

Total ridge-count sampling

by

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Glancing at the literature, you will notice that many authors, when studying fingerprints in a sample of population, use for their statistical investigations less subjects to establish the mean total ridge-count than they do for the determination of the frequency of occurrence of the different types of digital patterns.

Indeed, when a triradius is missing on a finger print of one of the subjects, it is often possible to determine the type of pattern, whereas, of course, one cannot count all the ridges of that pattern. One is thus led to reject that subject out of the sample for the calculation of the mean total ridge-count.

Of course, that reducing of the sample would not have any statistical implication if the distribution of the rejected subjects would be identical to the sample distribution. However, RIGTERS-ARIS (1975) showed that the mean individual number of digital triradii (pattern intensity index) is smaller when computed from subjects whose ten fingers are legible than when the fingers are added of the subjects who were eliminated because of some unreadable fingers.

Concerning the finger ridge-count, the more complex and larger patterns are more likely rejected : they are more often unreadable or incomplete. One can thus expect a greater value of the total ridge-count calculated on the ideal sample, than the value obtained when rejecting some of the subjects for trivial experimental reasons.

An investigation on a sample of 163 Belgian boys from Saint-Gilles, a suburb of Brussels, confirmed that impression. According to the finger, the ridges could be numbered on 126 to 146 prints, but the total ridge-count could be established for 87 subjects only.

We tackled the problem along two methods :

1. We compared the mean finger ridge-counts in two subsamples :

1° — the "complete" subjects, whose 10 fingers were legible ;

2° — the "isolated" fingers from prints which had to be eliminated because one or the other finger was not readable or simply missing.

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2. We compared the mean total ridge-count in two subsamples :
 1° — the “complete” subjects whose 10 fingers were legible ;
 2° — those with one or two illegible fingers : when the triradius was missing on the print, we estimated the ridge-count by counting all visible ridges so that we obtained a minimum ridge-count, less than the real one. When one finger was missing or quite unreadable, we replaced its count by that of the homologous finger, as Scotland Yard uses to do (CHERRILL, 1954). That method is founded on the high correlations between homologous fingers (0,74 to 0,85, HOLT, 1968). It is not as precise as Smith’s (BASU, 1977) but is was sufficient for our purpose.

1. FINGER RIDGE-COUNTS OF COMPLETE SUBJECTS
 AND OF ISOLATED FINGERS (Table 1 and fig. 1)

In the subsample of complete subjects, all means are smaller than those computed from fingers of subjects who were eliminated because of some illegible fingers. The differences amount from 1,44 (IV left) to 4,82 (II left) ridges. They reach the level of significance for 8 out of 10 fingers. The means computed for the total of the two subsamples do not differ from those of complete subjects, the differences amounting to 0,44 — 1,89 ridges. Isolated fingers do not vary as much as those of complete subjects. Nearly all of them have high ridge-counts. As there is a high correlation between the ridge-counts of different fingers of the same individual (0,36 to 0,85), those incomplete subjects would likely have high total ridge-counts.

TABLE 1

Mean finger ridge-counts (Belgian boys from Saint-Gilles)

	10 clear complete fingerprints			1 or 2 missing fingers			total			t	P
	n	\bar{x}	s	n	\bar{x}	s	n	\bar{x}	s		
Right I	87	17,78	6,65	59	19,56	5,34	146	18,51	6,19	1,79	n.s.
II	87	9,62	6,81	46	13,04	6,50	133	10,81	6,90	2,78	<0,01
III	87	10,66	5,85	54	13,87	5,52	141	11,89	5,94	3,22	<0,01
IV	87	13,39	6,17	44	15,82	6,56	131	14,21	6,41	2,04	<0,05
V	87	12,37	5,43	44	14,64	5,22	131	13,13	5,47	2,27	<0,05
Left I	87	14,67	6,13	59	17,19	5,15	146	15,69	5,89	2,58	<0,01
II	87	9,18	6,58	56	14,00	5,50	143	11,07	6,61	4,52	<0,001
III	87	10,98	6,34	59	14,24	5,27	146	12,30	6,14	3,24	<0,01
IV	87	13,77	5,86	39	15,21	6,36	126	14,21	6,06	1,20	n.s.
V	87	11,87	5,16	44	14,66	4,64	131	12,81	5,16	2,99	<0,01

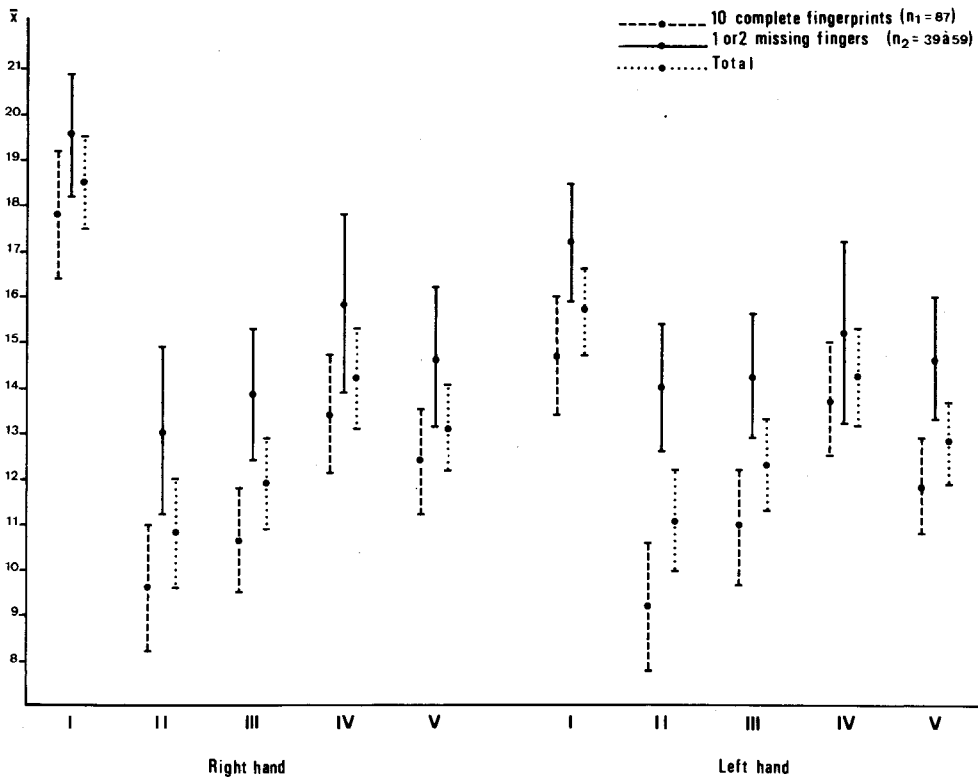


FIG. 1

2. ESTIMATE OF TOTAL RIDGE-COUNT (Table 2 and fig. 2)

1. The total ridge-count was established for 87 subjects whose 10 fingers were readable.

2. It was estimated for 49 other subjects: 36 prints where the triradius of one or two fingers was missing: we counted all visible ridges, obtaining a minimum count; on 13 other prints, one finger was wounded or unreadable and we replaced its ridge-count by that of the homologous finger.

The mean of the subsample of complete subjects is by 47 ridges less than the estimate for incomplete subjects ($P < 0.001$) and by 17 ridges less than the mean for the total of both subsamples (It should be remembered that ROTHAMMER *and al.*, 1973, observed a mean difference of 9,9 ridges between two observers, that difference amounting to less than twice the standard error of our means).

The standard deviation of the first subsample is greater than that of the second, but has the same value as that of the total.

The distribution of the total ridge-counts in the subsample of complete subjects, like all the distributions of that trait in human populations, is negatively skew. The distribution of estimated ridge-counts for incomplete subjects is practically limited to high values : 86% have 140 ridges or more, against 40% for the complete subjects.

In fact, the distribution of total ridge-counts in the subsample of subjects whose 10 fingers are readable, is not really curtailed, but the high values are under-represented, so that its skewness is lessened.

TABLE 2
Total ridge-count

	10 clear complete fingerprints	estimate for incomplete subjects	total	t	P
n	87	49	136		
mean	121,92	168,63	138,75	6,62	<0,001
standard deviation	48,67	33,22	49,07		
standard error	5,25	4,79	4,21		
variance	2369,11	1103,57	2407,88		

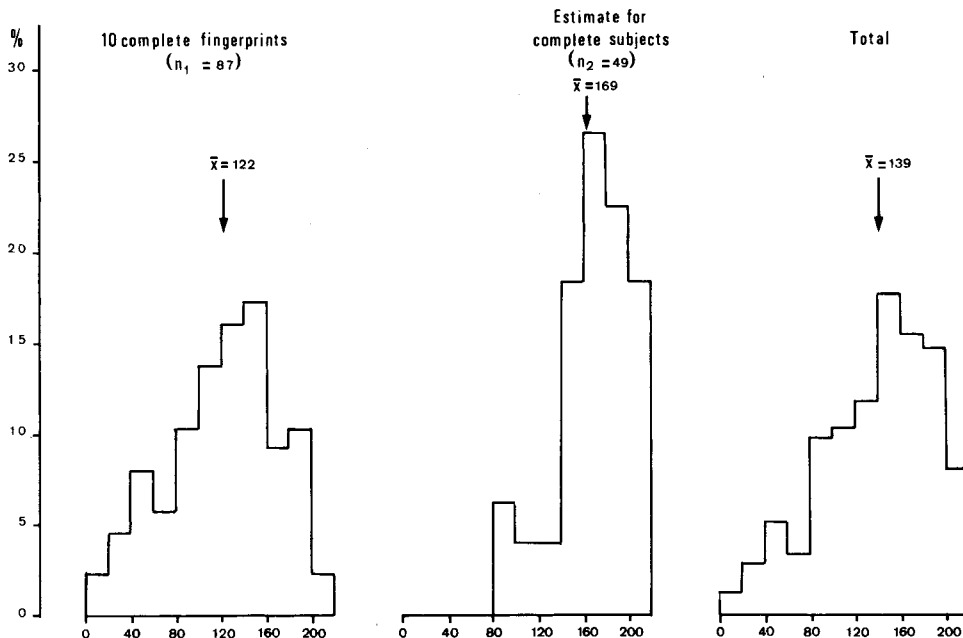


FIG. 2

CONCLUSION

Our intention was not to discredit the studies where the mean total ridge-count is established on part of the sample. We only wanted, by means of an example, to draw the attention on situations where means are calculated on a number of subjects inferior to the number announced for other traits. Authors should always indicate how many prints they had to eliminate. They should also precise the number of subjects used to establish the frequencies and means for each trait.

And, last but not least, like HOLT (1968), we enhance the absolute "need for clear, complete dermal prints".

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Erratum: The second histogram on opposite page gives the estimate for INCOMPLETE subjects.