGHT OF PUBLIC SCHOOL BOYS, AGED FOURTEEN LAST BIRTHDAY.

	Ordnate at 5th Division.	Difference between Grades.	Ordnate at 25th Division.	Difference between Grades.	Ordnate at 50th Division.	Difference between Grades.	Ordnate at 75th Division.	Difference between Grades.	Ordnate at 92nd Division.
HEIGHT.	inches.		inches.		inches.		inches.		inches.
Country Schools	56·4	2·7	59·1	2·0	61·1	2·4	63·5	2·5	66·0
Town Schools.....	55·2	2·1	57·3	2·4	59·7	2·3	62·0	2·3	64·3
Differences between Coun- try and Town Schools... }	1·2	...	1·8	...	1·4	...	1·5	...	1·7
Sum of differences between successive grades..... }	...	4·8	...	4·4	...	4·7	...	4·8	...
Mean of above .....	...	2·4	...	2·2	...	2·35	...	2·4	...
WEIGHT.	lbs.		lbs.		lbs.		lbs.		lbs.
Country Schools.....	81	10	91	8	99	11	110	15	115
Town Schools.....	73	9	82	9	91	11	102	14	116
Differences between Coun- try and Town Schools... }	9	...	9	...	8	...	8	...	9
Sum of difference between successive grades..... }	...	19	...	17	...	22	...	29	...
Mean of above .....	...	9·5	...	8·5	...	11	...	14·5	...

NOTE.—According to Quetelet's "Anthropometrie" the average height of Belgian Boys at 14 is only 1·469 (= 57·8 inches), and their weight 37·1 kilos. (= 82 pounds).

After this long explanation, I can briefly dispose of what remains to be said. The reason why I could not compare other ages than 14 is to be found in the data given by Table III., which show that the numbers of the boys of the various ages varies considerably. There are only 99 boys in the country school group aged 12, but 265 aged 13; consequently the average age of the boys aged 12 certainly exceeds $12\frac{1}{2}$, and must not be taken at that figure. I have protracted the curves for all the ages, both for height and weight, and find the existence of this cause of error to be unmistakeable. It seems, however, that we may neglect it as trivial in both groups at the

TABLE III.—NUMBER OF BOYS OF VARIOUS AGES IN CERTAIN PUBLIC SCHOOLS.

		AGE LAST BIRTHDAY.							
		10	11	12	13	14	15	16	17
COUNTRY SCHOOLS.	Marlborough . . .	3	14	34	96	90	140	103	47
	Clifton	6	43	34	65	93	99	80	49
	Haileybury . . .	...	...	9	37	77	92	70	42
	Wellington, in part	...	...	19	46	...	...	...	...
	Eton, 4th Form	...	1	3	21	36	16	3	...
Total		9	...	99	265	296	347	256	138
TOWN SCHOOLS.	City of London	42	57	96	102	109	57	23	14
	Christ's Hospital	29	114	175	171	188	110	4	10
	Birmingham . .	62	69	106	123	100	81	29	18
	Liverpool College	28	54	116	105	112	54	20	16
Total		161	294	493	501	509	302	76	58

age of 14. It is true, that the town school figures show a great falling off at the age of 15; but I understand this to be chiefly due to the fact of many boys leaving between 15 and 16, rather than to a commencing diminution between 14 and 15. The run of the curves confirms this view. However, the error, such as it is, raises the country schools somewhat above their true level, and depresses the town schools; and it may be held accountable for an error in the difference between them of, perhaps, a tenth of an inch, or even a trifle more. Therefore, instead of the statistical result of 1.4 inch difference of height, as shown in Table II., it is better to say about one and a quarter inch. Similarly, the 8 lb. of difference might be reduced to 7.

The curves I have drawn for the different ages show a tendency in the town boys to make up, as they grow older, for their early deficiency in height, but they never reach the standard of the country schools. I, therefore, conclude that the deficiency at the age of 14 is partly due to retardation, and partly to total suppression, of growth. The weight of the taller boys in towns does not increase with their height in the same proportion as among the country boys; in other words, the tall town boys are slight.

As regards the dependence to be placed on the results, it seems justified by the number of cases observed, and by the fact that the curves of height (of course, not those of weight) conform fairly to the Law of Error, as has already been pointed out;

also, as already remarked, the curves of heights and weights for consecutive ages form as good a series as we have a right to expect.

In conclusion, I fear that the statistics, in the form in which they have been hitherto asked for, cannot be so worked as to give as just an idea as we desire of the growth of English boys under different conditions, and that it will be necessary to modify our schedule by asking with more minuteness concerning age.

DISCUSSION.

Mr. WM. HARDING said that it might be desirable to understand with some exactness what was meant by the author of the paper by "the town and the country boy;" that if a great city like London were selected, and boys born and reared within its meshes were given as examples, then the superior development of the country boy would be at once conspicuous from every point of view; that it was scarcely possible to make superficial observation without noticing that the children who fell to the care of guardians of the poor in the great metropolitan parishes were of diminished stature and almost stunted growth; and that, under like disadvantageous circumstances, the same may probably be the case in other large towns. But throwing back his memory to observations made during early and country life, and taking for illustration the boys from boroughs of from five to thirty thousand inhabitants, then to him the comparison gave this result, *i.e.* the country boy was heavier, stronger, slower, and of larger chest-girth than the town boy, but that, as a rule, he was *shorter*. The town boy, on the other hand, was lighter, more active, smaller in his chest development, but, as a rule, he was *taller*. The subject was of some interest and deserving of observation, because if the town boys were (as many suppose) really degenerating in stature, it opened out rather an uncomfortable-looking future, as, once establish a true degeneration, and the hereditary principle must step in and help to secure its permanence.

The PRESIDENT, Mr. CHARLESWORTH, and Mr. HARRISON having spoken,

Mr. GALTON, in reply to the remarks of the various speakers, saw no cause of objection, in combining, as he had done, all the boys who were 14 on their last birthday in a single group. Of course, some of them were only just 14, and others were nearly 15, and a few cases of very short, and of very tall, stature might be chiefly due to that cause. But statistics did not concern themselves with exceptions, but with the mass, and, in the particular form of discussion which he had adopted, both ends of the series—the shortest and tallest—were excluded. No doubt the town group includes several cases of boys of country origin; but the distinction of town boys in the town group, and of country boys in the country group, is undoubtedly the prevailing characteristic. It should be noticed, that in the pre-eminently town school of the City of London, the

boys' stature was the smallest. It was not maintained by Mr. Galton that the deficiency of size in the town group was altogether due to bad effects of nurture on the individual boys; on the contrary, he would be disposed to ascribe much of it to the town life of their parents, and probably of other ancestors; but these were subjects requiring more statistics than were before them at present, before they could be properly discussed.

The following paper was read by the author :

On the ORIGIN and PROGRESS of the PEOPLE of MADAGASCAR.
By JOSEPH MULLENS, D.D., Foreign Secretary of the
London Missionary Society.

IN recent years special interest has been taken by Englishmen in the people of Madagascar. For a long period a bitter persecution was waged against the few Christian converts in the island; they were found to be heroic and faithful, and at length, as the result of their steadfastness, suddenly a strange transformation of the chief tribes took place; the idols were burned, and the rulers, nobles, and inhabitants in the Central Provinces declared themselves Christians. Many friendly travellers have since visited them. A cordial interest in the growth of the nation has been shown by both the English and French Governments; the export and import trade of the island has steadily increased to about £500,000 a year, and the course of improvement has been stimulated in a variety of ways.

Many books have been written both about the land and the people of Madagascar. But just as the descriptions of the country and its maps were (till lately) derived almost entirely from the memoir and map of Colonel Lloyd, so to a very large extent the descriptions given of the language, history, and customs of the people have been drawn from the ablest work on the subject, the "History of Madagascar," in two volumes, written by the Rev. W. Ellis, in 1838. The time has come to revise these views of former days. As much has been added of late to our knowledge of the geography of the island, so, many things have become clear which were formerly obscure, in relation to the people. During a twelve months' visit to the island, I have had the opportunity of travelling over all the Central Provinces, and of seeing much of the people, as well as of hearing of their past history and present progress. I gladly avail myself, therefore, of the opportunity which has been kindly furnished to me by the President and Council of this Institute, to state to its members some of the conclusions to which I have been led respecting them.

The Malagasy people appear to me to be a single race. Not-