A STUDY OF THE NASAL BRIDGE IN THE ANTHROPOID APES AND ITS RELATIONSHIP TO THE NASAL BRIDGE IN MAN.

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CONTENTS.

	PAGE
(1) Introductory: Nature of Material and Measurements made	391
(2) Reliability of Measurements: Effect of Personal Equation in Sexing, of Secular Change in Personal Equation of Measurer and of Differences in small Samples	393
(3) On the Observed and Calculated Values of the Subtense Mesodacryal Index. The Catenary Hypothesis	399
(4) On the Simotic and Mesodacryal Indices. Their Relative Evolutionary Value	401
(5) On the Absolute Nasal Measurements	405
(6) On the Absolute Mesodacryal Measurements	407
(7) On the relative Racial Variability of the Nasal Bridge Characters. Sexual Differences in Variability	409
(8) Racial Relationship as based on Nasal Bridge Measurements. Ancestral Tree	417
(9) On the Correlations of the Nasal Bridge Characters	418
(10) The Maxillary and Simotic Nasal Angles, ϕ and ϕ' . The Inter-relationships of Anatomical Units	420
(11) General Classification of Nasal Bridges by aid of Angles ϕ and ϕ' . Homoclinic and Heteroclinic Nasal Bridges. Measurements of Simosis and Gephyrosis. Contours of the Nasal Bridge	426
(12) Discussion of Projections of Nasal and Maxillary Portions of Nose on Base of Nasal Bridge	430
(13) Concluding Remarks	435

(1) *Introductory.*

The measurements on which the following paper is based were taken by Kathleen V. Ryley, in part at the Museum of the Royal College of Surgeons by the kindness of Professor Arthur Keith; in part at the British Museum (Natural History), where we have especially to thank Mr W. P. Pycraft; in part at the Cambridge Anatomical Museum and in the private collection of Dr Duckworth, whom we have heartily to thank for his courteous and ready aid; in part at the Oxford Museum by the kindness of Professor Bourne. Lastly we owe the possibility of measuring a few specimens to Professors Thane and Hill of University College, London, who readily placed their material at our disposal. We have further to express our indebtedness to Professor Thane and to Dr Derry for aid in a variety of other ways. Only by the great help received from all these authorities would

392 *A Study of the Nasal Bridge in the Anthropoid Apes*

it have been possible to bring together even the slender numbers now dealt with, and a very full sense of our obligations to these gentlemen must here be expressed.

In a recent paper entitled "A Study of the Negro Skull" (*Biometrika*, Vol. VIII. pp. 315—320) a special study was made of the nasal bridge in the Congo and Gaboon crania and the results compared with measurements on Egyptian and English series. There resulted values so suggestive that a wider study was promised, and that promise is to some extent fulfilled in the present paper.

In the former paper it will be remembered that the chord from dacryon to dacryon (DC) was measured—the mesodacryal chord—and the minimum arc from dacryon to dacryon (DA)—the mesodacryal arc. The ratio $100 (\text{arc} - \text{chord})/\text{chord}$ was termed the mesodacryal index β . If on the other hand we measure the subtense of the minimum arc (DS) and take the index $100 \text{ subtense}/\text{chord}$, we obtain a second mesodacryal index, which we will term here the mesodacryal index α . As α cannot be found without a special instrument, or a special construction, an attempt was made to determine the second mesodacryal index α from the first β by the hypothesis that in man the bridge of the nose may be sufficiently closely represented by a catenary, which seemed a fairly justifiable assumption in this case. The index thus indirectly found will be termed in this paper the mesodacryal index α' . Tables to determine α' from β calculated by one of us (Julia Bell) were published in the same number of *Biometrika*, pp. 338—9, as the paper on the negro skull. An extension of these Tables due to H. E. Soper, rendered necessary when we deal with apes, will be found in the footnote on p. 401 of the present paper. Meanwhile our attention was drawn by Professor G. D. Thane to Mérejkowsky's pioneer work of 1882 on the nasal bones. He measured the shortest horizontal chord from nasal suture to nasal suture (SC) and the minimum subtense (SS) and took the index $100 SS/SC$, which we have ventured to term the *Simotic Index*, S . There is little doubt that this index is of a more simple anatomic character, as being only concerned with the nasal bones, than the mesodacryal indices. But it is by no means so marked a physiognomic feature in the living as the mesodacryal index. It has further to be obtained by aid of a special instrument—in our case a modified Mérejkowsky instrument,—which may be termed the simometer. This simometer may also be used to test the relationship between observed α and calculated α' .

In the present investigation α , β , S have been measured and α' calculated for Gorilla, Chimpanzee, Gibbon and Orang. But in the case of the latter ape it was found possible to measure the simotic index in only a few cases,—the index taking frequently the form of the ratio of two almost vanishing quantities*. In

* There were three cases in which the simotic chord was recorded among the Orang-utans. In two males it was 5·7 and 5·8 mm. In both these cases the subtense was zero, for the bones were practically flat; thus the simotic index was zero. In the third case, a female, the simotic chord was 7·0 mm. and the subtense 1·2 mm. and therefore the simotic index was 17·1. There were a few further cases in which the chord only was measurable. Thus on the basis of such isolated cases we should have to place the Orang-utan below the Chimpanzee, and both of course below the Negroes.

the Orang the nasal bones are fused into a narrow flat strip from 5 to 6 mm. wide, sometimes there is only a thread at the nasal bridge or the nasals are entirely absent. In some cases the maxillary bones stand out forming a ledge which overhangs the region of the dacryon and extends beyond it, thus making it very difficult to measure with Mérejkowsky's instrument. Initially we excluded entirely from our measurements the Gibbon, but notwithstanding the difficulties of including this ape, it afterwards appeared to us that it might be worth while to indicate the results in rough numbers. The difficulties partly arise from the fact that a large proportion of the Gibbon crania available are without any statement as to sex and we did not feel that an attempt at sexing would be really profitable, as the total numbers were not large enough to give double series. Further we are compelled to distinguish between *Hylobates* and *Symphalangus*, and even of the former with the sparse data as to locus usually provided, it is impossible to assert that we are dealing with anything like a homogeneous race. Thus we found ourselves ultimately with only 25 cases—♂ + ♀ + ♂ —*Hylobates*—indeed only 16 for the simotic characters, and 9 cases—♂ + ♀ + ♂ —*Symphalangus*—with merely six for the simotic characters. Our results in this case can therefore only be rough indications of the racial characters of the nose of these apes. Our Museums have yet to learn that for comparative study we want at least 50 to 100 crania of each sex drawn from definite districts. To compare with those of the apes the corresponding indices were measured in a number of human races selected in order to contrast the values, if possible, with those of the anthropoid apes of the same continent. A few other human races are taken to indicate general relationships. The Hindoo, Egyptian and English crania used are at University College either in the Biometric Laboratory or in the Department of Anatomy; the Asiatic skulls and the Congo skulls are at the Royal College of Surgeons; the Gaboon skulls at the British Museum of Natural History. The nasal features of the latter as well as of the English and Egyptian crania had already been discussed in Dr Crewdson-Benington's paper referred to above.

(2) *Reliability of Measurements.*

The first point to be considered is the degree of reliability in the measurements made, and here we must again emphasise the difficulty of accuracy. Not only do the quantities measured differ by their extreme smallness from the customary cranial measurements, but the points for measurement and the instrument for measurement are by no means all that could be desired. When a small quantity has to be measured, an error of reading which would have no importance in the case of either head breadth or head length, the cephalic index being in question, becomes of very great significance in the case of the simotic or even the mesodacryal indices. Further in the handling of Mérejkowsky's instrument, there is much play for personal equation, and only after long practise will the recorder settle down into a process, which repeats within reasonable limits the values of the indices previously determined. In the next place for our present purposes only small series of crania were as a rule available, e.g. 20 to 40 of either

394 *A Study of the Nasal Bridge in the Anthropoid Apes*

sex of each ape, 10 to 40 of the various Asiatic races. Considering the smallness of these numbers, it did not appear needful, in view of the labour involved, to measure more than 50 of each sex of the English (Whitechapel) and Egyptian (xxvi—xxx dynasties) crania of which far larger numbers were at hand.

Further in such small series the question of sexing becomes of considerable influence. With a large series of crania of one type, we sex on our knowledge of that series itself. But in short series one is apt to sex by *a priori* impressions of sex in other races, because we have not before us wide enough material to appreciate sex differences within the race itself.

We propose to illustrate first the order of the differences which may arise from these sources, and we will deal first with sexing. Owing to the courtesy of Dr Derry we were able to test this point on 35 Nubian crania in his possession. They were independently sexed by Professor G. D. Thane and by Dr Derry himself*. The nasal measurements were taken and the mean values of the indices calculated. The following values were obtained, where we have added for comparative purposes those of other negro series:

TABLE I.

	m_a		$m_{a'}$		m_β		m_s	
	♂	♀	♂	♀	♂	♀	♂	♀
Nubians : Professor Thane ...	48·0	40·9	49·7	43·6	49·6	40·0	34·5	23·4
„ Dr Derry ...	48·9	39·7	51·0	42·1	51·6	37·7	33·7	23·5
Gaboon : 1864 ...	42·9	44·0	43·6	44·9	40·0	42·0	30·9	27·7
„ 1880 ...	42·9	44·1	44·8	45·1	41·9	42·3	29·0	22·9
Congo ...	39·1	37·2	40·5	38·6	35·5	32·6	25·6	25·7
“Nègres” : Mérejkowsky ...	—	—	—	—	—	—	25·6	

It will be seen that for short series the personal equation of sexing makes 1 to 2 points difference in the indices, but that in two series of the same race—Gaboon, 1864 and 1880,—differences of this order may occur at least in the simotic index. If we compare Mérejkowsky's value for the simotic index with ours, we see that there would be excellent agreement if his somewhat vague “Nègres” were from the Congo district. But we lay no stress on this agreement because we believe that Mérejkowsky tends almost invariably to get a higher simotic index than we do. This is illustrated in Table II.

Of course there are but few races common to both series and in Mérejkowsky's series as in ours the numbers dealt with are miserably small, but still cases where

* Before discussion there were four crania in a total of 35 on which there was difference of opinion, say 11 per cent., and we have used the original determinations, putting as usual ? ♂ and ? ♀ with the ♂'s and ♀'s respectively.

we can compare and the general appearance of the Table are both against the view that the differences are wholly racial. We believe them to be largely due to personal equation in taking a delicate measurement with a not very reliable instrument, and consider that without determination of personal equations by direct comparison of measurements on the same individual crania, it is not possible at present to compare simotic indices found by different craniologists.

TABLE II.

Values of the Simotic Index.

Race	Méréjkowsky		Race	Ryley	
	♂	♀		♂	♀
Negroes	25·6	—	Congo	25·6	25·7
Malays	31·3	—	Moluccas	26·5	—
New Caledonians ...	38·5	30·6	Gaboon, 1880 ...	29·0	22·9
Mongols	40·5	—	Sumatra	29·2	—
Melanesians	41·9	35·2	Celebes	29·7	—
Marquesas Island ...	43·9	34·0	Borneo	30·2	34·7
Maoris	47·9	43·3	Philippines ...	30·4	29·0
American Indians ...	48·0	46·2	Gaboon, 1864 ...	30·9	27·7
New Hebrides	49·1	44·5	Malay	33·7	—
Hindoos	51·1	42·5	Java and Madura ...	33·9	32·7
Auvergnats	51·8	45·0	Nubians	34·1	23·4
Gypsies	53·8	—	Ainos	43·4	—
Tahitians	54·3	—	Veddahs	43·6	36·9
French	54·8	47·1	Egyptians	44·4	36·9
Dutch	58·6	55·2	Hindoos	44·7	39·1
French Cymry	59·6	50·3	English	50·8	46·6

In two points, however, we agree fairly well with Méréjkowsky, i.e. in the general order of races and in the fact that the simotic index is a marked sexual character. In all cases—22 in number—except the Congo and Borneo crania, the female has a lower simotic index than the male and this is true for the apes, where we can determine it:

	♂	♀
Chimpanzee	21·4	18·5
Gorilla	56·8	55·1

The two exceptions are the Congo crania, where the two sexes are practically alike, and the crania from Borneo, where the female has the higher simotic index, but the probable errors being introduced, i.e. Borneo: ♂'s $30·2 \pm 1·2$, ♀'s $34·7 \pm 2·1$, show us that even here the difference is quite possibly non-significant. Thus we conclude that in the female the nasal bones are flatter than in the male, and this secondary sexual character may be used—as far as it is ocularly appreciable—as a help in sexing. It may be remarked—in order to avoid circular reasoning—that

396 *A Study of the Nasal Bridge in the Anthropoid Apes*

with the possible exception of Dr Derry's classifications, the judgment in sexing has not been influenced by nasal characters*.

While it appears to us that the difference of sexing will not be greater than that of two small samples of the same race and less probably than the difference of measurement of two different craniologists, we have still to answer the important question of how far the same craniologist will repeat results in the case of these delicate nasal measurements. We are able to make some interesting comparisons from this standpoint. K. V. Ryley made her first measurements of the nose on the Whitechapel, Egyptian, Congo and Gaboon series in the summer of 1911 for use in the paper on the negro skull (*Biometrika*, Vol. VIII, p. 316). She was then new to these particular measurements, and before the second series were made she had nearly a year's practice on a great variety of races. In the English Whitechapel series 13 crania measured in one series (1911) are not in the other series (1912), that is to say one quarter of the crania are not the same in the two series. These 13 crania of the first series were originally Museum specimens, i.e. skulls having some abnormality (other than nasal), or remarkable feature, and placed in the Anatomical Museum for exhibition. It was thought better to exclude these individuals in the second series and replace them by more normal examples. Thus the divergencies between the *A* (1911) and *B* (1912) English series are not solely due to personal equation. The Congo and Gaboon 1864 series are practically the same crania for *A* and *B* as nearly every skull which was measurable was measured on each occasion.

The two Egyptian series are not the same crania, for they consisted of the 100 crania of the series of 1800 skulls, which were being otherwise measured at the time when these nasal measurements were taken. Thus we may conclude that the Congo and Gaboon 1864 series represent changes due to the same measurer repeating operations at the beginning and end of a period during which experience was growing and methods being standardised; the Egyptian series represent this variation in the measurer together with the difference between random samples; and the English series represent not only the variation due to the measurer, but further the effect of modifying by 25 % the actual sample

* Dr Derry does give weight to nasal features in sexing, but if we examine the results in Table I from this standpoint, we have

Difference of male and female, i.e. $\sigma - \varphi$.

	m_a	$m_{a'}$	m_β	m_s
Professor Thane	7.1	6.1	9.6	11.1
Dr Derry ...	9.2	8.9	13.9	10.2

It will be clear from these results that Dr Derry used the mesodacryal indices, i.e. the entire bridge of the nose, rather than the nasal bones in his sexual appreciation; for he has a less sexual difference in the simotic index than Professor Thane, while he has greater values in the mesodacryal indices. As a matter of fact the sexual differences in the Nubians seem to us of such an exaggerated character, that we venture to suggest that the females may have been captives and thus may be more definitely negresses, with whom their indices accord, than the males were negroes; the males being possibly a conquering race.

measured. Finally to test the extent to which K. V. Ryley's methods were finally standardised, a third measurement of the male Whitechapel crania was made four months later than *B*, namely *C* in December, 1912. In the case of *C* the same 50 crania exactly were remeasured*. There now resulted a very close accordance between all the measurements absolute and indicial. It will be noticed on examination of the Table that:

(i) The error in the value of the simotic index due to variation of personal equation never exceeds a point.

TABLE III.

Comparison of Measurements on the Nasal Bridge made at intervals and on different samples.

Series	Meso-dacryal Chord (DC)	Meso-dacryal arc (DA)	Simotic Chord (SC)	Simotic Subtense (SS)	Meso-dacryal Index β	Meso-dacryal Index α' (from β)	Simotic Index (S)	Remarks
Gaboon, 1864, <i>A</i> ♂	24.5 ± .2	33.5 ± .3	9.16 ± .26	2.87 ± .11	42.7 ± .9	45.4 ± .6	30.8 ± .9	} Same crania
" " <i>B</i> ♂	23.2 ± .2	32.4 ± .3	9.43 ± .26	2.88 ± .11	40.0 ± .8	43.6 ± .5	30.9 ± .9	
" " <i>A</i> ♀	23.1 ± .3	32.3 ± .4	9.55 ± .28	2.68 ± .10	44.8 ± 1.3	46.7 ± .8	28.7 ± 1.0	} Same crania
" " <i>B</i> ♀	22.5 ± .3	31.8 ± .4	9.88 ± .29	2.68 ± .11	42.0 ± 1.3	44.9 ± .8	27.7 ± 1.0	
Congo, <i>A</i> ♂	24.4 ± .3	32.8 ± .4	9.44 ± .21	2.38 ± .08	34.5 ± .9	39.6 ± .6	25.6 ± .8	} Same crania
" <i>B</i> ♂	23.9 ± .3	32.4 ± .4	9.80 ± .21	2.48 ± .09	35.5 ± .8	40.5 ± .6	25.6 ± .7	
" <i>A</i> ♀	23.5 ± .3	32.2 ± .4	9.46 ± .33	2.31 ± .11	36.8 ± 1.0	41.5 ± .7	25.2 ± 1.3	} Same crania
" <i>B</i> ♀	23.3 ± .3	30.8 ± .3	9.72 ± .35	2.41 ± .12	32.6 ± .8	38.6 ± .6	25.7 ± 1.4	
Egyptians, <i>A</i> ♂	21.5 ± .2	34.5 ± .4	10.58 ± .18	4.67 ± .10	61.3 ± 1.5	57.0 ± .9	44.8 ± .8	} Different samples
" <i>B</i> ♂	21.5 ± .2	35.3 ± .2	10.42 ± .17	4.63 ± .10	65.0 ± 1.3	59.4 ± .8	44.4 ± .7	
" <i>A</i> ♀	20.4 ± .2	32.4 ± .2	10.76 ± .17	4.11 ± .09	59.3 ± .9	55.9 ± .6	38.6 ± .7	} Different samples
" <i>B</i> ♀	20.6 ± .3	32.0 ± .3	10.84 ± .16	3.97 ± .09	56.0 ± 1.1	53.9 ± .7	36.9 ± .8	
English, <i>A</i> ♂	22.6 ± .2	35.1 ± .3	9.52 ± .17	4.74 ± .11	56.2 ± 1.3	53.9 ± .8	50.7 ± 1.2	} 25% different crania
" <i>B</i> ♂	21.5 ± .2	34.8 ± .3	9.38 ± .17	4.68 ± .10	62.7 ± 1.2	58.0 ± .7	50.8 ± 1.2	
" <i>A</i> ♀	20.9 ± .2	31.9 ± .3	8.98 ± .18	4.14 ± .07	53.4 ± 1.2	52.2 ± .8	47.4 ± .9	} 25% different crania
" <i>B</i> ♀	20.6 ± .2	31.5 ± .3	9.10 ± .17	4.16 ± .07	53.7 ± 1.0	52.5 ± .6	46.6 ± .8	

TABLE III bis.

English Crania, 50 Males.

Series	Meso-dacryal Chord (DC)	Meso-dacryal arc (DA)	Meso-dacryal Subtense (DS)	Simotic Chord (SC)	Simotic Subtense (SS)	Meso-dacryal Index β	Meso-dacryal Index α'	Meso-dacryal Index α	Simotic Index <i>S</i>
<i>B</i> ...	21.5 ± .2	34.8 ± .3	12.1 ± .1	9.38 ± .17	4.68 ± .10	62.7 ± 1.2	58.0 ± .7	56.8 ± .7	50.8 ± 1.2
<i>C</i> ...	21.4 ± .2	34.6 ± .3	12.1 ± .1	9.43 ± .17	4.72 ± .10	62.7 ± 1.2	58.1 ± .7	57.4 ± .7	51.2 ± 1.2

A are measurements taken at start of investigation, *B* at conclusion of investigation after practise and standardisation, *B* only used in this memoir. In the Table III bis both series, *B* and *C*, were taken on the same crania at the end of the investigation with an interval of four months.

* K. V. Ryley, it is needless to say, had not her earlier values before her when making her remeasurements.

398 *A Study of the Nasal Bridge in the Anthropoid Apes*

That is, it is of the order of the probable error. It may amount to 1.7, which is only about twice the probable error when we combine the effect of random sampling with personal error.

(ii) The differences in the mesodacryal index β can amount for personal variation to 4.2 (Congo ♀'s), which is as large a value as we obtain on the Egyptian series for combined personal error and random sampling, and even to 6.6 points in the Whitechapel with change of sample and personal variation, which is five times the probable error. Corresponding differences will of course exist in α' deduced from β . We believe that this difference in the early and late values of β is due to greater standardisation of method in determining the dacryon with a rather blunt pointed instrument and to greater mastery of the difficulties arising from damaged crania and in the case of the apes from partially obliterated sutures.

(iii) In the absolute measurements mesodacryal chord (DC), mesodacryal subtense (DS), mesodacryal arc (DA), simotic chord (SC), simotic subtense (SS) there is a maximum error in the means of about 4.5%, but this is rare, and reduces to insignificance with practise in the measurements*.

(iv) A comparison of B and C shows that in all cases after continuous practise and standardisation of method, the variations in absolute measurements or in indices are less than the probable errors of random sampling.

Of course the whole of the above remarks apply to a comparison of *mean* values and not to measurements on an individual cranium. We should conclude as follows:

(a) The measurements on the nasal bridge need great care, and the same measurer may on repetition differ considerably from a previous determination on the same skull.

(b) But with long practise and careful standardisation of method the racial values obtained will repeat themselves, if the series be measured afresh, and values obtained by the same recorder are quite intercomparable.

(c) We are doubtful—especially having regard to Mérejkowsky's results—whether racial values obtained by different craniologists, who are fresh to this side of cranial measurement, or who have not tested their personal equation on the same series, will be directly comparable.

(d) Notwithstanding these difficulties, which are really only an intensification of difficulties which occur in all branches of craniometry, we believe these measurements on the nasal bridge to be really valuable and think that they ought to occupy more attention. They are of course only a phase of what may reach greater importance in the future: namely of what we may term *micro-metric* as distinguished from the usual or *macrometric* measurements of the skull.

* The earlier series of measurements tended rather to exaggerate the mesodacryal chord and arc.

There are bones other than those of the nasal bridge which might give racially significant micrometric measurements, although specially designed apparatus, or an adaption of existing physical instruments as yet unused in craniometry, would have to be employed in their determination.

(3) *On the observed (α) and calculated (α') values of the subtense mesodacryal index.*

In the discussion on the negro skull (*loc. cit.* pp. 297, 316) it was pointed out that our original measurements of the mesodacryal chord and arc leading to the index β did not enable us to determine the subtense directly, or indirectly, until some assumption was made as to the shape of the bridge of the nose. We were not at the time these measurements were suggested to Dr Crewdson-Benington aware of Méréjkowsky's instrument, which is as available for finding the mesodacryal subtense as for its designed purpose the determination of the simotic subtense. Accordingly after some consideration the catenary was selected as a fairly suitable curve for the nasal bridge and by means of it the value of the subtense mesodacryal index (α') was deduced from β . In the present investigation α has been found directly and it is of much interest to test the legitimacy of the catenary hypothesis.

TABLE IV. *Differences $\alpha' - \alpha$ of Calculated (α') and Observed (α) Values of Mesodacryal Subtense Index.*

	♂	♀	Average
Gorilla	0.21	0.07	0.14
Ainos	0.36	—	0.36
Negroes (Gaboon (1864 + 1880)	1.01	0.88	0.94
(Congo)	1.45	1.37	1.41
English	1.19	-0.47	0.36
Egyptians	1.53	1.12	1.32
Chimpanzees	1.64	1.41	1.52
Philippine Islands	1.10	2.16	1.63
Moluccas	1.63	—	1.63
Hindoos	1.79	3.12	2.45
Celebes	2.41	—	2.41
Borneo	2.76	3.86	3.31
Javanese	2.20	2.80	2.50
Sumatra	3.73	—	3.73
Veddahs	4.58	4.99	4.78
Orang-utans	17.33	20.23	18.78
Gibbons	♂ + ♀ + ♂ { <i>Hylobates</i> 18.60 <i>Symphalangus</i> 14.22		18.60 14.22

We see, to judge by this Table, that the hypothesis of the catenary suits the Gorilla and the Aino nose very closely; it is fairly good for Negro, English and

400 *A Study of the Nasal Bridge in the Anthropoid Apes*

Egyptian, roughly we must subtract one point from the calculated to get the actual value of the index; for the Chimpanzee, the Hindoos and the inhabitants of the Philippine and Molucca Islands two points must be subtracted; for those of the Celebes, Borneo, Java and Sumatra three points, for the Veddahs five points, and for the Orang-utan and Gibbon 14 to 20! Thus as we pass from Africa and the region of the Gorilla through Europe to Asia and to the East Indian Islands and the region of the Orang-utan we get roughly a continuous divergence from the catenary hypothesis, which fits the Gorilla, to a markedly non-catenary relation as in the case of the Orang*. While the Aino and Veddah have equal flatness of the nasal bones as measured by the simotic index, they stand at opposite ends of the scale with regard to a catenary hypothesis of the whole bridge of the nose. No attempt, however, is made to deduce any racial order from Table IV although it is not without suggestiveness.

Another method of approaching the degree of relationship of α' to α is to consider the correlation coefficient between them, $r_{\alpha\alpha'}$. A glance at Table XX shows that it is very high. We have, averaging results:

TABLE V. *Correlation $r_{\alpha\alpha'}$.*

<i>Chimpanzees and Orang-utans</i>	...	...	·754
<i>Gibbons (Hylobates)</i>	...	...	·815
East Asiatic Group	...	...	·878
<i>Gorillas</i>	...	...	·906
Negro Group	...	...	·923
Hindoos	...	...	·931
Egyptians and English	...	...	·964
Veddahs	...	...	·965

Finally in order to calculate the value of α from α' for a given individual of one of the races dealt with, we append the regression lines, which provide the most probable value of α for a given α' .

TABLE VI.

Male		Female	
<i>Orang-utans</i>	$a = \cdot6697a' + 12\cdot99$	<i>Orang-utans</i>	$a = \cdot5053a' + 28\cdot98$
<i>Chimpanzees</i>	$a = \cdot6629a' + 8\cdot66$	<i>Chimpanzees</i>	$a = \cdot6096a' + 10\cdot50$
Veddahs	$a = \cdot8324a' + 5\cdot75$	<i>Gorillas</i>	$a = \cdot8404a' + 7\cdot11$
Congo	$a = \cdot8431a' + 4\cdot91$	Egyptians	$a = \cdot8877a' + 4\cdot93$
Egyptians	$a = \cdot9359a' + 2\cdot25$	Gaboon, 1880	$a = \cdot8842a' + 4\cdot28$
Philippine	$a = \cdot9448a' + 1\cdot25$	Gaboon, 1864	$a = \cdot8931a' + 3\cdot94$
Javanese	$a = \cdot9359a' + \cdot82$	English	$a = 1\cdot0037a' + \cdot27$
Gaboon, 1864	$a = \cdot9782a' + \cdot23$	Congo	$a = \cdot9739a' - \cdot36$
English	$a = \cdot9756a' + \cdot22$	"Mixed" Malays	$a = 1\cdot0420a' - 5\cdot76$
Hindoos	$a = \cdot9665a' + \cdot11$	Veddahs	$a = 1\cdot1203a' - 12\cdot71$
Borneo	$a = \cdot9645a' - 1\cdot16$	[<i>Gibbons, Hylobates</i> $\sigma + \phi + \delta$]	$a = \cdot7083a' - 2\cdot41$]
Gaboon, 1880	$a = 1\cdot0045a' - 2\cdot09$		
<i>Gorillas</i>	$a = 1\cdot0750a' - 3\cdot29$		

* The reader will observe (see contours, pp. 428—9) that it is not proper to speak of a catenary form of the nose. The English and Gorilla noses are not at all catenary in contour, but the chord and subtense relation is on the average clearly that of the catenary chord and subtense.

It will be seen that the catenary assumption as to the bridge of the nose, notwithstanding the relatively high correlations of α and α' , is not very satisfactory*. If it were, the best fitting or regression line would be simply $\alpha = \alpha'$. Thus the regression coefficient should be unity and the constant term zero. This is roughly true for English females, less true for English and Hindoo males, and approximately the case in Congo females and Gaboon (1864) males. For the anthropoids the deviations are very considerable, and this is also true for the Vedda's. The catenary form of the nose appears to be an impression largely based on familiarity with the higher racial types. Thus the mesodacryal subtense index α can only be deduced from the mesodacryal arcual index β for *individuals* of the higher races. At the same time Table IV shows that the *racial* value α' of α as deduced from β is very little in excess of the true value for a number of races, and we conclude that the hypothesis has greater value for interracial than for intraracial comparisons†.

(4) *On the Simotic and Mesodacryal Indices.*

If we are going to use these indices as a racial scale, it becomes of some importance to determine which provides the better classification. Unfortunately the simotic index cannot be determined for the Orang-utan. But an examination of Table IX shows that the Chimpanzee is placed at one end, the Gorilla at

* It serves excellently, however, as a control of individual measurements, and when α' is not approximately α it is always worth reconsidering the measurements involved.

† In order to obtain the values of α' from those of β for the catenary hypothesis in the case of the Chimpanzee and Orang-utan, the table published in *Biometrika*, Vol. VIII. pp. 338—9, had to be somewhat extended. The values in Table VII below were obtained.

TABLE VII.

Supplementary Tables for Subtense Mesodacryal Index α as calculated from the arcual value β on the Catenary Hypothesis.

(A) Values of α .

β	$\cdot 0$	$\cdot 1$	$\cdot 2$	$\cdot 3$	$\cdot 4$	$\cdot 5$	$\cdot 6$	$\cdot 7$	$\cdot 8$	$\cdot 9$
6	15.3	15.4	15.6	15.7	15.8	16.0	16.1	16.2	16.3	16.5
7	16.6	16.7	16.8	17.0	17.1	17.2	17.3	17.4	17.6	17.7
8	17.8	17.9	18.0	18.1	18.3	18.4	18.5	18.6	18.7	18.8
9	18.9	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9
10	20.0	20.1	20.2	20.3	20.4	20.6	20.7	20.8	20.9	21.0
11	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	22.0
12	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	23.0

402 *A Study of the Nasal Bridge in the Anthropoid Apes*

the other end of the simotic scale*, while in the case of the mesodacryal indices the Chimpanzee and Gorilla although widely separated from each other are both placed at the low end of the scale next the Negroes, while the Orang-utan appears next the Veddahs at the top of the scale. This appears an arrangement at least more in keeping with geographical relations, although we make no assertion that similarity in nasal form between Veddah and Orang and again between Negro and Gorilla or Chimpanzee is due either to closer descent relationship, or to a common environment compelling species dwelling under it to follow similar nasal developments†. As far as the mesodacryal indices are concerned, English, Egyptian and Hindoo are closer to the Veddah than they are to the Negro, and may in nasal form be considered closer to the Orang than to

TABLE VII. (*continued*).

(B)

β	α	β	α	β	α	β	α	β	α	β	α
101	80.2	126	94.0	151	107.5	176	120.8	201	133.9	226	147.0
102	80.8	127	94.5	152	108.0	177	121.3	202	134.5	227	147.5
103	81.3	128	95.1	153	108.5	178	121.8	203	135.0	228	148.0
104	81.9	129	95.6	154	109.1	179	122.4	204	135.5	229	148.6
105	82.4	130	96.2	155	109.6	180	122.9	205	136.0	230	149.1
106	83.0	131	96.7	156	110.2	181	123.4	206	136.6	231	149.6
107	83.5	132	97.2	157	110.7	182	124.0	207	137.1	232	150.1
108	84.1	133	97.8	158	111.2	183	124.5	208	137.6	233	150.6
109	84.6	134	98.3	159	111.8	184	125.0	209	138.1	234	151.2
110	85.2	135	98.9	160	112.3	185	125.5	210	138.7	235	151.7
111	85.8	136	99.4	161	112.8	186	126.1	211	139.2	236	152.2
112	86.3	137	99.9	162	113.4	187	126.6	212	139.7	237	152.7
113	86.9	138	100.5	163	113.9	188	127.1	213	140.2	238	153.2
114	87.4	139	101.0	164	114.4	189	127.7	214	140.8	239	153.8
115	88.0	140	101.6	165	114.9	190	128.2	215	141.3	240	154.3
116	88.5	141	102.1	166	115.5	191	128.7	216	141.8	241	154.8
117	89.1	142	102.7	167	116.0	192	129.2	217	142.3	242	155.3
118	89.6	143	103.2	168	116.5	193	129.8	218	142.8	243	155.8
119	90.1	144	103.7	169	117.1	194	130.3	219	143.4	244	156.3
120	90.7	145	104.3	170	117.6	195	130.8	220	143.9	245	156.9
121	91.2	146	104.8	171	118.1	196	131.3	221	144.4	246	157.4
122	91.8	147	105.3	172	118.7	197	131.8	222	144.9	247	157.9
123	92.3	148	105.9	173	119.2	198	132.4	223	145.4	248	158.4
124	92.9	149	106.4	174	119.7	199	132.9	224	146.0	249	159.0
125	93.4	150	106.9	175	120.2	200	133.4	225	146.5	250	159.5

* There is slender evidence also to place the Orang-utan out of position below the Chimpanzee and Negroes in the matter of this index.

† Dr Hans Friedenthal (*Beiträge zur Naturgeschichte des Menschen*, Th. v. "Sonderform der menschlichen Leibs-bildung," Jena, 1910, S. 61) considers the nasal form determined by environmental conditions: "Die anthropoiden Affen als Baumbewohner bedurften keiner Vervollkommenung der Atemröhre während der Reduktion des Riechorgans, wie die bodenbewohnenden Menschen und Paviane. Die Gorilla, mehr dem Bodenleben angepasst als die übrigen Anthropoiden, ja, mehr als viele Ostaffen und Westaffen, zeigt eine ausgebildete äussere Nase als Schimpanse, Orang und Hylobates."

TABLE VIII. *Man and the Anthropoid Apes. Means of Nasal Bridge Measurements.*

		Mesodacryal Chord	Mesodacryal Arc	Mesodacryal Subtense	Simotic Chord	Simotic Subtense	Index α	Index α'	Index β	Index S
Males	Congo	50 23.93 ± .26	50 32.39 ± .38	50 9.32 ± .15	50 9.80 ± .21	50 2.48 ± .09	50 39.09 ± .54	50 40.54 ± .57	50 35.48 ± .83	50 25.58 ± 1.73
	Gaboon, 1864	48 23.16 ± .18	48 32.38 ± .28	48 9.91 ± .13	47 9.43 ± .26	47 2.88 ± .11	48 42.91 ± .55	48 43.63 ± .51	48 39.96 ± .75	47 30.90 ± .87
	Gaboon, 1880	16 23.16 ± .46	16 32.64 ± .40	16 9.78 ± .19	16 8.30 ± .40	16 2.30 ± .11	16 42.93 ± 1.29	16 44.82 ± 1.25	16 41.93 ± 1.91	16 29.01 ± 1.49
	Philippine Islands	17 20.31 ± .29	17 28.12 ± .35	17 8.42 ± .24	17 8.42 ± .31	17 2.55 ± .13	17 41.55 ± 1.08	17 42.65 ± .83	17 38.48 ± 1.26	17 30.40 ± 1.09
	Moluccas	8 21.41	8 30.19	8 9.15	8 9.36	8 2.48	8 42.86	8 44.49	8 41.15	8 26.53
	Borneo	26 21.25 ± .32	26 30.06 ± .32	26 8.86 ± .14	26 7.93 ± .24	26 2.33 ± .10	26 42.24 ± 1.06	26 45.00 ± 1.04	26 42.19 ± 1.65	26 30.15 ± 1.24
	Malays	14 21.12 ± .48	14 29.96 ± .64	14 9.23 ± .22	14 7.76 ± .35	14 2.62 ± .17	14 44.16 ± 1.14	14 45.25 ± 1.24	14 42.50 ± 1.90	14 33.71 ± 1.41
	Celebes	9 21.31	9 30.78	9 9.40	9 8.54	9 2.58	9 44.52	9 46.93	9 45.12	9 29.74
	Sumatra	9 22.03	9 32.56	9 9.86	8 10.10	8 2.88	9 44.73	9 48.46	9 47.44	8 29.18
	Java and Madura	39 21.63 ± .23	39 31.36 ± .33	39 9.63 ± .18	39 8.83 ± .22	39 2.99 ± .12	39 44.95 ± .94	39 47.15 ± .95	39 45.60 ± 1.48	39 33.88 ± 1.21
	Nubians*	17 24.21	17 36.49	17 11.72	17 11.45	17 3.74	17 48.47	17 50.37	17 50.60	17 34.07
	Ainos	6 20.88	6 31.42	6 10.42	6 8.80	6 3.80	6 49.92	6 50.28	6 50.45	6 43.37
	Hindoos	10 19.47 ± .44	10 31.20 ± .68	10 10.66 ± .33	10 8.71 ± .35	10 3.78 ± .18	10 54.95 ± 1.54	10 56.74 ± 1.49	10 60.68 ± 2.44	10 44.70 ± 2.25
	English	50 21.47 ± .21	50 34.78 ± .26	50 12.09 ± .11	50 9.38 ± .17	50 4.68 ± .10	50 56.78 ± .71	50 57.97 ± .70	50 62.72 ± 1.16	50 50.83 ± 1.17
	Egyptians	50 21.52 ± .20	50 35.34 ± .23	50 12.34 ± .12	50 10.42 ± .17	50 4.63 ± .10	50 57.82 ± .72	50 59.35 ± .75	50 65.05 ± 1.25	50 44.38 ± .69
	Veddahs	15 20.14 ± .44	15 33.87 ± .69	15 11.43 ± .28	16 9.14 ± .28	16 3.93 ± .15	15 57.08 ± 1.25	15 61.66 ± 1.44	15 68.92 ± 2.41	16 43.58 ± 1.65
	<i>Chimpanzees</i>	33 18.86 ± .33	33 22.99 ± .42	33 5.44 ± .15	13 8.32 ± .34	13 1.78 ± .14	33 28.91 ± .66	33 30.55 ± .67	33 22.02 ± .84	13 21.42 ± 1.43
	<i>Gorillas</i>	27 22.76 ± .52	27 30.78 ± .55	27 9.04 ± .21	21 6.47 ± .30	21 3.31 ± .11	27 40.82 ± 1.26	27 41.03 ± 1.04	27 36.43 ± 1.50	21 56.80 ± 3.26
	<i>Orang-utans</i>	44 15.43 ± .24	44 33.76 ± .57	44 11.16 ± .20	—	—	44 74.45 ± 1.89	44 91.78 ± 2.39	44 122.78 ± 4.38	—
Both Sexes	<i>Gibbons</i> { <i>Hylobates</i> <i>Symphalangus</i>	25 10.54 ± .15 9 13.17	25 16.70 ± .29 9 18.53	25 3.85 ± .13 9 3.89	16 5.33 ± .13 6 6.00	16 0.46 ± .04 6 0.62	25 36.88 ± 1.18 9 28.98	25 55.48 ± 1.36 9 43.20	25 58.87 ± 2.22 9 39.77	16 8.66 ± .75 6 10.15
Females	Congo	27 23.27 ± .26	27 30.81 ± .32	27 8.63 ± .16	25 9.72 ± .35	25 2.41 ± .12	27 37.22 ± .67	27 38.59 ± .60	27 32.60 ± .82	25 25.70 ± 1.37
	Gaboon, 1864	37 22.52 ± .32	37 31.81 ± .37	37 9.82 ± .17	35 9.88 ± .29	35 2.68 ± .11	37 44.01 ± .80	37 44.87 ± .84	37 42.04 ± 1.27	35 27.71 ± .97
	Gaboon, 1880	18 21.84 ± .33	18 31.00 ± .50	18 9.60 ± .24	18 9.46 ± .27	18 2.13 ± .13	18 44.14 ± 1.11	18 45.09 ± 1.21	18 42.34 ± 1.88	18 22.86 ± 1.49
	Philippine Islands	5 19.36	5 28.00	5 8.66	4 8.80	4 2.58	5 44.84	5 47.00	5 45.04	4 29.00
	Borneo	12 19.68 ± .33	12 27.88 ± .43	12 8.00 ± .20	11 7.66 ± .40	11 2.59 ± .19	12 41.07 ± 1.35	12 44.93 ± 1.06	12 41.92 ± 1.61	11 34.71 ± 2.06
	Javanese	6 19.42	6 27.58	6 8.18	6 8.58	6 2.80	6 42.75	6 45.55	6 43.10	6 32.67
	Nubians*	19 23.37	19 32.08	19 9.22	19 11.90	19 2.81	19 40.32	19 42.82	19 38.87	19 23.48
	Hindoos	5 18.90	5 29.00	5 9.24	5 7.86	5 3.02	5 49.38	5 52.50	5 53.74	5 39.06
	English	50 20.55 ± .19	50 31.50 ± .28	50 10.81 ± .12	50 9.10 ± .17	50 4.16 ± .07	50 52.92 ± .63	50 52.45 ± .61	50 53.70 ± .98	50 46.58 ± .77
	Egyptians	50 20.63 ± .25	50 32.04 ± .33	50 10.78 ± .12	50 10.84 ± .16	50 3.97 ± .09	50 52.74 ± .63	50 53.86 ± .69	50 56.02 ± 1.12	50 36.94 ± .79
	Veddahs	12 18.52 ± .44	12 31.83 ± .59	12 10.70 ± .29	12 8.28 ± .33	12 3.08 ± .20	12 59.24 ± 2.44	12 64.23 ± 2.11	12 73.38 ± 3.65	12 36.86 ± 2.62
	<i>Chimpanzees</i>	18 17.63 ± .54	18 21.45 ± .63	18 5.09 ± .20	9 8.07 ± .18	9 1.47 ± .13	18 29.09 ± .96	18 30.50 ± 1.24	18 22.29 ± 1.54	9 18.53 ± 1.73
	<i>Gorillas</i>	25 20.22 ± .51	25 28.58 ± .62	25 8.88 ± .21	19 5.31 ± .23	19 2.82 ± .16	25 44.87 ± 1.16	25 44.94 ± 1.28	25 42.74 ± 1.93	19 55.07 ± 3.15
	<i>Orang-utans</i>	13 11.85 ± .26	13 27.75 ± .65	13 9.29 ± .22	—	—	13 79.24 ± 2.48	13 99.47 ± 3.51	13 136.55 ± 6.50	—

* Mean of results obtained by two sexings.

404 *A Study of the Nasal Bridge in the Anthropoid Apes*

the Chimpanzee, although all the races dealt with are nearer to the Gorilla than either of the two apes. The following table gives the racial order for the simotic and two mesodacryal indices:

TABLE IX.

Simotic and Mesodacryal Indices. Mean Values.*

Simotic Index (S)		Mesodacryal (Subtense) Index (α)		Mesodacryal (Arcual) Index (β)	
♂	♀	♂	♀	♂	♀
[<i>Orang-utans</i> 0?]	[<i>Orang-utans</i> 17?]	—	—	—	—
<i>Chimpanzees</i> 21	<i>Chimpanzees</i> 19	<i>Chimpanzees</i> 29	<i>Chimpanzees</i> 29	<i>Chimpanzees</i> 22	<i>Chimpanzees</i> 22
Congo 26	Nubians† 23	Congo 39	Congo 37	Congo 35	Congo 33
Moluccas 27	—	<i>Gorillas</i> 41	Nubians† 40	<i>Gorillas</i> 36	—
Gaboon, 1880 29	Gaboon, 1880 23	Philippines 42	Borneo 41	Philippines 38	—
Sumatra 29	Congo 26	Borneo 42	Javanese 43	Gaboon, 1864 40	Nubians† 39
Celebes 30	—	Moluccas 43	Gaboon, 1880 44	Moluccas 41	Gaboon, 1864 42
Borneo 30	—	Gaboon, 1864 43	Gaboon, 1864 44	Gaboon, 1880 42	Gaboon, 1880 42
Philippines 30	Gaboon, 1864 28	Gaboon, 1880 43	<i>Gorillas</i> 45	Borneo 42	Borneo 42
Gaboon, 1864 31	Philippines 29	Malays 44	Philippines 45	Malays 43	<i>Gorillas</i> 43
Malays 32	—	Celebes 45	—	Celebes 45	Javanese 43
Javanese 34	Javanese 33	Sumatra 45	—	Javanese 46	Philippines 45
Nubians† 34	Borneo 35	Javanese 45	—	Sumatra 47	—
Ainos 43	—	Nubians† 48	—	Ainos 50	—
Veddahs 44	Veddahs 37	Ainos 50	—	Nubians† 51	—
Egyptians 44	Egyptians 37	Hindoos 55	Hindoos 49	Hindoos 61	Hindoos 54
Hindoos 45	Hindoos 39	English 57	English 53	English 63	English 54
English 51	English 47	Veddahs 57	Egyptians 53	Egyptians 65	Egyptians 56
<i>Gorillas</i> 57	<i>Gorillas</i> 55	Egyptians 58	Veddahs 59	Veddahs 69	Veddahs 73
—	—	<i>Orang-utans</i> 74	<i>Orang-utans</i> 79	<i>Orang-utans</i> 123	<i>Orang-utans</i> 137

Now if we compare the results given in this table we see that with one exception, that of the Borneo crania, the simotic index is greater in the males than in the females; but there is a greater agreement between the sexes—the Hindoos, English and Egyptians excepted—in the mesodacryal indices. For the mesodacryal index, α , there are 7 cases (judging from Table VIII, p. 403) in which the female is greater, as against 7 in which the male is greater; for the mesodacryal index β , there are also 7 cases for the male and 7 for the female with greater value, and

* The following are the values for the Gibbons:

	Simotic Index	Mesodacryal (Subtense) Index	Mesodacryal (Arcual) Index
<i>Gibbons</i> { <i>Hylobates</i> ♂ + ♀ + ♂	9	37	55
{ <i>Symphalangus</i> ♂ + ♀ + ♂	10	29	43

† The position of the “Nubians” confirms the view that the men were more Egyptian and the women almost negroes.

the individual cases are the same for α and β . On the whole it is the lower races for which the female has the greater value, and the higher races—in the scale of civilisation—for which the male has the greater value. Thus the mesodacryal index appears more of a racial and less of a sexual character than the simotic index. Roughly also the two sexes give nearly the same racial order, especially if we regard the large probable errors (see Table VIII, p. 403) of some of our results. Looked at in broad outline we have the nose of the Gorilla closely associated with that of the Negro, and the Negro lies between the Chimpanzee and the Asiatic races. At the bottom of the scale we have the Orang-utans closest of all to the Veddahs, who lie between the Orang-utans and the higher races, so far as such are provided by these measurements*. On the whole the racial scale of the mesodacryal indices seems far more suggestive than that of the simotic index, where the Gorilla is widely separated from the Negro, and is divided from the Veddahs by English, Hindoos and Egyptians†. We believe that a measure of the mesodacryal index is likely to be of as much value as the determination of the simotic index, possibly of greater value.

(5) *On the Absolute Nasal Measurements.*

We are doubtful as to what if any stress can be laid on the absolute measurements. Mérejkowsky, however, cites the absolute values of the simotic subtenses and it is of interest to compare our results with his. This is done in Table X. It will be seen that for Negroes, Malays and "White races" our results are in fair agreement with Mérejkowsky's; with his Melanesian, Polynesian and American groups, we have nothing to compare. There is relatively little difference in the order between the two sexes, but the actual height of the nasal bones, with the one exception of the Borneo crania, is considerably less for the females. This smaller value of the simotic subtense in the female is not true for the chord, which in Nubians, Egyptians, Gaboon (1864), Gaboon (1880), and Philippine Islanders is greater in the female as will be seen in Table XI. There is very little we think to be learnt concerning racial differences in either Table X or Table XI.

The races are mixed in a rather meaningless way—at least we have failed to find any clue to their order, although in this respect the simotic chord appears worse than the simotic subtense. On the whole we believe little of real value is to be learnt from the absolute size of the nasal bones.

* The Gibbons agree with the Orang for the simotic index, but are nearer to the Chimpanzee than to the Orang for the mesodacryal index α , while for the arcual index β their position, like that of the Gorilla, is within the human range.

† Judged by the mesodacryal indices the Gorilla has a flatter nose than any human race, the Negroes approaching most closely; judged by the simotic index the Gorilla has a sharper nose than any human race, the English approaching most closely. At any rate from the standpoint of physiognomy, there can be no doubt that the mesodacryal indices express better the general visual state of affairs: see, however, the contours, pp. 428—9.

406 *A Study of the Nasal Bridge in the Anthropoid Apes*TABLE X. *Simotic Subtense* *.

Males		Females		Sex ?† Mérejkowsky	
<i>Chimpanzees</i>	1·78	<i>Chimpanzees</i>	1·47	—	—
Gaboon, 1880	2·30	Gaboon, 1880	2·13	—	—
Borneo	2·33	Congo	2·41	—	—
Congo	2·45	Philippines	2·58	Negroes	2·60
Moluccas	2·48	—	—	—	—
Philippines	2·55	Borneo	2·59	Mongols	3·00
Celebes	2·58	—	—	—	—
Malays	2·62	—	—	Malays	2·90
Gaboon, 1864	2·88	Gaboon, 1864	2·68	—	—
Sumatra	2·88	—	—	Polynesians	3·13
Javanese	2·99	Javanese	2·80	—	—
<i>Gorillas</i>	3·31	Nubians	2·81	—	—
Nubians	3·74	<i>Gorillas</i>	2·82	—	—
Hindoos	3·78	Hindoos	3·02	—	—
Ainos	3·80	—	—	American Indians	3·80
Veddahs	3·93	Veddahs	3·08	Melanesians	3·85
Egyptians	4·63	Egyptians	3·97	—	—
English	4·68	English	4·16	White races	4·74

TABLE XI. *Simotic Chord* ‡.

Males		Females	
<i>Gorillas</i>	6·47	<i>Gorillas</i>	5·31
Malays	7·76	—	—
Borneo	7·93	Borneo	7·66
Gaboon, 1880	8·30	Hindoos	7·86
<i>Chimpanzees</i>	8·32	<i>Chimpanzees</i>	8·07
Philippines	8·42	Veddahs	8·28
Celebes	8·54	—	—
Hindoos	8·71	Javanese	8·58
Ainos	8·80	—	—
Javanese	8·83	Philippines	8·80
Veddahs	9·14	—	—
Moluccas	9·36	English	9·10
English	9·38	—	—
Gaboon, 1864	9·43	Gaboon, 1880	9·46
Congo	9·80	Congo	9·72
Sumatra	10·10	Gaboon, 1864	9·88
Egyptians	10·42	Egyptians	10·84
Nubians	11·45	Nubians	11·90

* The Gibbons lie at the very top of this scale close to the Orang-utan with its practically zero value of the subtense. Thus for the simotic subtense we have:

$$\text{Gibbons, } \sigma + \varphi + \delta \left\{ \begin{array}{l} \text{Hylobates} \quad 0\cdot46 \\ \text{Symphalangus} \quad 0\cdot62 \end{array} \right.$$

† Apparently Mérejkowsky mixes both sexes together, which is hardly permissible considering the large sexual differences.

$$\ddagger \quad \text{Gibbons, } \sigma + \varphi + \delta \left\{ \begin{array}{l} \text{Hylobates} \quad 5\cdot33 \\ \text{Symphalangus} \quad 6\cdot00 \end{array} \right.$$

(6) *On the Absolute Mesodacryal Measurements.*

The following table gives the order for the mesodacryal subtense, chord and arc:

TABLE XII.

Racial Order of Mesodacryal Measurements.

SUBTENSE				CHORD				ARC			
♂		♀		♂		♀		♂		♀	
<i>Chimpanzees</i>	5.44	<i>Chimpanzees</i>	5.09	<i>Orangs</i>	15.4	<i>Orangs</i>	11.9	<i>Chimpanzees</i>	23.0	<i>Chimpanzees</i>	21.4
Philippines	8.42	Borneo	8.00	<i>Chimpanzees</i>	18.9	<i>Chimpanzees</i>	17.6	Philippines	28.1	Javanese	27.6
Borneo	8.86	Javanese	8.18	Hindoos	19.5	Veddahs	18.5	Malays	30.0	—	—
<i>Gorillas</i>	9.04	Congo	8.63	Veddahs	20.1	Hindoos	18.9	Borneo	30.1	<i>Orangs</i>	27.8
Moluccas	9.15	—	—	Philippines	20.3	Philippines	19.4	Moluccas	30.2	Borneo	27.9
Malays	9.23	—	—	Ainos	20.9	—	—	Celebes	30.8	—	—
Congo	9.32	Philippines	8.66	Malays	21.1	Javanese	19.4	<i>Gorillas</i>	30.8	Philippines	28.0
Celebes	9.40	—	—	Borneo	21.2	—	—	Hindoos	31.2	<i>Gorillas</i>	28.6
Javanese	9.63	<i>Gorillas</i>	8.88	Celebes	21.3	—	—	Ainos	31.4	—	—
Gaboon (1880)	9.78	Nubians	9.22	Moluccas	21.4	Borneo	19.7	Javanese	31.4	Hindoos	29.0
Sumatra	9.86	—	—	English	21.5	<i>Gorillas</i>	20.2	Gaboon (1864)	32.4	Congo	30.8
Gaboon (1864)	9.91	Hindoos	9.24	Egyptians	21.5	English	20.6	Congo	32.4	Gaboon (1880)	31.0
Ainos	10.42	—	—	Javanese	21.6	—	—	Sumatra	32.6	—	—
Hindoos	10.66	<i>Orangs</i>	9.29	Sumatra	22.0	—	—	Gaboon (1880)	32.6	—	—
<i>Orangs</i>	11.16	Gaboon (1880)	9.60	<i>Gorillas</i>	22.8	Egyptians	20.6	<i>Orangs</i>	33.8	English	31.5
Veddahs	11.43	Gaboon (1864)	9.82	Gaboon (1864)	23.2	Gaboon (1880)	21.8	Veddahs	33.9	Veddahs	31.8
Nubians	11.72	Veddahs	10.70	Gaboon (1880)	23.2	Gaboon (1864)	22.5	English	34.8	Gaboon (1864)	31.8
English	12.09	Egyptians	10.78	Congo	23.9	Congo	23.3	Egyptians	35.3	Egyptians	32.0
Egyptians	12.34	English	10.81	Nubians	24.2	Nubians	23.4	Nubians	36.5	Nubians	32.1
<i>Gibbons</i> , ♂ + ♀ + ♂ { <i>Hylobates</i> 3.85 <i>Symphalangus</i> 3.89				<i>Gibbons</i> , ♂ + ♀ + ♂ { <i>Hylobates</i> 10.54 <i>Symphalangus</i> 13.12				<i>Gibbons</i> , ♂ + ♀ + ♂ { <i>Hylobates</i> 16.70 <i>Symphalangus</i> 18.53			

408 *A Study of the Nasal Bridge in the Anthropoid Apes*

Now we have already seen that the sexual differences in the mesodacryal indices are not very large, but we notice at once that these sexual differences are very considerable in the absolute measurements. It becomes rather meaningless to assert that the Hindoo's eyes are closer together than the Englishman's, when the difference in mesodacryal chord is less than that between male and female Javanese. They are less for the same reason, namely, because the cranium as a whole is smaller. Practically the female is less—and often very considerably less—in every mesodacryal absolute measurement, and we cannot usefully compare males and females—except as to absolute size, a sexual difference we are already familiar with—unless we get rid of this problem of size by using as we have already done the indices. But surely if this be true for sex, it is also true for race. Our scales become scales of absolute size and of very small racial significance. In all probability absolute lengths or breadths of the head would tell just as much as is to be learnt from these tables of relative racial sizes of the bridge of the nose. In our opinion there is little that has bearing on racial relationships. In, for example, the chord scales, it is possible that Veddah and Orang-utans are close together because of an ancestral link, but the Hindoo appears in this part of the scale because of his small size. The association of the Negroes with the Gorillas may again be partly ancestral, but the association of English and Javanese in the same part of the scale as the Gorillas is probably fortuitous. We are inclined to say that very little indeed can be deduced from absolute scales of this kind for nasal characters.

It is often asserted that a characteristic feature of the negro lies in the fact that he has his eyes farther apart than other races of man. The average value of the mesodacryal chord for the Congo and Gaboon male negroes is 23·5 and for English and Egyptians 21·5; for the females, Congo and Gaboon, it is 22·6, and for English and Egyptians 20·6. There is thus 2 mm. difference on the average. Is it possible for the human eye to appreciate this difference? We are inclined to doubt it and believe that it is the marked simotic platygephyrosis (see p. 430 below) of the negro nose which produces largely the impression of greater ocular

Value of Ratio $100 \times \text{Mesodacryal Chord}/\text{Minimum Forehead Breadth}$.

Race	♂	♀
Congo	24·6	25·1
Gaboon, 1864 ...	24·0	24·3
Gaboon, 1880 ...	23·5	23·5
Egyptians	22·6	22·4
Veddahs	22·0	21·2
English	21·9	22·1
Hindoos	21·3	21·0

breadth*. As the total size of the skull varies much from race to race it seems desirable to compare the mesodacryal chord with another horizontal measure and we have taken the minimum forehead breadth: see Table, p. 408.

It will be seen that the Negroes stand at one end of the list and the Indo-Europeans at the other, but again the change of index is relatively small, and it may be legitimately doubted whether it would be visually significant.

(7) *On the relative Racial Variability of the Nasal Bridge Characters.*

Tables XIII and XIV give respectively the Standard Deviations and the Coefficients of Variation of the characters determined in such series as supplied sufficient data for even an attempt at these constants. There is no doubt in our minds that the coefficient of variation is the better measure for racial purposes in the case of absolute measurements. We will consider first what points arise from a discussion of the variability of the mesodacryal subtense, chord and arc from this standpoint. The relative orders of variability are given in Table XV.

Again beyond the broad fact that the apes on the whole are far more variable than the races of men, perhaps little can be learnt from this table. In the apes the female is more variable than the male in 5 out of 9 cases; the same ratio of 5 to 4 is maintained in the case of the negro races; in the lower races from Borneo and the Veddahs, the males are more variable than the females in the ratio of 5 cases to 1, while in the higher races—Egyptian and English—the ratio is 5 cases of the female to 1 case of the male more variable. Altogether therefore the female is more variable in 16 and the male in 14 cases. Generally there is no evidence for greater male variation in these coefficients of variation of the mesodacryal absolute lengths. Even if we based our comparison on the absolute variations of the mesodacryal characters, we find among the apes the male is more variable in 5 the female in 3, with one case—the Chimpanzee mesodacryal subtense—of equality; in the lower races (Veddahs and Borneo) the male is more variable in all 6 cases; in the negro races in 5 out of 9, but in the higher races (English and Egyptian) in only 1 out of 6 cases. Thus in absolute measurement the male is more variable in 17, the female in 12 cases.

* The reader must not judge from Figs. 6—9 of the contours, pp. 428—9. These all have the mesodacryal chord in considerable excess of the negro mean, and were selected to give approximately mean angles, not mean absolute lengths.

TABLE XIII. *Man and Anthropoid Apes. Nasal Bridge Characters. Standard Deviations.*

		Mesodacryal Chord	Mesodacryal Arc	Mesodacryal Subtense	Simotic Chord	Simotic Subtense	Index α	Index α'	Index β	Index S
Males	Congo ...	50 2.70 ± .18	50 4.02 ± .27	50 1.53 ± .10	50 2.24 ± .15	50 .91 ± .06	50 5.67 ± .38	50 5.92 ± .40	50 8.67 ± .58	50 7.64 ± .52
	Gaboon, 1864 ...	48 1.89 ± .13	48 2.86 ± .20	48 1.37 ± .09	47 2.66 ± .18	47 1.08 ± .07	48 5.65 ± .39	48 5.22 ± .36	48 7.75 ± .53	47 8.82 ± .61
	Gaboon, 1880 ...	16 2.70 ± .32	16 2.37 ± .28	16 1.11 ± .13	16 2.38 ± .28	16 .67 ± .08	16 7.63 ± .91	16 7.43 ± .89	16 11.32 ± 1.35	16 8.81 ± 1.05
	Philippine Islands	17 1.76 ± .20	17 2.15 ± .25	17 1.47 ± .17	17 1.91 ± .22	17 .80 ± .09	17 6.60 ± .76	17 5.08 ± .59	17 7.68 ± .89	17 6.64 ± .77
	Borneo ...	26 2.39 ± .22	26 2.43 ± .23	26 1.08 ± .10	26 1.81 ± .17	26 .77 ± .07	26 8.01 ± .75	26 7.85 ± .73	26 12.49 ± 1.17	26 9.35 ± .88
	Malays ...	14 2.67 ± .34	14 3.53 ± .45	14 1.24 ± .16	14 1.93 ± .25	14 .95 ± .12	14 6.34 ± .81	14 6.90 ± .88	14 10.55 ± 1.34	14 7.81 ± 1.00
	Java and Madura	39 2.10 ± .16	39 3.05 ± .23	39 1.68 ± .13	39 2.04 ± .16	39 1.15 ± .09	39 8.74 ± .67	39 8.81 ± .67	39 13.72 ± 1.05	39 11.20 ± .86
	Hindoos ...	10 2.04 ± .31	10 3.20 ± .48	10 1.54 ± .23	10 1.62 ± .24	10 .83 ± .13	10 7.23 ± 1.09	10 6.97 ± 1.05	10 11.46 ± 1.73	10 10.55 ± 1.59
	English ...	50 2.16 ± .15	50 2.71 ± .18	50 1.20 ± .08	50 1.77 ± .12	50 1.04 ± .07	50 7.47 ± .50	50 7.32 ± .49	50 12.19 ± .82	50 12.21 ± .82
	Egyptians ...	50 2.05 ± .14	50 2.45 ± .17	50 1.21 ± .08	50 1.75 ± .12	50 1.07 ± .07	50 7.57 ± .51	50 7.89 ± .53	50 13.07 ± .88	50 7.27 ± .49
	Veddahs ...	15 2.51 ± .31	15 3.95 ± .49	15 1.61 ± .20	16 1.68 ± .20	16 .90 ± .11	15 7.16 ± .88	15 8.24 ± 1.01	15 13.86 ± 1.71	16 9.77 ± 1.16
	<i>Chimpanzees</i> ...	33 2.81 ± .23	33 3.61 ± .30	33 1.27 ± .11	13 1.82 ± .24	13 .73 ± .10	33 5.65 ± .47	33 5.74 ± .48	33 7.13 ± .59	13 7.64 ± 1.01
	<i>Gorillas</i> ...	27 3.97 ± .36	27 4.23 ± .39	27 1.66 ± .15	21 2.01 ± .21	21 .73 ± .08	27 9.69 ± .89	27 8.00 ± .73	27 11.56 ± 1.06	21 22.15 ± 2.30
	<i>Orang-utans</i> ...	44 2.35 ± .17	44 5.56 ± .40	44 1.93 ± .14	—	—	44 18.63 ± 1.34	44 23.49 ± 1.69	44 43.04 ± 3.09	—
Both Sexes	<i>Gibbons, Hylobates</i>	25 1.13 ± .11	25 2.12 ± .20	25 0.85 ± .08	16 0.77 ± .09	16 0.26 ± .03	25 8.74 ± .83	25 10.06 ± .96	25 16.43 ± 1.57	16 4.48 ± .53
Females	Congo ...	27 2.00 ± .18	27 2.43 ± .22	27 1.20 ± .11	25 2.58 ± .25	25 .90 ± .09	27 5.15 ± .47	27 4.58 ± .42	27 6.35 ± .58	25 10.15 ± .97
	Gaboon, 1864 ...	37 2.86 ± .22	37 3.35 ± .26	37 1.51 ± .12	35 2.57 ± .21	35 .92 ± .07	37 7.19 ± .56	37 7.61 ± .60	37 11.49 ± .90	35 8.47 ± .68
	Gaboon, 1880 ...	18 2.10 ± .24	18 3.15 ± .35	18 1.52 ± .17	18 1.69 ± .19	18 .83 ± .09	18 7.00 ± .78	18 7.60 ± .85	18 11.84 ± 1.33	18 9.38 ± 1.05
	Borneo ...	12 1.69 ± .23	12 2.23 ± .31	12 1.01 ± .14	11 1.94 ± .28	11 .95 ± .14	12 6.94 ± .96	12 5.46 ± .75	12 8.24 ± 1.13	11 10.15 ± 1.46
	English ...	50 2.04 ± .14	50 2.90 ± .20	50 1.27 ± .09	50 1.81 ± .12	50 .78 ± .05	50 6.64 ± .45	50 6.36 ± .43	50 10.25 ± .69	50 8.09 ± .55
	Egyptians ...	50 2.59 ± .17	50 3.47 ± .23	50 1.22 ± .08	50 1.66 ± .11	50 .90 ± .06	50 6.62 ± .45	50 7.19 ± .49	50 11.76 ± .79	50 8.24 ± .56
	Veddahs ...	12 2.27 ± .31	12 3.04 ± .42	12 1.49 ± .21	12 1.72 ± .24	12 1.03 ± .14	12 12.52 ± 1.72	12 10.86 ± 1.49	12 18.77 ± 2.58	12 13.45 ± 1.85
	<i>Chimpanzees</i> ...	18 3.38 ± .38	18 3.93 ± .44	18 1.27 ± .14	9 .82 ± .13	9 .58 ± .09	18 6.05 ± .68	18 7.77 ± .87	18 9.70 ± 1.09	9 7.69 ± 1.22
	<i>Gorillas</i> ...	25 3.75 ± .36	25 4.57 ± .44	25 1.59 ± .15	19 1.51 ± .17	19 1.04 ± .11	25 8.61 ± .82	25 9.47 ± .90	25 14.27 ± 1.36	19 20.33 ± 2.22
	<i>Orang-utans</i> ...	13 1.37 ± .18	13 3.49 ± .46	13 1.20 ± .16	—	—	13 13.27 ± 1.76	13 18.78 ± 2.48	13 34.72 ± 4.59	—

TABLE XIV. *Man and Anthropoid Apes. Nasal Bridge Characters. Coefficients of Variation.*

		Mesodacryal Chord	Mesodacryal Arc	Mesodacryal Subtense	Simotic Chord	Simotic Subtense	Index α	Index α'	Index β	Index S
Males	Congo ...	50 11.28 ± .77	50 12.41 ± .85	50 16.44 ± 1.14	50 22.89 ± 1.62	50 36.85 ± 2.80	50 14.49 ± 1.00	50 14.61 ± 1.01	50 24.43 ± 1.74	50 29.87 ± 2.19
	Gaboon, 1864 ...	48 8.15 ± .56	48 8.83 ± .61	48 13.84 ± .97	47 28.15 ± 2.11	47 37.35 ± 2.94	48 13.16 ± .92	48 11.98 ± .84	48 19.39 ± 1.38	47 28.54 ± 2.14
	Gaboon, 1880 ...	16 11.67 ± 1.41	16 7.28 ± .87	16 11.33 ± 1.37	16 28.66 ± 3.69	16 29.29 ± 3.78	16 17.77 ± 2.18	16 16.57 ± 2.03	16 26.99 ± 3.44	16 30.37 ± 3.94
	Philippine Islands	17 8.67 ± 1.01	17 7.63 ± .89	17 17.42 ± 2.08	17 22.68 ± 2.76	17 31.27 ± 3.95	17 15.89 ± 1.88	17 11.92 ± 1.40	17 19.97 ± 2.40	17 21.84 ± 2.64
	Borneo ...	26 11.23 ± 1.06	26 8.09 ± .76	26 12.22 ± 1.16	26 22.78 ± 2.24	26 32.86 ± 3.39	26 18.97 ± 1.84	26 17.45 ± 1.68	26 29.61 ± 3.00	26 31.03 ± 3.17
	Malays ...	14 12.64 ± 1.64	14 11.77 ± 1.52	14 13.45 ± 1.75	14 24.81 ± 3.35	14 36.32 ± 5.20	14 14.36 ± 1.87	14 15.24 ± 1.99	14 24.82 ± 3.35	14 23.16 ± 3.11
	Java and Madura	39 9.72 ± .75	39 9.73 ± .75	39 17.46 ± 1.37	39 23.06 ± 1.85	39 38.38 ± 3.34	39 19.45 ± 1.54	39 18.70 ± 1.48	39 30.10 ± 2.50	39 33.06 ± 2.79
	Hindoos ...	10 10.49 ± 1.60	10 10.27 ± 1.56	10 14.48 ± 2.23	10 18.60 ± 2.90	10 21.94 ± 3.46	10 13.16 ± 2.02	10 12.29 ± 1.88	10 18.88 ± 2.95	10 23.60 ± 3.75
	English ...	50 10.04 ± .68	50 7.80 ± .53	50 9.93 ± .68	50 18.85 ± 1.32	50 22.13 ± 1.56	50 13.16 ± .90	50 12.63 ± .87	50 19.43 ± 1.36	50 24.03 ± 1.71
	Egyptians ...	50 9.51 ± .65	50 6.93 ± .47	50 9.80 ± .67	50 16.84 ± 1.17	50 23.10 ± 1.64	50 13.09 ± .90	50 13.29 ± .91	50 20.09 ± 1.41	50 16.38 ± 1.13
	Veddahs ...	15 12.45 ± 1.56	15 11.67 ± 1.46	15 14.12 ± 1.77	16 18.35 ± 2.26	16 23.04 ± 2.89	15 12.54 ± 1.57	15 13.37 ± 1.68	15 20.11 ± 2.57	16 22.42 ± 2.80
	<i>Chimpanzees</i> ...	33 14.91 ± 1.27	33 15.72 ± 1.34	33 23.34 ± 2.04	13 21.88 ± 3.03	13 41.07 ± 6.28	33 19.53 ± 1.68	33 18.80 ± 1.62	33 32.39 ± 2.96	13 35.69 ± 5.29
	<i>Gorillas</i> ...	27 17.46 ± 1.65	27 13.75 ± 1.29	27 18.31 ± 1.74	21 31.12 ± 3.54	21 21.96 ± 2.39	27 23.74 ± 2.30	27 19.51 ± 1.86	27 31.74 ± 3.19	21 38.99 ± 4.63
	<i>Orang-utans</i> ...	44 15.22 ± 1.12	44 16.46 ± 1.22	44 17.28 ± 1.28	—	—	44 25.02 ± 1.91	44 25.60 ± 1.96	44 35.06 ± 2.81	—
Both Sexes	<i>Gibbons, Hylobates</i>	25 10.67 ± 1.03	25 12.69 ± 1.23	25 22.05 ± 2.20	16 14.49 ± 1.76	16 57.15 ± 8.76	25 23.70 ± 2.38	25 18.13 ± 1.79	25 27.90 ± 2.86	16 51.72 ± 7.64
Females	Congo ...	27 8.61 ± .80	27 7.89 ± .73	27 13.86 ± 1.30	25 26.58 ± 2.71	25 37.33 ± 4.03	27 13.84 ± 1.29	27 11.88 ± 1.11	27 19.48 ± 1.85	25 39.47 ± 4.31
	Gaboon, 1864 ...	37 12.68 ± 1.01	37 10.54 ± .84	37 15.34 ± 1.23	35 25.97 ± 2.23	35 34.50 ± 3.09	37 16.34 ± 1.32	37 16.95 ± 1.37	37 27.34 ± 2.30	35 30.58 ± 2.69
	Gaboon, 1880 ...	18 9.60 ± 1.09	18 10.17 ± 1.16	18 15.78 ± 1.82	18 17.88 ± 2.07	18 39.15 ± 5.03	18 15.87 ± 1.83	18 16.85 ± 1.95	18 27.97 ± 3.38	18 41.04 ± 5.33
	Borneo ...	12 8.60 ± 1.19	12 7.99 ± 1.11	12 12.56 ± 1.76	11 25.35 ± 3.87	11 36.59 ± 5.93	12 16.89 ± 2.39	12 12.15 ± 1.70	12 19.66 ± 2.81	11 29.24 ± 4.55
	English ...	50 9.93 ± .68	50 9.21 ± .63	50 11.74 ± .80	50 19.85 ± 1.39	50 18.83 ± 1.31	50 12.55 ± .86	50 12.14 ± .83	50 19.09 ± 1.33	50 17.36 ± 1.21
	Egyptians ...	50 12.57 ± .86	50 10.83 ± .74	50 11.32 ± .77	50 15.28 ± 1.05	50 22.78 ± 1.61	50 12.56 ± .86	50 13.35 ± .92	50 21.00 ± 1.48	50 22.32 ± 1.58
	Veddahs ...	12 12.28 ± 1.72	12 9.56 ± 1.33	12 13.95 ± 1.96	12 20.71 ± 2.97	12 33.44 ± 5.09	12 21.13 ± 3.04	12 16.90 ± 2.39	12 25.57 ± 3.74	12 36.48 ± 5.65
	<i>Chimpanzees</i> ...	18 19.19 ± 2.24	18 18.33 ± 2.13	18 24.95 ± 2.97	9 10.11 ± 1.62	9 39.22 ± 7.13	18 20.79 ± 2.44	18 25.48 ± 3.05	18 43.51 ± 5.74	9 41.48 ± 7.65
	<i>Gorillas</i> ...	25 18.56 ± 1.83	25 16.00 ± 1.57	25 17.91 ± 1.76	19 28.40 ± 3.35	19 36.98 ± 4.57	25 19.19 ± 1.90	25 21.07 ± 2.10	25 33.40 ± 3.52	19 36.91 ± 4.56
	<i>Orang-utans</i> ...	13 11.54 ± 1.55	13 12.58 ± 1.69	13 12.88 ± 1.73	—	—	13 16.75 ± 2.28	13 18.88 ± 2.59	13 25.43 ± 3.57	—

TABLE XV.
Variability Scales for Mesodacryal Characters.*

Subtense		Chord		Arc	
♂	♀	♂	♀	♂	♀
Egyptians 9·8	Egyptians 11·3	Gaboon (1864) 8·2	Borneo 8·6	Egyptians 6·9	Congo 7·9
English 9·9	English 11·7	Philippines 8·7	—	Gaboon (1880) 7·3	Borneo 8·0
Gaboon (1880) 11·3	Borneo 12·6	Egyptians 9·5	Congo 8·6	Philippines 7·6	—
Borneo 12·2	<i>Orangs</i> 12·9	Javanese 9·7	—	English 7·8	English 9·2
Malays 13·5	—	English 10·0	Gaboon (1880) 9·6	Borneo 8·1	Veddahs 9·6
Gaboon (1864) 13·8	Congo 13·9	Hindoos 10·5	—	Gaboon (1864) 8·8	Gaboon (1880) 10·2
Veddahs 14·1	Veddahs 14·0	Borneo 11·2	English 9·9	Javanese 9·7	—
Hindoos 14·5	—	Congo 11·3	<i>Orangs</i> 11·5	Hindoos 10·3	—
Congo 16·4	Gaboon (1864) 15·3	Gaboon (1880) 11·7	Veddahs 12·3	Veddahs 11·7	Gaboon (1864) 10·5
Philippines 17·4	—	Veddahs 12·5	Egyptians 12·6	Malays 11·8	—
<i>Orangs</i> 17·3	—	Malays 12·6	Gaboon (1864) 12·7	Congo 12·4	Egyptians 10·8
Javanese 17·5	Gaboon (1880) 15·8	<i>Chimpanzees</i> 14·9	—	<i>Gorillas</i> 13·8	<i>Orangs</i> 12·6
<i>Gorillas</i> 18·3	<i>Gorillas</i> 17·9	<i>Orangs</i> 15·2	<i>Gorillas</i> 18·6	<i>Chimpanzees</i> 15·7	<i>Gorillas</i> 16·0
<i>Chimpanzees</i> 23·3	<i>Chimpanzees</i> 25·0	<i>Gorillas</i> 17·5	<i>Chimpanzees</i> 19·2	<i>Orangs</i> 16·5	<i>Chimpanzees</i> 18·3

* The values for Hylobates are for both sexes together :

Subtense 22·1 | Chord 10·7 | Arc 12·7

For the simotic chord and subtense we have :

TABLE XVI.

Order of Racial Variability for Simotic Characters.*

Simotic Subtense				Simotic Chord			
♂		♀		♂		♀	
Hindoos	21.9	—	—	Egyptians	16.8	<i>Chimpanzees</i>	10.10
<i>Gorillas</i>	22.0	English	18.8	Veddahs	18.4	Egyptians	15.3
English	22.1	Egyptians	22.8	Hindoos	18.6	—	—
Veddahs	23.0	Veddahs	33.4	English	18.9	Gaboon (1880)	17.9
Egyptians	23.1	Gaboon (1864)	34.5	<i>Chimpanzees</i>	21.9	English	19.9
Gaboon (1880)	29.3	Borneo	36.6	Philippines	22.7	—	—
Philippines	31.3	—	—	Borneo	22.8	Veddahs	20.7
Borneo	32.9	<i>Gorillas</i>	37.0	Congo	22.9	Borneo	25.4
Malays	36.3	—	—	Javanese	23.1	—	—
Congo	36.9	Congo	37.3	Malays	24.8	—	—
Gaboon (1864)	37.4	Gaboon (1880)	39.2	Gaboon (1864)	28.2	Gaboon (1864)	26.0
Javanese	38.4	—	—	Gaboon (1880)	28.7	Congo	26.6
<i>Chimpanzees</i>	41.1	<i>Chimpanzees</i>	39.2	<i>Gorillas</i>	31.1	<i>Gorillas</i>	28.4

Again there is practically little to be learnt, the *Gorillas* are very variable in nasal chord and much less variable (in scale position) on the subtense, while the reverse holds for the *Chimpanzees*, the subtense being far more variable than the chord. The Negroes are as a rule low down on the scale, being considerably more variable than the English, Egyptians or Hindoos. In 9 cases the female and in 9 the male is more variable in simotic characters.

Lastly we pass to the indices, omitting the calculated mesodacryal subtense index α' . We find for Standard Deviations the order given in Table XVII.

Again there seems little to be learnt with regard to racial variability from these results, beyond the confirmation of what we have learnt from the earlier tables that the Orangs, and the *Gorillas* as a rule, have large variability; here, however,—as distinguished from the coefficients of variation of the absolute lengths—the *Chimpanzee* is seen to have very small variability. If, however, we take the coefficients of variation of the indices we find the *Chimpanzee* is associated with the other two anthropoids of our scales in high variability. Turning to the sexual differences, we find in the apes as many cases (4) of female as of male greater variability; among the human races there are 10 cases in which the female is more variable and 11 cases in which the male is more variable, or again there is little if any distinction of sex in variability.

An examination of Tables XIII and XIV will show the reader that much of the non-significance of the variation scale for racial purposes is quite possibly due

* The values for *Hylobates*, both sexes together, are: simotic chord 14.5 and simotic arc 57.2.

TABLE XVII.
Order of Standard Deviations of Nasal Bridge Indices.*

Mesodacryal Subtense Index				Mesodacryal Arcual Index				Simotic Index			
♂		♀		♂		♀		♂		♀	
<i>Chimpanzees</i>	5·65	Congo	5·15	<i>Chimpanzees</i>	7·13	Congo	6·35	Philippines	6·64	—	
Gaboon (1864)	5·65	<i>Chimpanzees</i>	6·05	Philippines	7·68	—		Egyptians	7·27	<i>Chimpanzees</i>	7·69
Congo	5·67	Egyptians	6·62	Gaboon (1864)	7·75	Borneo	8·24	Congo	7·64	English	8·09
Malays	6·34	—		Congo	8·67	<i>Chimpanzees</i>	9·70	<i>Chimpanzees</i>	7·64	Egyptians	8·24
Philippines	6·60	—		Malays	10·55	—		Malays	7·81	—	
Veddahs	7·16	English	6·64	Gaboon (1880)	11·32	English	10·25	Gaboon (1880)	8·81	Gaboon (1864)	8·47
Hindoos	7·23	—		Hindoos	11·46	—		Gaboon (1864)	8·82	Gaboon (1880)	9·38
English	7·47	Borneo	6·94	<i>Gorillas</i>	11·56	Gaboon (1864)	11·49	Borneo	9·35	Congo	10·15
Egyptians	7·57	Gaboon (1880)	7·00	English	12·19	Egyptians	11·76	Veddahs	9·77	Borneo	10·15
Gaboon (1880)	7·63	Gaboon (1864)	7·19	Borneo	12·49	Gaboon (1880)	11·84	Hindoos	10·55	—	
Borneo	8·01	<i>Gorillas</i>	8·61	Egyptians	13·07	<i>Gorillas</i>	14·27	Javanese	11·20	—	
Javanese	8·74	—		Javanese	13·72	—		English	12·21	Veddahs	13·45
<i>Gorillas</i>	9·69	Veddahs	12·52	Veddahs	13·86	Veddahs	18·77	<i>Gorillas</i>	22·15	<i>Gorillas</i>	20·33
<i>Orangs</i>	18·63	<i>Orangs</i>	13·27	<i>Orangs</i>	43·04	<i>Orangs</i>	34·72	—		—	

* The values for Hylobates, both sexes together, are : Mesodacryal (Subtense) Index 8·7, Mesodacryal (Arcual) Index 10·1, Simotic Index 51·7.

to the smallness of our samples. Except in the case of Egyptians and English, the size of these samples was not under our control; we set out to compare the African and Asiatic anthropoids with the human races of the same environment, and we measured all the crania available, and calculated the variabilities for all series of 10 and over*. Further the homogeneity of some of the series, as the Malay and Javanese, is possibly open to doubt. We have accordingly clubbed together our variation results for the coefficients of variation of the absolute measurements, with the results given in Table XVIII.

TABLE XVIII.

Average Values of Variability of Absolute Measurements on the Nasal Bridge.

With Simotic Lengths			Without Simotic Lengths		
	♂	♀		♂	♀
<i>Chimpanzees</i> ...	23·4	22·4	<i>Chimpanzees</i> ...	18·0	20·8
<i>Gorillas</i> ...	20·5	23·6	<i>Gorillas</i> ...	16·5	17·5
<i>Orangs</i> ...	—	—	<i>Orangs</i> ...	16·3	12·3
[<i>Hylobates</i> ♂ + ♀ 23·4]			[<i>Hylobates</i> ♂ + ♀ 15·1]		
Mean 22·5†			Mean 16·9†		
Malays ...	19·8	—	Malays ...	12·6	—
Javanese ...	19·7	—	Javanese ...	12·3	—
Mean 19·8			Mean 12·5		
Congo ...	20·0	18·9	Congo ...	13·5	10·1
Gaboon (1864)	19·3	19·8	Gaboon (1864)	10·3	12·9
Gaboon (1880)	17·6	18·5	Gaboon (1880)	10·1	11·9
Mean 19·0			Mean 11·5		
Philippines ...	17·5	—	Philippines ...	11·2	—
Borneo... ..	17·4	18·2	Borneo... ..	10·5	9·7
Mean 17·4			Mean 10·5		
Veddahs ...	15·9	18·0	Veddahs ...	12·7	11·9
Hindoos ...	15·2	—	Hindoos ...	11·7	—
Mean 16·4			Mean 12·1		
Egyptians ...	13·2	14·6	Egyptians ...	8·7	11·5
English ...	13·7	13·9	English ...	9·3	10·3
Mean 13·8			Mean 10·0		
<i>General Means</i>	17·9	18·7	<i>General Means</i>	12·5	12·9

* Nubians excepted: these were included at a later date.

† *Hylobates* not included.

416 *A Study of the Nasal Bridge in the Anthropoid Apes*

Whether we take the number of cases in which the female is more variable than the male—i.e. 7 out of 9 in the first series and 6 out of 10 in the second—or the mean variabilities of the whole series, we see that the female is certainly not less variable than the male.

Massed as above the table seems to show more racial relationship to variability. The races group better together, and generally speaking—Veddahs, perhaps, excepted—there is decreasing variability as we reach higher degrees of civilisation, i.e. as we pass from the Apes through East Asiatics and Negroes to Hindoo, Ancient Egyptian and English. It is as well to see if these results correspond with those for the two mesodacryal and the simotic indices.

It will be seen in the first place that these results (Table XIX) confirm those of the previous table (XVIII) for the variation of the absolute lengths, in that

TABLE XIX.

Average Values of Variability of Indices of Nasal Bridge (α , β and S)

From Standard Deviations			From Coefficients of Variation		
	♂	♀		♂	♀
<i>Chimpanzees</i> ...	6·8	7·8	<i>Chimpanzees</i> ...	29·2	35·3
<i>Gorillas</i> ...	14·5	14·4	<i>Gorillas</i> ...	31·5	29·8
<i>Orangs</i> ...	30·8	24·0	<i>Orangs</i> ...	30·0	21·1
[<i>Hylobates</i> ♂ + ♀ 9·9]			[<i>Hylobates</i> ♂ + ♀ 30·4]		
<i>Mean</i> 16·4*			<i>Mean</i> 29·5*		
Malays ...	8·2	—	Malays ...	20·8	—
Javanese ...	11·2	—	Javanese ...	27·5	—
<i>Mean</i> 9·7			<i>Mean</i> 24·2		
Congo ...	7·3	7·2	Congo ...	22·9	24·3
Gaboon (1864)	7·4	9·1	Gaboon (1864)	20·4	24·8
Gaboon (1880)	9·3	9·4	Gaboon (1880)	25·0	28·3
<i>Mean</i> 8·3			<i>Mean</i> 24·3		
Philippines ...	7·0	—	Philippines ...	19·2	—
Borneo... ..	10·0	8·4	Borneo... ..	28·5	21·9
<i>Mean</i> 8·5			<i>Mean</i> 23·2		
Veddahs ...	10·3	14·9	Veddahs ...	18·4	27·7
Hindoos ...	9·7	—	Hindoos ...	18·5	—
<i>Mean</i> 11·6			<i>Mean</i> 21·5		
Egyptians ...	9·3	8·9	Egyptians ...	16·5	18·6
English ...	10·6	8·3	English ...	18·9	16·3
<i>Mean</i> 9·3			<i>Mean</i> 17·6		
<i>General Means</i>	10·9	11·2	<i>General Means</i>	23·4	24·8

* *Hylobates* not included.

they make the female slightly more variable on the average than the male. For the standard deviations the male is more variable in 6 out of 10 cases; for the coefficients of variation the female is more variable in 6 out of 10 cases. In either method of measurement the apes are more variable than men, with the one exception of the Chimpanzees in the case of the standard deviations, where the small variation is associated with small variation in the Negro group.

(8) *Racial Relationship as based on Nasal Bridge Measurements.*

Having general regard to Tables XV—XIX for variability, and comparing the orders therein with those for the racial order of absolute lengths, it seems impossible to suggest any *linear* scale of arrangement which will mark racial relationship; it is impossible to assert that the Negroes or the East Asiatic group stand regularly higher or lower in a *linear* scale. Still there does appear to be some order in the scales both for absolute mesodacryal values and for variabilities. Thus the Veddah nasal bridge is more closely related to that of the Orang than the latter's to the Negro group, which on the whole is closer to that of the African apes. Our numbers are too small, our probable errors too large, for instance on any individual point, but the measurements lead to constants both for index and variability suggesting a scheme of the following type:

Tree. Mesodacryal Subtense Index and Average Variability for ♂'s indicated.

418 *A Study of the Nasal Bridge in the Anthropoid Apes*

On this tree we have placed the mean values of the mesodacryal subtense index (α) and the average variability of the mesodacryal lengths*, both for males to indicate the degree of correspondence suggested.

In such a tree as this we see the general tendency of the higher races to have (1) a more developed nasal bridge, and (2) a markedly lessened variability. The tree is merely diagrammatic and no great stress is of course laid on it, but it does suggest that the results reached both for mean values and variabilities may not be merely contradictory, but correspond to a real evolutionary order in the development of the nasal bridge.

(9) *On the Correlations of the Nasal Bridge Characters.*

The correlations of the two mesodacryal indices and the simotic index are given in Table XX.

TABLE XX.

Coefficients of Correlation. Nasal Bridge Indices.

	$r_{\alpha\beta}$		$r_{\alpha\alpha'}$		$r_{\alpha s_a}$	
	♂	♀	♂	♀	♂	♀
Congo	50 .881 ± .021	27 .864 ± .033	50 .882 ± .021	27 .867 ± .032	50 .613 ± .060	25 .704 ± .068
Gaboon, 1864	48 .904 ± .018	37 .941 ± .013	48 .905 ± .018	37 .945 ± .012	47 .258 ± .092	35 .509 ± .084
Gaboon, 1880	16 .976 ± .008	18 .959 ± .013	16 .978 ± .007	18 .959 ± .013	16 .423 ± .138	18 .508 ± .118
Philippine Islands	17 .725 ± .078	—	17 .727 ± .077	—	17 .374 ± .141	—
Borneo	26 .948 ± .013	—	26 .945 ± .014	—	26 .426 ± .108	—
Java and Madura	39 .940 ± .013	—	39 .944 ± .012	—	39 .318 ± .097	—
Mixed "Malays"	—	24 .897 ± .027	—	24 .897 ± .027	—	23 .696 ± .073
Hindoos	10 .929 ± .029	—	10 .931 ± .028	—	10 .891 ± .044	—
English	50 .955 ± .008	50 .961 ± .007	50 .956 ± .008	50 .962 ± .007	50 .440 ± .077	50 .519 ± .070
Egyptians	50 .976 ± .005	50 .964 ± .007	50 .975 ± .005	50 .964 ± .007	50 .444 ± .077	50 .471 ± .074
Veddahs	15 .959 ± .014	12 .971 ± .011	15 .958 ± .014	12 .972 ± .011	15 .291 ± .159	12 .369 ± .168
<i>Chimpanzees</i>	33 .675 ± .064	18 .782 ± .062	33 .674 ± .064	18 .784 ± .061	13 .062 ± .186	—
<i>Gorillas</i>	27 .889 ± .027	25 .928 ± .019	27 .888 ± .027	25 .924 ± .020	21 .740 ± .067	19 .464 ± .121
<i>Orang-utans</i>	44 .839 ± .030	13 .720 ± .090	44 .844 ± .029	13 .715 ± .091	—	—
<i>Gibbons, Hylobates</i> ♂ + ♀	25 .812 ± .046	—	25 .815 ± .045	—	16 .199 ± .162	—

We have already (see pp. 399—401) discussed the relation of α to α' and seen that it does not lead us to any very marked racial order. The correlation of the two mesodacryal indices gives a somewhat clearer result, if we group the correlations thus:

* Coefficients of variation of arc, chord and subtense.

$r_{a\beta}$ in Groups.

	♂	♀
<i>Apes</i> ...	·801	·810
East Asiatics ...	·871	·897
Negroes ...	·920	·931
Veddahs ...	·959	·971
Hindoos ...	·929	—
Egyptians } English }	·965	·962
All values, means	·892	·899

The suggestion is that there is increased correlation with higher civilisation, the Veddahs being somewhat out of rule. The females are slightly, but very probably not significantly, more highly correlated than the males. There is nothing out of keeping in this correlation order with that for the means and variations exhibited in the "tree" on p. 417, but it is too slender to give it much support. If we turn to the correlations of simotic and mesodacryal (subtense) indices r_{sa} we find a greater range of variation and thus more possibility of getting an order of some racial interest.

 r_{sa} . Correlation Order.

	♂	♀
<i>Chimpanzees</i> ...	·06	—
[<i>Hylobates</i> ...	·20 (♂ + ♀)	—]
Gaboon, 1864 ...	·26	·51
Veddahs ...	·29	·37
Javanese ...	·32	—
Philippines ...	·37	—
Gaboon, 1880 ...	·42	·51
Borneo ...	·43	—
Malays ...	—	·70
English ...	·44	·52
Egyptians ...	·44	·47
Congo ...	·61	·70
<i>Gorillas</i> ...	·74	·46
Means	·40	·53

With the single exception of the Gorilla the females have in every case, and often markedly, more correlation than the males. But the results are extremely irregular, even if we allow for the small numbers dealt with. Accordingly it seemed worth while to deal more at length with the relation between the simotic and mesodacryal characters, and further correlations were worked out. It must

420 *A Study of the Nasal Bridge in the Anthropoid Apes*

be borne in mind that the mesodacryal subtense consists of two portions, the first part due to the nasal bones is the simotic subtense, the second part is due to the maxillary bones. If we subtract the simotic subtense from the mesodacryal subtense $(DS) - (SS)$, we have a measure of the part of the nose due solely to the maxillary bones, and we may correlate this with (SS) the part due to the nasal bones. There will be no spurious correlation in this as in correlating (DS) and (SS) directly. Further we may form an index $\{(DS) - (SS)\}/(DC)$ and correlate this with the simotic index $(SS)/(SC)$, although in doing this (SC) must be considered in a certain sense as contained in (DC) . The spurious correlation, however, is unlikely to be as great in this as in (SS) and (DS) , for the maxillary walls of the nose can approach so close that there is no (SC) at all, as in the case of many Orangs and in some Negro skulls*.

FIG. (i).

(10) *The Maxillary and Simotic Nasal Angles, ϕ and ϕ' .*

The value of $DC - SC$ may be used to obtain a measure of the flatness of the maxillary walls of the nose. Clearly (see figure above)

$$\tan \phi = (DS - SS)/\frac{1}{2}(DC - SC).$$

We term ϕ the maxillary nasal angle and its complement $90^\circ - \phi$ measures approximately the angle the maxillary wall of the nose makes with the median plane of the skull. Table XXI records the values of the nasal maxillary angle ϕ for the races dealt with; they are obtained not from the calculation of ϕ from individual crania, but by the rougher process of using the mean values of the mesodacryal and simotic subtenses and chord in the above formula†. The table emphasises again the relation of the Veddahs and the higher races to Orang and Hylobates, while it indicates the relation of the Negro races to the African anthropoids. At some points the female order is not in accord with the male, but the smallness of many of the series dealt with seems sufficient to explain the source of these differences. Some races have clearly a marked sexual difference, but it is not always one way and the means show no very great difference; more data and longer series would be needful to be certain of a persistent sexual differentiation.

* E.g. Gaboon 1864, Nos. 10, 11, 81, and Congo 70: see *Biometrika*, Vol. VIII. p. 319, and see especially the remarks in Tables of measurements. In one gibbon the simotic subtense was actually negative or the nasal bones depressed.

† Table XXIV A gives the values of ϕ and their variabilities for a small number of selected races. It will be seen that the differences due to the two methods are not great. The short method will give results close enough for any conclusions which are in the least likely to be drawn from such small series.

TABLE XXI.

Maxillary Nasal Angle ϕ .

σ		η	
<i>Orang-utans</i>	55.3°	<i>Orang-utans</i>	57.5°
Egyptians	54.3°	Veddahs	56.1°
Veddahs	53.8°	Egyptians	54.3°
[<i>Hylobates</i> ($\sigma + \eta$)]	52.5°	[<i>Hylobates</i> ($\sigma + \eta$)]	52.5°
Hindoos	52.0°	Gaboon, 1880	50.3°
Nubians	51.3°	English	49.3°
Sumatra	51.3°	Philippines	49.0°
English	50.8°	—	—
Ainos	47.6°	—	—
Moluccas	47.0°	—	—
Celebes	46.9°	Gaboon, 1864	48.5°
Javanese	46.0°	—	—
Gaboon, 1864	45.7°	Hindoos	48.4°
Gaboon, 1880	45.2°	Nubians	48.2°
Malays	44.7°	—	—
Philippines	44.6°	Javanese	44.8°
Borneo	44.4°	Congo	42.5°
Congo	44.1°	[<i>Symphalangus</i>	42.3°
[<i>Symphalangus</i> ($\sigma + \eta$)]	42.3°	Borneo	42.0°
<i>Gorillas</i>	35.1°	<i>Gorillas</i>	39.1°
<i>Chimpanzees</i>	34.8°	<i>Chimpanzees</i>	37.8°
Mean	47.1°	Mean	47.7°

The smaller ϕ , the flatter the maxillary part of nasal bridge.

If we now turn to Table XXII we find a number of additional correlations, which are sufficiently interesting to make one appreciate how much more valuable they would have been had we had longer series and more variety of races available. We have first correlated the mesodacryal and simotic portions, $DS - SS$ and SS , of the whole subtense of the nasal bridge. In every case dealt with, male and female, these subtenses are *negatively* correlated. On the other hand the correlation of the mesodacryal subtense with the simotic subtense is always positive and often substantial*. This positive correlation is therefore due to the appearance of SS in both variates, i.e. it is a spurious correlation. Actually when the maxillary part of the nasal bridge is larger, then the simotic part is smaller. Intraracially—that is among individuals of the same race—there is a compensatory growth of the nasal bridge and those who develop large nasal bones have a smaller maxillary nasal development. This point seems to us of very great importance; the tendency now-a-days is to insist on the importance of anatomical unities. This has largely arisen from two sources. In the first place craniology

* For the mesodacryal subtense with the simotic subtense, all the correlations except that for the male Chimpanzee are positive and often substantial, the intraracial correlation amounting to +.34 to +.38. Further the interracial correlation is high indeed, being +.81 to +.87. But as we see these results are in part spurious.

TABLE XXII.

Additional Correlations. Nasal Bridge Characters.

	$r_{DS, SS}$		$r_{DS-SS, SS}$		$r_{\frac{DS-SS}{DC}, \frac{SS}{SC}}$		$r_{DC, SC}$		$r_{DC-SC, SC}$	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Congo	$+ \cdot 467 \pm \cdot 075$	$+ \cdot 632 \pm \cdot 081$	$- \cdot 143 \pm \cdot 093$	$- \cdot 138 \pm \cdot 109$	$- \cdot 074 \pm \cdot 095$	$+ \cdot 092 \pm \cdot 134$	$+ \cdot 275 \pm \cdot 088$	$+ \cdot 217 \pm \cdot 129$	$- \cdot 501 \pm \cdot 071$	$- \cdot 729 \pm \cdot 063$
Gaboon, 1864 ...	$+ \cdot 295 \pm \cdot 090$	$+ \cdot 437 \pm \cdot 092$	$- \cdot 487 \pm \cdot 075$	$- \cdot 207 \pm \cdot 109$	$- \cdot 229 \pm \cdot 093$	$+ \cdot 026 \pm \cdot 114$	$+ \cdot 345 \pm \cdot 087$	$+ \cdot 536 \pm \cdot 081$	$- \cdot 745 \pm \cdot 044$	$- \cdot 387 \pm \cdot 097$
Java and Madura	$+ \cdot 658 \pm \cdot 061$	—	$- \cdot 035 \pm \cdot 108$	—	$- \cdot 165 \pm \cdot 105$	—	$+ \cdot 266 \pm \cdot 100$	—	$- \cdot 589 \pm \cdot 071$	—
English	$+ \cdot 355 \pm \cdot 083$	$+ \cdot 505 \pm \cdot 071$	$- \cdot 480 \pm \cdot 073$	$- \cdot 130 \pm \cdot 094$	$- \cdot 102 \pm \cdot 094$	$+ \cdot 274 \pm \cdot 088$	$+ \cdot 446 \pm \cdot 076$	$+ \cdot 611 \pm \cdot 060$	$- \cdot 386 \pm \cdot 081$	$- \cdot 328 \pm \cdot 085$
Egyptians	$+ \cdot 416 \pm \cdot 079$	$+ \cdot 230 \pm \cdot 090$	$- \cdot 457 \pm \cdot 075$	$- \cdot 465 \pm \cdot 075$	$- \cdot 132 \pm \cdot 094$	$- \cdot 169 \pm \cdot 093$	$+ \cdot 172 \pm \cdot 093$	$+ \cdot 520 \pm \cdot 070$	$- \cdot 571 \pm \cdot 064$	$- \cdot 138 \pm \cdot 094$
Gorillas	$+ \cdot 327 \pm \cdot 131$	$+ \cdot 120 \pm \cdot 153$	$- \cdot 138 \pm \cdot 144$	$- \cdot 468 \pm \cdot 121$	$+ \cdot 624 \pm \cdot 090$	$- \cdot 079 \pm \cdot 154$	$+ \cdot 512 \pm \cdot 109$	$+ \cdot 303 \pm \cdot 141$	$- \cdot 107 \pm \cdot 146$	$- \cdot 137 \pm \cdot 152$
Chimpanzees ...	$- \cdot 153 \pm \cdot 183$	$+ \cdot 364 \pm \cdot 195$	$- \cdot 587 \pm \cdot 123$	$- \cdot 042 \pm \cdot 224$	$- \cdot 377 \pm \cdot 161$	$- \cdot 079 \pm \cdot 223$	$- \cdot 039 \pm \cdot 187$	$+ \cdot 425 \pm \cdot 184$	$- \cdot 613 \pm \cdot 117$	$+ \cdot 222 \pm \cdot 214$
[<i>Hylobates</i> ...	$+ \cdot 116 \pm \cdot 166$	for ♂ + ♀	$- \cdot 220 \pm \cdot 161$	for ♂ + ♀	$- \cdot 112 \pm \cdot 166$	for ♂ + ♀	$- \cdot 195 \pm \cdot 162$	for ♂ + ♀	$- \cdot 730 \pm \cdot 079$	for ♂ + ♀]
Interracial (omitting <i>Orangs</i>)	$+ \cdot 868 \pm \cdot 039$	$+ \cdot 806 \pm \cdot 066$	$+ \cdot 581 \pm \cdot 105$	$+ \cdot 501 \pm \cdot 140$	$+ \cdot 370 \pm \cdot 137$	$+ \cdot 393 \pm \cdot 158$	$+ \cdot 344 \pm \cdot 140$	$+ \cdot 612 \pm \cdot 117$	$- \cdot 413 \pm \cdot 132$	$- \cdot 332 \pm \cdot 167$
Intraracial mean*	$+ \cdot 338$	$+ \cdot 381$	$- \cdot 333$	$- \cdot 226$	$- \cdot 065$	$+ \cdot 011$	$+ \cdot 283$	$+ \cdot 435$	$- \cdot 502$	$- \cdot 250$

* *Hylobates* excluded.

has been chiefly in the hands of the pure anatomist rather than in those of the student of philosophical evolution. The former has insisted on the importance of growth centres and anatomical unity of measurement; he has usually no appreciation of the relatively high correlations of the parts of the bony structure. He is thus liable to overlook the fact that from the standpoint of evolution a complex anatomical organ may be of far more importance to the race and to the individual than one factor of it which may be an anatomical unity. In the second place Mendelism has become the mode, and to surmount difficulties about characters which do not "mendelise," it has been customary to assert that they consist of a complex of simple Mendelian units*. On the original Mendelian theory such "units" were asserted to be independent, although as such a theory was found to be unworkable, a crude theory of "coupling," as a measurable association of anatomically or physiologically simple unities, was evolved to cover the real facts of correlation. In this manner there has arisen a conscious or unconscious association of anatomical and Mendelian units, and it has been supposed that an anatomical unity would be more likely to "mendelise" than a combination of such unities—a single bone like the femur than a measurement like the leg length or the stature. The present result seems an illustration of the futility of neglecting the correlation of characters or treating them as compounded of independent Mendelian or even anatomical unities. The bridge of the nose consists of parts which are distinct anatomical unities, but the evolutionary factor is probably far better represented by the physiognomic factor—the whole bridge of the nose—than by any anatomical unit. When one part exceeds there is a correlated defect in the other part, and this rule extends practically through all the races examined. It is thus quite conceivable that a single measurement like the sagittal arc is from the evolutionary standpoint far more important than any of the simple arcs—opisthion to lambda, lambda to bregma, and bregma to nasion—into which we may reduce it by aiming at the measurement of anatomical unities. There is such a thing as an evolutionary factor, a determinant which controls the development of a whole series of anatomical unities, and the heredity brought into evidence by such a factor may be far more important from the standpoint of evolution than the heredity of any simple anatomical character. What group of anatomical units go to form any such determinant can only be appreciated by a thorough study of the correlations of simple anatomical parts.

Especially in the nasal bridge is this matter of very great importance, for while within the race an individual with small maxillary height ($DS - SS$) has a large simotic height (SS), *interracially* this is no longer true, the race with a small maxillary height will have a small simotic height and the positive correlation *interracially* is very substantial ($+ \cdot 581$)—this must be compared with the mean intraracial correlation which is $- \cdot 333$. Both these results are for males, for females the numbers are $+ \cdot 501$ and $- \cdot 226$ respectively. This reversal of sign

* Of course when it is convenient a vast congeries of factors, such as "Albinism" or "Jewishness," are illogically treated as a simple Mendelian "unit"!

424 *A Study of the Nasal Bridge in the Anthropoid Apes*

when we pass from intraracial to interracial correlations is a thing previously not unknown. Thus in 1903 in a paper* on interracial and intraracial correlations, Jacob, Lee and Pearson showed that while with individuals a long cranium is likely to be a broad cranium, yet interracially a compensating factor comes in, a long-headed race is likely to be a narrow-headed race. Thus it is quite conceivable that capacity of the cranium—depending on many anatomical units—may be of far more evolutionary importance than the measure of any single “anatomical unit” of the skull. We have referred at length to these matters here, because there is a growing idea—fostered probably by the idea of Mendelian “units,” that the measurement of “anatomical units”—or the measurement between “anatomical points”—is of primary importance in craniology. Whether craniologists measure the *same* thing or not is immensely important, the correlation between anatomical units is also of great value as determining what combinations of simple units form evolutionary factors. But very little service is done by insisting too largely on anatomical unity in and for itself. Evolution depends largely on physiological fitness, and organs of physiological importance are rarely compounded of either single anatomical or of single Mendelian units.

If we now turn to the index correlations of $(DS - SS)/DC$ —i.e. height of maxillary portion of nose by its breadth—with SS/SC —i.e. height of nasal bones portion by its breadth—our results are less uniform. Putting the male Gorillas on one side for a moment there are only two of the correlations which can be said to be significant, namely, possibly the male Chimpanzee and the female English, and these are of opposite signs. The means for male races and for female races are $-.065$ and $+.011$, and these would be of no service for prediction. With regard to the Gorilla result, this arises principally from three males with the very high simotic indices of 88, 106 and 103. It is conceivable that the material is not really homogeneous; the arithmetic has been carefully repeated without change in values. If we take these indices to measure the cuneal or wedge-shaped properties of the two portions of the nose, we should say that individually there is very little relation between the ratio of height to breadth in the simotic and maxillary portions of the nasal bridge; the only exception to this rule being the male Gorilla. On the other hand the cuneal characters are *positively* and sensibly correlated ($+.370$ to $+.393$) interracially, an obtuso-cuneal nasal part being also associated with an obtuso-cuneal maxillary part and an acuto-cuneal nasal part with an acuto-cuneal maxillary part.

We have already discussed the maxillary nasal angle ϕ , the complement of which roughly measures the angle between the maxillary wall of the nose at the bridge and the sagittal plane of the skull. We can introduce a similar angle ϕ' to measure roughly the angle between the nasal bone and the simotic chord. We may take (see Fig. (i), p. 420):

$$\begin{aligned}\tan \phi' &= SS/(\tfrac{1}{2} SC) \\ &= 2 \text{ Simotic Index.}\end{aligned}$$

* *Biometrika*, Vol. II. p. 355. For the first introduction of the ideas of *intraracial* and *interracial* correlation, see *Biometrika*, Vol. I. p. 460.

It will be of interest to investigate whether the correlations of ϕ and ϕ' are higher than those of the cuneal indices. The following table* (XXIII) gives the

TABLE XXIII. *Simotic Nasal Angle ϕ' .*

σ		η	
<i>Gorillas</i>	48·6°	<i>Gorillas</i>	47·8°
English	45·5°	English	43·0°
Hindoos	41·8°	Hindoos	38·0°
Egyptians	41·6°	Egyptians	36·5°
Veddahs	41·1°	Veddahs	36·4°
Ainos	40·9°	—	—
Nubians	34·3°	Borneo	34·8°
Javanese	34·1°	Javanese	33·2°
Malays	34·0°	—	—
Gaboon, 1864	31·7°	Philippines	30·1°
Philippines	31·3°	Gaboon, 1864	29·0°
Borneo	31·1°	Congo	27·2°
Celebes	30·7°	—	—
Sumatra	30·3°	—	—
Gaboon, 1880	30·1°	Nubians	25·2°
Moluccas	28·0°	—	—
Congo	27·1°	Gaboon, 1880	24·6°
<i>Chimpanzees</i>	23·2°	<i>Chimpanzees</i>	20·3°
† <i>Symphalangus</i>	11·5°	† <i>Symphalangus</i>	11·5°
† <i>Hylobates</i>	9·8°	† <i>Hylobates</i>	9·8°
Mean	32·3°	Mean	29·8°

The smaller ϕ' the flatter the simotic portion of the nasal bridge, i.e. the greater the simosis.

TABLE XXIV A. *Maxillary Nasal Angle ϕ . Mean and Variability.*

	MALE			FEMALE		
	Mean	Standard Deviation	Coefficient of Variation	Mean	Standard Deviation	Coefficient of Variation
Egyptians ...	54·33 ± ·57	5·97 ± ·40	10·99 ± ·75	54·29 ± ·53	5·56 ± ·37	10·24 ± ·70
[<i>Hylobates</i> (σ + η)]	53·06 ± 1·50	8·90 ± 1·06	16·78 ± 2·06]	—	—	—
English ...	50·63 ± ·55	5·74 ± ·39	11·35 ± ·78	49·15 ± ·48	5·00 ± ·34	10·17 ± ·69
Javanese ...	46·06 ± ·91	8·43 ± ·64	18·31 ± 1·44	—	—	—
Gaboon, 1864 ...	45·94 ± ·53	5·34 ± ·37	11·63 ± ·82	49·19 ± ·64	5·62 ± ·45	11·43 ± ·93
Congo ...	44·13 ± ·53	5·52 ± ·37	12·50 ± ·86	43·30 ± ·71	5·27 ± ·50	12·16 ± 1·18
<i>Gorillas</i> ...	36·12 ± ·96	6·56 ± ·68	18·15 ± 1·95	39·92 ± 1·10	7·11 ± ·78	17·82 ± 2·01
<i>Chimpanzees</i> ...	35·96 ± 1·80	9·61 ± 1·27	26·74 ± 3·78	34·39 ± 1·82	8·12 ± 1·29	23·60 ± 3·96

* These values of ϕ' are calculated from the mean racial simotic index. In Table XXIV B the mean value of ϕ' as obtained from averaging the simotic angles of the individual members of the race is given for a few races as well as the variabilities for these selected races. The agreement of the directly and indirectly calculated means is quite reasonable.

† Both sexes together.

426 *A Study of the Nasal Bridge in the Anthropoid Apes*

interracial values of ϕ' . It will be seen of course that the order must be the same as that of the simotic index, but if we compare this table with Table XXI some interesting points arise as we shall show in the next section. Tables XXIV A and XXIV B give the means and variabilities of the maxillary and simotic angles ϕ and ϕ' .

TABLE XXIV B.
Simotic Nasal Angle ϕ' . Mean and Variability.

	MALE			FEMALE		
	Mean	Standard Deviation	Coefficient of Variation	Mean	Standard Deviation	Coefficient of Variation
Egyptians ...	41.25 $\pm$.45	4.70 $\pm$.32	11.40 $\pm$.78	35.97 $\pm$.57	6.02 $\pm$.41	16.73 $\pm$ 1.16
[<i>Hylobates</i> (σ + φ)]	9.75 $\pm$.84	4.97 $\pm$.59	50.99 $\pm$ 7.50]	—	—	—
English ...	44.70 $\pm$.63	6.58 $\pm$.44	14.73 $\pm$ 1.01	42.58 $\pm$.47	4.96 $\pm$.33	11.65 $\pm$.80
Javanese ...	33.23 $\pm$.88	8.15 $\pm$.62	24.54 $\pm$ 1.98	—	—	—
Gaboon, 1864 ...	31.15 $\pm$.72	7.34 $\pm$.51	23.56 $\pm$ 1.73	28.46 $\pm$.85	7.42 $\pm$.60	26.08 $\pm$ 2.24
Congo ...	26.62 $\pm$.73	7.68 $\pm$.52	28.86 $\pm$ 2.10	26.48 $\pm$ 1.20	8.91 $\pm$.85	33.63 $\pm$ 3.55
<i>Gorillas</i> ...	46.48 $\pm$ 1.52	10.30 $\pm$ 1.07	22.16 $\pm$ 2.42	45.63 $\pm$ 1.74	11.23 $\pm$ 1.23	24.61 $\pm$ 2.85
<i>Chimpanzees</i> ...	22.77 $\pm$ 1.37	7.31 $\pm$.97	32.10 $\pm$ 4.66	20.00 $\pm$ 1.73	7.70 $\pm$ 1.22	38.51 $\pm$ 6.97

It would appear from Tables XXI and XXIII that ϕ' has a greater interracial range and from Tables XXIV A and B that it has a greater intraracial variability than ϕ . What we need for a good racial character is a great interracial range and a small intraracial variability. We cannot therefore say that ϕ' is a better racial character than ϕ .

(11) *General Classification of Nasal Bridges by ϕ and ϕ' **.

We need some new terms. We propose to term races which have high values or low values of both ϕ and ϕ' *homoclinic*, while those which have low values of one and high of the other are *heteroclinic*. Among apes the Gorilla is markedly heteroclinic, and *Hylobates* is the same, but in the opposite direction. The Chimpanzee and *Symphalangus* are both homoclinic and so are the English, Egyptians, Hindoos and Veddlahs.

Without regard to the exact numerical values and as merely descriptive terms the following types of Gephyrosis will indicate the nature of the characterisation, where it must be remembered that the reader has to fix his attention on the

* Professor G. D. Thane has kindly made the following suggestions for a more complete angle nomenclature of the nasal bridge (see Fig. (i), p. 420):

Lateral simotic angle = our simotic nasal angle ϕ' .

Mesial simotic angle = our $90^\circ - \phi'$ = angle between simotic chord and median plane.

Simotic angle (median) = our $180^\circ - 2\phi'$ = internal angle between two simotic chords.

Lateral maxillary angle = our ϕ = maxillary nasal angle.

Maxilli-simotic angle = our $180^\circ - \phi + \phi'$ = internal angle between simotic and maxillary chords.

The most important point here is the maxilli-simotic angle, the approach of which to 180° , i.e. the

lower parts of the "bridge" from its "springings" at the dacrya to the strokes marking the naso-maxillary sutures.

FIG. (ii). *Types of Gephyrosis.*

Similarly we have for the part of the "bridge" from "haunch" to "haunch," i.e. the nasal bones, or part between the strokes marking the naso-maxillary sutures, the following characterisation:

FIG. (iii). *Types of Simosis.*

For classificatory purposes it may be useful to divide ϕ into three classes: when ϕ is under 46° , the group shall be called *platygephyreal*, when ϕ lies between 46° and 51° , the group is *mesogephyreal*, and when ϕ is over 51° , the equality of ϕ and ϕ' , marks the "triangularity" of the bridge, or the unbroken character of the nasal wall.

$$\text{Maxilli-simotic angle } 180^\circ - \phi + \phi'.$$

σ		η	
<i>Gorillas</i>	193.5°	<i>Gorillas</i>	188.7°
English	174.7°	English	173.7°
Ainos	173.3°	—	—
Hindoos	169.8°	Borneo	172.8°
Malays	169.3°	—	—
<i>Chimpanzees</i>	168.4°	Hindoos	169.6°
Javanese	168.1°	Javanese	168.4°
Veddahs	167.3°	Congo	164.7°
Egyptians	167.3°	<i>Chimpanzees</i>	162.5°
Borneo	166.7°	Egyptians	162.2°
Philippines	166.7°	Philippines	161.1°
Gaboon (1864)	166.0°	Gaboon (1864)	160.5°
Gaboon (1880)	164.9°	Veddahs	160.3°
Celebes	163.8°	—	—
Congo	163.0°	Nubians	157.0°
Nubians	163.0°	Gaboon (1880)	154.3°
Moluccas	161.0°	—	—
Sumatra	159.0°	—	—
<i>Symphalangus</i>	149.2°	<i>Symphalangus</i>	149.2°
<i>Hylobates</i>	137.3°	<i>Hylobates</i>	137.3°

Only the Gorillas have a re-entrant racial maxilli-simotic angle, although such angles occur in individual cases of other races. Of the races considered the English appear to have most nearly an unbroken nasal wall. The racial order is not clearly marked as Negroes and Asiatics are much intermixed.

428 *A Study of the Nasal Bridge in the Anthropoid Apes*

TYPES OF THE NASAL BRIDGE.

Dog. Nasal Bridge.

Dog. Muzzle Section.

1—2 bis = Hypersimotic Platygephyrosis.

Chimpanzee.

Chimpanzee.

Symphalangus.

Congo Negroes.

7

8

9

Gaboon Negroes.

3—9 = Simotic Platygephyrosis.

Malay.

Malay.

Malay.

10—12 = Mesotic Platygephyrosis.

Gorilla.

Gorilla.

13—14 = Stenotic Platygephyrosis.

It has not always been possible to select a nasal bridge with the mean values of both ϕ and ϕ' , and the typical form will hardly be realised even from two or three cases.

TYPES OF THE NASAL BRIDGE.

15

Hylobates.

16

Hylobates.

17

Hylobates.

18

Orang-utan.

15=Hypersimotic Mesogephyrosis. 16—17=Simotic Leptogephyrosis. 18=Simotic Leptogephyrosis.

19

Natives of Moluccas.

20

19—20=Simotic Mesogephyrosis.

21

Natives of Sumatra.

22

21—22=Simotic Leptogephyrosis.

23

Aino.

24

Aino (Variant).

23—24=Mesotic Mesogephyrosis.

25

Nubian.

26

Nubian (Variant).

25—26=Mesotic Leptogephyrosis.

27

English.

29

Veddah.

31

Egyptian.

33

Hindoo.

28

English.

30

Veddah.

32

Egyptian.

34

Hindoo.

27—28=Stenotic Mesogephyrosis. 29—34=Stenotic Leptogephyrosis.

It has not always been possible to select a nasal bridge with the mean values of both ϕ and ϕ' , and the typical form will hardly be realised even from two or three cases.

430 *A Study of the Nasal Bridge in the Anthropoid Apes*

group is *leptogephyreal*. In the same way the simotic nasal angle ϕ' may be classed as *simotic* when under 32° , *mesotic* between 32° and 41° , and *stenotic* when over 41° . These limits should all be reduced by about 2° in classifying the female simotic nasal angle, which differs sexually by at least this amount from the male. We have accordingly the following table, of which we give illustrations to indicate the type. The diagonal from simotic platygephyrosis to

TABLE XXV.

Value of Maxillary Nasal Angle ϕ .

Value of Simotic Nasal Angle ϕ' .	Value of Maxillary Nasal Angle ϕ .		
	Under 46°	46° to 51°	Over 51°
	Under 32°	Simotic Mesogephyrosis e.g. Natives of Moluccas	Simotic Leptogephyrosis e.g. <i>Hylobates</i> and natives of Sumatra
	32° to 41°	Mesotic Mesogephyrosis e.g. Ainos	Mesotic Leptogephyrosis e.g. Nubians
Over 41°	Stenotic Platygephyrosis e.g. <i>Gorillas</i>	Stenotic Mesogephyrosis e.g. English	Stenotic Leptogephyrosis e.g. Egyptians and Hindoos

stenotic platygephyrosis marks the homoclinic groups. The simotic leptogephyrosis of the smaller gibbon and the stenotic platygephyrosis of the gorilla mark the heteroclinic extremes, which weaken the interracial correlation of ϕ and ϕ' . Table XXVI gives the values of $r_{\phi\phi'}$.

With the exception of the Gorilla, which is as in the case of the cuneal indices (p. 424) again anomalous, we see that there is *intraracially* a small *negative* correlation between flatness of the maxillary and flatness of the nasal bones. But *interracially* it is otherwise; there is quite a moderate degree of positive correlation and a flat nasal part of the bridge is found in the same races as a flat maxillary part. This is another instance of the reversal of intraracial by interracial correlation.

(12) *Discussion of Projections of Nasal and Maxillary Portions of Nose on the Base of the Nasal Bridge.*

Having studied the relation of the subtenses, the indices and the angles, we now turn to the chords. The mesodacryal chord is positively correlated with the simotic chord for all races except male Chimpanzees and the mixed data for *Hylobates*, but in both these cases the correlations are insignificant having regard to their probable errors; see Table XXII, p. 422. Both interracial and intraracially a broad maxillary

TABLE XXVI.

*Correlation of Maxillary and Simotic Nasal Angles
 ϕ and ϕ' .*

	♂	♀
Congo	$-.037 \pm .095$	$-.127 \pm .133$
Gaboon, 1864	$-.338 \pm .087$	$-.095 \pm .113$
Javanese	$-.054 \pm .108$	—
English	$-.169 \pm .093$	$-.005 \pm .095$
Egyptians	$+.053 \pm .095$	$-.183 \pm .092$
<i>Gorillas</i>	$+.447 \pm .118$	$-.217 \pm .147$
<i>Chimpanzees</i>	$-.329 \pm .167$	$-.247 \pm .211$
[<i>Hylobates</i> (♂ + ♀)]	$-.058 \pm .168$	$-.058 \pm .168$
Intraracial Mean	$-.061$	$-.146$
Interracial Value*	$+.353 \pm .139$	$+.220 \pm .178$

portion of the nose would thus signify a broad simotic portion. But the whole result is, as that for the subtenses, spurious and arises from the simotic portion recurring in the mesodacryal chord. If we subtract the simotic chord from the mesodacryal then the difference ($DC - SC$) is *negatively* correlated with the simotic chord SC , and the correlation is fairly substantial both interracially and intraracially. In other words, whenever a race or an individual is found for which the nasal bones have a big projection on the base of the nasal bridge, then the maxillary bones have a small projection, and *vice versa*. Thus individually and racially a principle of compensation appears at work. Now we have seen that intraracially ϕ is negatively correlated with ϕ' , or a steep maxillary portion is associated in the individual with a flat nasal bone portion of the bridge. Thus intraracially it is conceivable that even if the breadth of the nasal bone and the breadth of the maxillary wall of the nose were positively correlated, the projections might well be of opposite signs. But we cannot use this explanation to account for the negative interracial correlation of the projections, for here the maxillary and simotic nasal angles are positively correlated. In the case of intraracial correlations not only are the projections $\frac{1}{2}SC$ and $\frac{1}{2}(DC - SC)$ negatively correlated but also the subtenses SS and $(DS - SS)$. Thus it is not improbable that in the individual a small nasal bone is associated with a large maxillary wall of the nose—a feature we may speak of as the Orang-utan character. But this does not hold interracially, for the subtenses SS and $(DS - SS)$ are *positively* correlated (Table XXII) and substantially so for both sexes. It is of some interest to consider whether interracially the nasal bone and the maxillary wall of the nose are

* *Hylobates* excluded.

432 *A Study of the Nasal Bridge in the Anthropoid Apes*

positively correlated. In order to test this point a little more definitely, let us suppose SB to be the breadth of a nasal bone and DB the breadth of the maxillary wall at the bridge. *Approximately*:

$$SB = \sqrt{\frac{1}{4}(SC)^2 + (SS)^2} = (SS)/\sin \phi',$$

$$DB = \sqrt{\frac{1}{4}(DC - SC)^2 + (DS - SS)^2} = (DS - SS)/\sin \phi.$$

Table XXVII gives the values of SB and DB found for each race from the means of that race for SC , SS , DC and DS . Of course the nasal bone and the

TABLE XXVII.

Calculated Values of SB, the breadth of either nasal bone at the bridge and DB, the breadth of the maxillary portion of the nasal wall at the bridge.*

Race	♂		♀	
	SB	DB	SB	DB
Congo	5.44	9.83	5.37	9.21
Gaboon, 1864	5.48	9.82	5.53	9.53
Gaboon, 1880	4.59	10.54	5.12	9.71
Philippines	4.91	8.36	5.14	8.06
Moluccas	5.28	9.12	—	—
Borneo	4.51	9.33	4.54	8.09
Malays	4.69	9.40	—	—
Celebes	5.05	9.34	—	—
Sumatra	5.71	8.94	—	—
Javanese	5.33	9.23	5.11	7.64
Nubians	6.64	10.22	6.60	8.60
Ainos	5.80	8.96	—	—
Hindoos	5.67	8.73	4.91	8.32
English	6.56	9.56	6.10	8.77
Egyptians	6.97	9.49	6.67	8.39
Veddahs	5.98	9.29	5.19	9.17
<i>Chimpanzees</i>	4.52	6.41	4.24	5.91
<i>Gorillas</i>	4.41	9.97	3.81	9.61
<i>Orang-utans</i>	—	[13.57]	—	[11.02]
<i>Hylobates</i> (♂ + ♀) ...	2.70	4.27	2.70	4.27
<i>Symphalangus</i> (♂ + ♀) ...	3.11	4.86	3.11	4.86

maxillary wall are often, as our contours (pp. 428—9) show, considerably curved, but the chord of these arcs will indicate, at any rate approximately, what is the nature of the interracial correlations. Omitting *Hylobates* and *Symphalangus* as unsexed and the Orangs we find:

Interracial correlation of nasal bone and maxillary wall

Males + .238, Females + .215.

* These values are really the hypotenuses or chords corresponding to the nasal and maxillary portions of the bridge of the nose, and these portions are often curved.

It appears therefore reasonable to assume that racially, where the nasal portion is large, so also is the maxillary portion of the nose. Notwithstanding this and the positive correlation of the simotic and maxillary nasal angles, as well as of the subtenses, the projections of the nasal and maxillary portions on the base of the nasal bridge are *negatively* correlated. The algebraic explanation of this paradox is given below*, but it seems probable that its physiological explanation lies in the relative constancy of the mesodacryal chord. If the reader will examine Table XIV he will see that the variability of the simotic chord relative to its size is almost twice that of the mesodacryal chord, and although some of this may be due to the relatively greater difficulty of accurate measurement the bulk of it is not. The following results will indicate the relative stability of the mesodacryal chord. They are deduced from Tables VIII and XIII, males.

	Mesodacryal Chord	Simotic Chord
Interracial Mean	21.6	8.47
Mean racial s. d.	2.44	1.97
Interracial s. d.	1.37	1.20
$100 \times \frac{\text{Mean racial s. d.}}{\text{Interracial Mean}}$	11.3	23.3
$100 \times \frac{\text{Interracial s. d.}}{\text{Interracial Mean}}$	6.34	14.13
$100 \times \frac{\text{Racial Range}}{\text{Interracial Mean}}$	23.5	58.9

Whichever method we take to measure the variation we see that the mesodacryal chord is far less variable than the simotic chord. The breadth of the base of the nasal bridge is relatively constant. The nasal bridge has to span the nasal base, and whether we deal with the problem from the interracial or intraracial standpoint we realise that the nasal structure has to be considered as a whole, and that its anatomical units are very far from being necessarily evolutionary units, or in

* The problem is algebraically of the following kind: given two right angled triangles ABC and $A'B'C'$ with C and C' for right angles, then with the usual notation $c^2 = a^2 + b^2$, $c'^2 = a'^2 + b'^2$, is it possible for c and c' , a and a' and A and A' to be positively correlated together and yet b and b' to be negatively correlated? Clearly if the means be denoted in the usual manner, we have approximately:

$$\bar{b} \delta b = \bar{c} \delta c - \bar{a} \delta a, \quad \bar{b}' \delta b' = \bar{c}' \delta c' - \bar{a}' \delta a'.$$

Hence multiplying together, summing for all possible pairs and dividing by their number, we have

$$\bar{b} \bar{b}' \sigma_b \sigma_{b'} r_{bb'} = \bar{c} \bar{c}' \sigma_c \sigma_{c'} r_{cc'} + \bar{a} \bar{a}' \sigma_a \sigma_{a'} r_{aa'} - \bar{c} \bar{a}' \sigma_c \sigma_{a'} r_{ca'} - \bar{c}' \bar{a} \sigma_{c'} \sigma_a r_{c'a}.$$

Hence if $r_{cc'}$ and $r_{aa'}$ are positive as the hypothesis supposes, and at least one or both $r_{ca'}$ and $r_{c'a}$ are positive also, the negative term or terms on the right may exceed the positive and $r_{bb'}$ be *negative*. In the case of the simotic and maxillary nasal triangles both $r_{ca'}$ and $r_{c'a}$ are positive, and the last pair of terms on the right is wholly negative and in excess of the first pair. The above result depends of course on $c^2 = \bar{a}^2 + \bar{b}^2$ and $c'^2 = \bar{a}'^2 + \bar{b}'^2$ being nearly true. These give $\bar{c}^2 = 84.83$ against actual 84.64 and $c'^2 = 29.68$ against 29.16 . These are close enough to justify the use of the above formula, which on putting in the actual numbers gave $r_{bb'}$ the correlation of the projections negative, as the direct investigation gave it. Thus the origin of the negative value for the projections' correlation lies in the negative terms involving the cross-correlations of nasal bone with maxillary height and simotic subtense with maxillary wall, which are themselves positive.

434 *A Study of the Nasal Bridge in the Anthropoid Apes*

themselves primarily significant for interracial comparison or evolutionary history. The intimate correlations of anatomical units renders them also very frequently of small importance as hereditary characters, and a complex of anatomical units may be much closer to an evolutionary unit,—that entity which as a whole is the subject of selective action. For respiratory efficiency the mesodacryal arc may be of far more importance than either of its components, the maxillary or nasal bone portions. Thus we think it probable that the value of anatomical units in craniometric measurements is liable to be overrated, and in view of their complex and subtle intercorrelations their identification with *independent* “Mendelian units”—whatever the latter may signify—is unjustifiable.

In the series of cuts on pp. 428—9, we have endeavoured to give “type” contours of the nasal bridge for various races on the basis of the classification adopted in Table XXV. The reader is warned that in any race individuals may be found with many of these types. Our “types” are those of individuals whose simotic and maxillary nasal angles, ϕ' and ϕ , are as near as we could get to the mean values of those angles in the race. Not too much weight must of course be placed on the classification of races thus reached, but the diagrams are not without suggestiveness. We have added the Dog with its *negative* simotic subtense, a condition which is just reached in one or two Gibbons. In the case of the dog, however, the dacryon to dacryon section seems to miss the physiognomic nasal bridge, and we have given also a lower section termed on p. 428 the muzzle section. The short strokes mark for each contour the limits of the nasal bone; the contours are in each case from dacryon to dacryon, and were traced after orientating the skull so that the two dacrya and the summit of the bridge were in one horizontal plane. Obviously larger numbers of many more races would provide a more adequate classification, especially if extended into the animal kingdom generally*.

* The Gibraltar skull is the only “ancient type” of man for which we have been able to obtain the nasal bridge constants. They are:

	Mesodacryal Subtense	8·6,		Simotic Subtense	2·8
	„ Chord	22·0?		„ Chord	10·8
	„ Arc	31·0?			
These give	$\alpha = 39·1, \quad \alpha' = 44·4, \quad \beta = 40·9, \quad S = 25·9, \quad \phi = 46°·0, \quad \phi' = 27°·5,$				

the nasal bridge is thus on the border of the simotic platygephyreal and simotic mesogephyreal groups. The difficulty, however, of determining the dacrya in the absence of the sutures in the cast used is very

Gibraltar Skull.

considerable. The contour of the nasal bridge is shown above. It will be seen to be in no way markedly differentiated. If we accept it as approximating to that of the original, that original would have stood somewhere between the Negroes and the natives of the Moluccas for both the maxillary and simotic nasal angles, i.e. at the Chimpanzee and Symphalangus end of the scales. But the evidence is too fragile to lay any stress on this point.

(13) *Concluding Remarks.* We are aware how much of the present paper is open to criticism on account of the limited number of the racial series dealt with and the sparseness of the individual crania in those series. Notwithstanding we hope that the reader may find suggestive paths leading off from these preliminary researches. We believe that the time must come when in the larger Universities there will exist established schools of craniometry with adequate anatomical, physical and statistical training, and that such schools will carry on secular work in collecting and measuring. We have indicated in this paper that the study of the personal equation of craniometricians has hardly begun, but we look forward to the day when it will be as customary for one of the workers in an established craniometry laboratory to be adopted as a standard and his personal equation relative to other workers at home and abroad discussed, as it is for one astronomical observer to be tested against a second. The intercomparability of measurements is largely taken on blind trust by craniologists to-day. Only when relative personal equation has been studied will it be possible safely to pool the measurements of small series made by different laboratories.

Again, anatomical and zoological museums and collections are singularly defective at the present time. If it were desirable to make a thorough study of the cranium of any animal other than man—say dog or horse—is there any collection which could place at the disposal of the inquirer a hundred crania of definite sex, fairly uniform age and reasonable limits of race? We sadly fear not, and yet how much could be learnt of evolutionary descent by an exact study of a variety of species based on even a hundred crania from each! Take the plane of the foramen magnum, determined say by a plane through basion and opisthion perpendicular to the sagittal plane, and consider the angle this makes with the horizontal plane of the skull, as determined, say, by the Frankfurt Concordat. This angle—closely allied to Dauberton's angle—is of very great evolutionary importance, but who can say—on the basis of really numerically adequate measurements* and other than from mere impression gained on a few specimens—what its value is in the chief mammals, in the anthropoid apes, in negroes and in the various other races of man? Comparative craniometry is almost at its origins if we refer, not to descriptions of “typical”† crania, but to the measurement of numerically adequate series. Not until investigations, only roughly foreshadowed in such a paper as the present, have been made on a far greater variety of species and on a wide range of cranial characters—and this will have to wait until adequate material accumulates in our museums—would any suggestion of evolutionary descent pass into comparative certainty. When the reader realises that some 25 gorilla skulls of one sex, but of all ages

* We do not wish for a moment to underrate Broca's work in this field; but besides his views as to the horizontal planes, his series are often unsexed, and, especially for the chief mammals, wholly inadequate numerically. Thus he uses two or three apes, dogs, cats, and so forth, where we need 50 to 100 of each breed and sex.

† How few anatomists realise that nobody knows what a “typical” cranium is until a *long* series of the particular race has been measured! We remember seeing in one museum a skull, labelled “typical English,” and this at a date when not 50 English crania from one district and period had been measured.

436 *A Study of the Nasal Bridge in the Anthropoid Apes*

and all districts, are about all that the English worker has to rely upon at present, and that it may be doubted whether he could find the same number of dog skulls of known sex, of *one breed* and of fairly certain age, anywhere in the country, he will, we hope, pardon one source of the inadequacy of the present study.

In choosing the nasal bridge we had in view the importance of the nasal organs as a factor of survival, and we believe we have at least indicated that with caution the parts of the bridge can be measured and comparative results obtained. The measurements lead directly, we think, to the suggestion of a racial scale and throw light on the importance of dealing with groups of correlated characters and not with isolated anatomical units. The classification we have suggested, both in the limits of its categories and its terminology, is of course not put forward as final, but we believe it will be helpful as a step to a good ultimate classification and as enabling meanwhile the characters of the nasal bridge of any other race to be associated with those treated in this paper. The needful measurements are simotic chord and simotic subtense, and again mesodacryal chord and subtense; from the first two the simotic nasal angle can be readily found and from all four the maxillary nasal angle. The two taken in conjunction will enable the recorder to classify the nose by aid of Table XXV.

On the whole we consider that Mérejkowsky broke fruitful ground, especially, if the discussion of the nasal bridge be extended to the mesodacryal chord and subtense, which appear of more evolutionary importance than his simotic chord and subtense; but there will undoubtedly have to be standardisation of individual craniometricians in a far higher degree than even for the macrometric measurements of the skull, if these micrometric measurements are to be dealt with confidently.

Addendum. Since this paper was written, it occurred to us that the Moriori crania from Chatham Island in the Royal College of Surgeons might be worth investigating from the standpoint of the nasal bridge—as they are undoubtedly worth investigating from their general craniometric importance.

The nasal bridges, however, turned out to be of no markedly primitive type, as the accompanying contours will indicate.

Moriori Nasal Contours.

They are mesotic mesogephyreal, and stand between Malay and Aino with:

	♂	♀
ϕ	46.0°	49.0°
ϕ'	40.6°	34.3°

48 crania were taken as male, 15 as female.

There is a somewhat noteworthy difference between male and female, but a still more remarkable feature of the results is that for the *whole* eleven characters discussed the male is more variable and in some cases no less than twice as variable as the female. Such exaggerated differences in variation in the sexes are so unusual, especially in primitive races, that we believe that the noteworthy cranial characters of this race, in which "maleness" seems almost a racial character, may have led to a far too stringent selection of female crania. Thus on the present sexing the female coefficient of variation of the mesodacryal subtense is 8.0, of the mesodacryal index α , 8.0, and of the simotic index 14.4,—all values much below any reached for females of the human races given in Table XIV. We consider it better to postpone publication of the Moriori results, until a fuller study has been made of all the craniological characters of the Royal College series, which we hope may soon be undertaken.

Tables A—D give the measurements made for the apes only. The tape measurements of the mesodacryal arc scarcely ever permitted of the determination to tenths of a millimetre, and this makes the tenths in the mesodacryal chord of small value, when we are determining the arcual index β . In the tables doubt as to a value is only expressed in the columns of the absolute measurements and not repeated in the index columns deduced from these absolute measurements. Of course the index values have no more weight than the data from which they are deduced.

Note. The Editor is responsible for the terminology used in this paper. He fully admits its barbarism. But no English form for the Greek adjective exists, and when a distinguished classical scholar fails to find one, science must take the matter into its own hands, and adjectives in -otic seem the only possibility. *Simotic* has practically Greek sanction; the pathologists have already adopted *stenotic*; thus the step to *mesotic* was not a very great one, and it is shorter than *mesomorphic* or *mesorhinal*,—were indeed compounds in rhinal not already allocated.

438 *A Study of the Nasal Bridge in the Anthropoid Apes*TABLE A. *Characters of the*

Museum Number	Sex	Meso-dacryal Chord	Meso-dacryal Arc	Meso-dacryal Subtense	Mesodacryal Indices				Simotic Chord	Simotic Subtense
					α	α'	$\alpha - \alpha'$	β		
1011. S	♂	19.5	29	9.1	46.7	49.4	- 2.7	48.7	6.0	3.3
7. 1. 8. 2	♀	21.6	30	9.9	45.8	43.1	+ 2.7	38.9	5.8	4.3
7. 1. 8. 1	♀	29.3	34	7.6	25.9	25.9	0	16.1	8.1	1.8
—	♀	33.5 ?	41 ?	7.6 ?	22.7	31.2	- 8.5	22.4	—	—
1011. u	♀	21.1	32	11.4	54.0	51.3	+ 2.7	51.7	5.7	2.7
1011. c	♀	16.2	23	7.5	46.3	45.1	+ 1.2	42.0	—	—
Okwa	♀	25.4	31.5	8.6	33.9	32.4	+ 1.5	24.0	—	—
7. 1. 8. 4	♀	19.1	29.2	9.2	48.2	52.1	- 3.9	52.9	3.6	2.2
7. 1. 8. 5	♀	22.2	31.7	9.6	43.2	45.6	- 2.4	42.8	5.4	3.3
7. 1. 8. 3	♀	25.6 ?	33 ?	9.0	35.2	36.1	- .9	28.9	4.7	3.8
7. 1. 8. 7	♀	25.0	32	9.2	36.8	35.4	+ 1.4	28.0	5.6	2.6
7. 1. 8. 6	♀	21.8 ?	30.6 ?	10.3	47.2	44.1	+ 3.1	40.4	4.0 ?	1.8 ?
64. 12. 1. 1	♀	17.8 ?	28 ?	10.0	56.2	54.8	+ 1.4	57.3	—	—
1011. d	♀	21.3	32.5	10.2	47.9	51.9	- 4.0	52.6	4.2	2.6
—	♀	21.5 ?	34 ?	10.1 ?	47.0	55.3	- 8.3	58.1	7.5 ?	5.7 ?
1011. b	♀	16.2	23	7.5	46.3	45.1	+ 1.2	42.0	3.0	2.0
22	♀	16.8	27 ?	11.0	65.5	56.9	+ 8.6	60.7	4.1	3.6
20	♀	18.7	23	5.3	28.3	31.6	- 3.3	23.0	—	—
21	♂	25.9	37	11.4	44.0	45.7	- 1.7	42.9	8.8	3.7
28	♀	22.6	30	8.7	38.5	38.8	- .3	32.7	5.0	2.4
25	♀	22.0	33	8.6	39.1	50.3	- 11.2	50.0	3.8	2.7
21. a	♀	25.0	30	7.2	28.8	29.2	- .4	20.0	8.2	3.6
23	♀	23.8 ?	34 ?	10.5 ?	44.1	45.7	- 1.6	42.9	6.4	2.0
26	♀	24.2	31	8.3	34.2	35.5	- 1.3	28.1	6.0	2.6
27	♀	12.5 ?	19 ?	6.2 ?	49.6	45.7	+ 3.9	52.0	—	—
24	♀	22.0	28	8.4	38.2	34.9	+ 3.3	27.3	9.1	2.2
93	♀	20.3	29	8.4	41.4	45.7	- 4.3	42.9	8.7	3.9
—	♀	26.5	32	8.9	33.6	29.9	+ 3.7	20.8	6.0	3.1
T	♀	23.2	30	9.2	39.7	36.4	+ 3.3	29.3	8.2	3.7
T	♀	21.7	32	10.7	49.3	48.7	+ .6	47.5	7.0	1.5 ?
—	♀	21.2	34	11.2	52.8	56.7	- 3.9	60.4	5.4	2.7
3	♀	19.0	23	5.4	28.4	30.1	- 1.7	21.1	4.2	1.1
6. 124	♀	11.8	17	6.4	54.2	46.5	+ 7.7	44.1	5.6	3.3
4	♀	19.5	31	11.6	59.5	55.8	+ 3.7	59.0	5.6	3.5
43. 5	♀	24.8 ?	30 ?	8.1	32.7	30.0	+ 2.7	21.0	—	—
"Gerrard"	♀	21.7	26	7.6	35.0	29.1	+ 5.9	19.8	—	—
5 xii. 05	♀	28.0 ?	29 ?	10.2	36.4	—	—	3.6	—	—
16	♀	16.2 ?	28 ?	9.9	61.1	64.1	- 3.0	72.8	3.2	3.2
2	♀	17.6 ?	25 ?	7.6	43.2	45.2	- 2.0	42.1	—	—
3	♀	25.4	34	9.4	37.0	39.6	- 2.6	33.9	9.2	3.8
1 ^a	♀	22.0 ?	30 ?	9.8	44.6	41.4	+ 3.2	36.4	—	—
1161. F	♀	18.2	28	9.6	52.8	52.7	+ .1	53.9	4.2	3.1
1161. A	♀	24.7	36.5	12.9	52.2	48.9	+ 3.3	47.8	3.2	3.4
423. 5	♀	17.0	23	7.2	42.4	40.6	+ 1.8	35.3	3.0	2.2
7	♀	23.8 ?	33 ?	10.0	42.0	42.9	- .9	38.7	6.0	2.9
L	♀	30.0	36.5	8.5	28.3	30.6	- 2.3	21.7	8.8	2.9
8	♀	20.9	32.5	11.6	55.5	53.7	+ 1.8	55.5	4.0	4.1
10	♀	19.7	28	9.0	45.7	45.2	+ .5	42.1	6.5	5.0
1	♀	21.0	30	8.9	42.4	45.7	- 3.3	42.9	8.0	3.5
1	♀	25.0 ?	32.5 ?	8.9	35.6	36.9	- 1.3	30.0	—	—
2052	♀	21.8 ?	28 ?	6.5	29.8	35.8	- 6.0	28.5	8.8	3.0
982	♀	21.0 ?	27 ?	9.7	46.2	35.9	+ 10.3	28.6	—	—
2051	♀	15.4	23	6.9	44.8	49.9	- 5.1	49.4	6.2	4.3

Nasal Bridge in the Gorilla.

Simotic Index	Locus				Remarks
55.0	Natural History Museum	...	...	...	Sutures very vague
74.1	"	"	"	...	From Okuni district. Sutures clear
22.2	"	"	"	...	From Okuni district. Sutures vague [specimen mounted in case
—	"	"	"	...	Measurements uncertain owing to bad light and position of
47.4	"	"	"	...	Very large and heavy skull. Sutures not clear
—	"	"	"	...	Permanent teeth not quite erupted. Nasal bones too narrow to
—	"	"	"	...	Nasal bones too narrow to measure [measure
47.4	"	"	"	...	From Okuni district. Sutures vague
61.1	"	"	"	...	From Okuni district. Sutures clear
80.9	"	"	"	...	From Okuni district. Sutures vague
46.4	"	"	"	...	From Okuni district. Sutures very vague
45.0	"	"	"	...	From Okuni district. Sutures vague
—	"	"	"	...	In the Du Chaillu collection. Sutures obliterated
61.9	"	"	"	...	Sutures clear [specimen mounted in case
76.0	"	"	"	...	Measurements uncertain owing to bad light and position of
66.7	"	"	"	...	Young. Permanent teeth not quite erupted. Nasal bones
87.8	Royal College of Surgeons	...	...	...	Sutures clear [very narrow
—	"	"	"	...	Sutures clear. Split skull and therefore measurements un-
42.1	"	"	"	...	certain. Nasal bone abnormal on one side
48.0	"	"	"	...	Heavily made skull. Sutures clear. Nasal and maxillary
71.1	"	"	"	...	bones large, lacrymal bones very small
43.9	"	"	"	...	Young. Permanent teeth erupting
31.3	"	"	"	...	Split skull
43.3	"	"	"	...	Sutures clear [sutures are vague
—	"	"	"	...	Difficult to measure as skull is attached to skeleton in case and
24.2	"	"	"	...	Sutures vague
44.8	University College, Zoology Department	...	...	...	Adolescent. Split skull with badly fitting halves. Sutures
51.7	"	"	"	...	Perfect sutures [complex
45.1	Professor Thane	...	...	...	Young adult. Sutures clear
21.4	"	"	"	...	Sutures rather vague
50.0	Professor Pearson, Biometric Laboratory	...	...	...	Sutures vague
26.2	Cambridge Anthropological Laboratory	...	...	...	Sutures clear
58.9	"	"	"	"	Young adult. Sutures clear
62.5	"	"	"	"	Sutures clear
—	"	"	"	"	Sutures obliterated. Skull varnished
—	"	"	"	"	Sutures obliterated
—	"	"	"	"	Young. Third molar and canines not yet erupted. Nose
100.0	"	"	"	"	apparently damaged and deformed. Omitted from statistical
—	"	"	"	"	Sutures obliterated. A high, narrow nose [reductions
41.3	"	"	"	"	Sutures obliterated. Fourth molar appearing on right side
—	"	"	"	"	Sutures clear. Bicuspid out of place on right side
73.8	Cambridge Zoological Laboratory	...	...	...	Sutures very vague
106.3	"	"	"	"	Sutures clear [bones
73.3	Dr W. L. H. Duckworth	...	...	...	Sutures clear. Very narrow nasal bones and large maxillary
48.3	"	"	"	...	Young. Third molars and canines erupting
33.0	"	"	"	...	Sutures obliterated
102.5	"	"	"	...	Sutures clear but complex. Heavily developed skull
76.9	"	"	"	...	Sutures clear, but measurements rather uncertain on account
43.8	"	"	"	...	of ossicles in naso-maxillary suture
—	Oxford Museum	...	...	...	Sutures obliterated. Much developed crest
34.1	"	"	"	...	Sutures clear. Heavily developed skull
—	"	"	"	...	Sutures obliterated. Cleft in sagittal cres
69.4	"	"	"	...	Sutures obliterated
—	"	"	"	...	Aged. Sutures obliterated
—	"	"	"	...	Nearly adult. Sutures clear. Third molar nearly erupted

440 *A Study of the Nasal Bridge in the Anthropoid Apes*TABLE B. *Characters of the*

Museum Number	Sex	Meso-daeryal Chord	Meso-daeryal Arc	Meso-daeryal Subtense	Mesodaeryal Indices				Simotic Chord	Simotic Subtense
					α	α'	$\alpha - \alpha'$	β		
7	♂	20.0	27	7.1	35.5	40.4	- 4.9	35.0	6.0	.8
10	♂	14.8	16.8	3.8	25.7	23.5	+ 2.2	13.5	8.6	2.5
11. A	♂	15.2	19	4.8	31.6	33.2	- 1.6	25.0	5.0	1.3
11. 2	♂	15.1	18.5	2.7	17.9	31.2	- 13.3	22.5	9.8	1.8
10. A	♂	17.2	21	4.6	26.7	30.9	- 4.2	22.1	—	—
8	♂	16.0	19	3.9	24.4	28.3	- 3.9	18.8	8.2	2.1
9	♂	19.9	23	5.5	27.6	25.5	+ 2.1	15.6	7.7	.6
12	♂	21.1	27	5.5	26.1	35.4	- 9.3	28.0	10.0	1.0
3	♂	19.0	24	5.5	29.0	34.2	- 5.2	26.3	8.0	1.8
1	♂	19.2 ?	22 ?	4.9 ?	25.5	24.6	+ .9	14.6	—	—
2	♀	19.0 ?	20.2 ?	4.0	21.1	15.7	+ 5.4	6.3	—	—
11	♀	23.0	25	5.4	23.5	18.6	+ 4.9	8.7	8.7	2.4
11. 1	♀	19.0	22 ?	5.0	26.3	25.6	+ .7	15.8	9.0	1.6
11. B	♀	12.0	15	3.8	31.7	33.2	- 1.5	25.0	7.0	1.0
4	♀	17.0	19.5	2.7	15.9	24.7	- 8.8	14.7	8.7	.6
94	♀	22.3	26	5.2	23.3	26.4	- 3.1	16.6	—	—
7. 7. 8. 19	♀	25.0 ?	31	6.8	27.2	32.4	- 5.2	24.0	—	—
94. 7. 25. 2	♀	21.0	23.7	6.4	30.5	23.0	+ 7.5	12.9	8.0	3.0
64. 12. 1. 7	♀	19.0	22	5.4	28.4	25.6	+ 2.8	15.8	9.0	.9
87. 12. 1. 1	♀	14.1	17	4.8	34.0	29.7	+ 4.3	20.6	7.4	1.5
2. e	♀	20.0	27	7.6	38.0	40.4	- 2.4	35.0	8.2	1.7
82. 9. 18. 1	♀	22.0	25 ?	3.7 ?	16.8	23.6	- 6.8	13.6	—	—
64. 12. 1. 6	♀	18.2	22	6.3 ?	34.6	30.0	+ 4.6	20.9	8.4	2.0
Koo Loo 2. 1	♀	20.5	26.5 ?	7.8	38.1	36.4	+ 1.7	29.3	—	—
Talbot 33	♀	18.2	24 ?	6.1	33.5	38.2	- 4.7	31.9	—	—
90. 6. 8. 1	♀	19.2 ?	24.2 ?	6.5	33.9	33.9	.0	26.0	—	—
65/11 (b)	♀	16.0	18	3.7	23.1	22.6	+ .5	12.5	—	—
65/11 (a)	♀	22.0	28.5	6.2	28.2	36.5	- 8.3	29.5	—	—
1. 8. 9. 84	♀	15.2	21	6.0	39.5	42.6	- 3.1	38.2	—	—
7. 1. 8. 8	♀	18.0	21.5	5.4	30.0	28.7	+ 1.3	19.4	—	—
1. 8. 9. 10	♀	21.0	25	5.9	28.1	28.5	- .4	19.1	—	—
94. 7. 25. 3	♀	20.0	25.5	7.3	36.5	35.1	+ 1.4	27.5	7.0	2.0
95. 4. 11	♀	21.0	26	7.3	34.8	32.3	+ 2.5	23.8	—	—
2. a	♀	19.8	24	6.2	31.3	30.2	+ 1.1	21.2	—	—
83	♀	11.0	13	2.4	21.8	27.7	- 5.9	18.2	8.2	1.8
90. 6. 8. 2	♀	14.3	18	4.5 ?	31.5	33.9	- 2.4	25.9	7.0	1.9
61. 7. 29. 12	♀	23.2	28	4.9	21.1	29.8	- 8.7	20.7	—	—
83. 7. 28. 18	♀	18.8	25.5 ?	5.8	30.9	40.8	- 9.9	35.6	—	—
87. 12. 1. 2	♀	19.0	24.5	7.3	38.4	36.1	+ 2.3	28.9	—	—
A	♀	19.0	23	5.3	27.9	30.1	- 2.2	21.1	8.0	1.0
B	♀	16.2	20	5.3	32.7	32.0	+ .7	23.5	12.8	3.0
C	♀	21.0 ?	24 ?	5.3	25.2	24.3	+ .9	14.3	—	—
D	♂	8.8	13	3.5	39.8	48.8	- 9.0	47.7	—	—
K	♀	20.0 ?	25 ?	6.0	30.0	33.2	- 3.2	25.0	—	—
5	♀	13.2	19	5.1	38.6	46.4	- 7.8	43.9	—	—
E	♀	19.6 ?	23.5 ?	6.3 ?	32.1	29.2	+ 2.9	19.9	—	—
1163	♀	22.8 ?	28.5 ?	7.0 ?	30.7	33.2	- 2.5	25.0	—	—
1	♀	19.5	21	3.9	20.0	17.4	+ 2.6	7.7	—	—
2	♀	13.0	18	4.6	35.4	42.8	- 7.4	38.5	—	—
1	♀	15.0	18	3.6	24.0	29.2	- 5.2	20.0	—	—
2049 ^b	♀	14.8	17.4	4.7	31.8	27.2	+ 4.6	17.6	—	—
979	♂	19.1 ?	21.5 ?	5.2 ?	27.2	22.7	+ 4.5	12.6	—	—

Nasal Bridge in the Chimpanzee.

Simotie Index	Locus					Remarks
13.3	Royal College of Surgeons	...	...	...	...	Adolescent. Sutures clear
29.1	"	"	"	...	...	Sutures clear. A wide nose with abnormal nasal bones
26.0	"	"	"	...	...	Nearly adult. Sutures clear. Nasal bones narrow
18.4	"	"	"	...	...	Two sutures clear but the third suture quite obliterated
—	"	"	"	...	...	Sutures obliterated
25.6	"	"	"	...	...	Sutures very vague
7.8	"	"	"	...	...	Sutures very vague. Split skull
10.0	"	"	"	...	...	Sutures fairly clear
22.5	"	"	"	...	...	Sutures very vague
—	"	"	"	...	...	Sutures quite obliterated. Measurements uncertain owing to the position of the skull, which is attached to the skeleton in an exhibition case
—	"	"	"	...	...	Sutures obliterated. Measurements uncertain owing to the position of the skull, which is attached to the skeleton [in an exhibition case]
27.6	"	"	"	...	...	Aged
17.8	"	"	"	...	...	Sutures very vague
14.3	"	"	"	...	...	Young adult. Sutures clear
6.9	"	"	"	...	...	Two of the sutures clear
—	University College, Zoology Department					Sutures clear
—	Natural History Museum					Sutures obliterated. A large skull with very broad nose
37.5	"	"	"	...	...	Sutures clear
10.9	"	"	"	...	...	Sutures clear
20.3	"	"	"	...	...	Young. Three molars erupting. Sutures clear
20.7	"	"	"	...	...	Sutures fairly clear
—	"	"	"	...	...	Sutures obliterated
23.8	"	"	"	...	...	Sutures obliterated
—	"	"	"	...	...	Sutures obliterated
—	"	"	"	...	...	Sutures rather vague
—	"	"	"	...	...	Sutures obliterated
—	"	"	"	...	...	Young. Third molar erupted
—	"	"	"	...	...	Sutures obliterated
—	"	"	"	...	...	Aged. Sutures obliterated
—	"	"	"	...	...	Aged. Sutures obliterated
—	"	"	"	...	...	Aged. Sutures obliterated
28.6	"	"	"	...	...	Aged. Sutures rather vague
—	"	"	"	...	...	Sutures obliterated
—	"	"	"	...	...	Sutures vague
22.0	"	"	"	...	...	Sutures clear
27.1	"	"	"	...	...	Sutures vague
—	"	"	"	...	...	Sutures obliterated
—	"	"	"	...	...	Sutures obliterated
—	"	"	"	...	...	Sutures obliterated
12.5	Cambridge Anthropological Laboratory					Young. Third molar erupting. Sutures clear
23.4	"	"	"	"	"	Young. Third molar erupting. Very broad nasal bones and [narrow maxillary
—	"	"	"	"	"	Sutures obliterated
—	"	"	"	"	"	Young. Third molar erupting. Sutures obliterated. Omitted from statistical reductions owing to incomplete development
—	"	"	"	"	"	Aged. Sutures obliterated
—	"	"	"	"	"	Young adult. Sutures clear
—	"	"	"	"	"	Sutures obliterated
—	Cambridge Zoological Laboratory					Sutures obliterated
—	Dr Duckworth					Sutures clear
—	"	"	...	...	...	Young. Third molar and canines erupting
—	Oxford Museum					Fronto-maxillary suture obliterated
—	"	"	...	...	...	Sutures clear
—	"	"	...	...	...	Sutures obliterated

442 *A Study of the Nasal Bridge in the Anthropoid Apes*TABLE C. *Characters of the*

Museum Number	Sex	Meso-dacryal Chord	Meso-dacryal Arc	Meso-dacryal Subtense	Mesodacryal Indices			
					α	α'	$\alpha - \alpha'$	β
39	O ₂	18.0?	36	11.8?	65.6	79.6	-14.0	100.0
41		16.8	59?	12.6	75.0	160.1	-85.1	251.2
37		15.2	34.2	10.7	70.4	93.4	-23.0	125.0
38		13.8	37?	12.9?	93.5	116.6	-23.1	168.1
38. A		17.5	35	8.6	49.1	79.6	-30.5	100.0
45		11.8	33?	11.4	96.6	122.7	-26.1	179.7
42		16.8	38?	11.0	65.5	94.1	-28.6	126.2
40. A		10.0	25.3	7.7	77.0	108.5	-31.5	153.0
40. B		13.4	35.5	9.1	67.9	114.9	-47.0	164.9
40. E		11.6	23	6.8	58.6	78.7	-20.1	98.3
44		13.8	27.3	9.2	66.7	78.4	-11.7	97.8
44. A		12.7	27	9.7	76.4	86.6	-10.2	112.6
46		12.0	28.2	9.3	77.5	98.9	-21.4	135.0
—		16.6	29	8.5	51.2	65.2	-14.0	74.7
59. 8. 16. 2		11.0	33	12.7	115.5	133.4	-17.9	200.0
1101	O ₂	12.0	38	14.7	122.5	142.2	-19.7	216.7
92. 11. 5. 14		18.8	31	9.7	51.6	59.4	-7.8	64.9
55		17.1	26	7.7	45.0	51.6	-6.6	52.1
1087	O ₂	11.4	31	10.9	95.6	118.6	-23.0	171.9
1179. a		10.2	29	10.5	102.9	125.2	-22.3	184.3
3. b		13.8	31?	10.0	72.5	93.2	-20.7	124.6
—		14.0	35?	14.5	103.6	106.9	-3.3	150.0
3. i		15.2	30.5	11.2	73.7	80.0	-6.3	100.7
92. 11. 5. 4		17.0	35	11.6	68.2	82.9	-14.7	105.9
3. b ²		14.0	33	12.4	88.6	99.3	-10.7	135.7
3. m		13.4	24	10.5	78.4	67.8	+10.6	79.1
32		17.7	40	13.1	74.0	94.0	-20.0	126.0
79. 11. 21. 24		13.0?	33.5?	11.1	85.4	111.1	-25.7	157.7
52. 12. 26		16.0?	35?	9.6	60.0	90.0	-30.0	118.8
8. 7. 17. 1		14.8	26	9.5	64.2	65.8	-1.6	75.7
98. 2. 28. 11		15.0	32	10.7	71.3	87.0	-15.7	113.3
3. j		19.7	34	10.6	53.8	64.0	-10.2	72.6
3. a	O ₂	18.0	37	13.4	74.4	82.8	-8.4	105.6
3. d		15.6?	39	11.9	76.3	106.9	-30.6	150.0
3. q ²		12.4	25	9.4	75.8	80.5	-4.7	101.6
3. c ²		13.8	32?	10.9	79.0	97.2	-18.2	131.9
92. 11. 5. 5		20.8	37	11.0	52.9	67.1	-14.2	77.9
68. 16. 42		16.0	28.5?	10.2	63.8	67.2	-3.4	78.1
92. 11. 5. 3		20.8	32	8.4	40.4	52.7	-12.3	53.9
85. 20. 7. 1		16.0	29?	9.0	56.3	69.0	-12.7	81.3
85. 2. a 7. 2		10.8	25	9.5	88.0	97.0	-9.0	131.5
4		14.7	34?	11.8	80.3	96.9	-16.6	131.3
3		16.0	34	12.4	77.5	86.6	-9.1	112.5
2		13.0	32.5?	11.4	87.7	106.9	-19.2	150.0
1		15.7?	33?	12.2	77.7	85.3	-7.6	110.2
5		10.5?	26?	9.7	92.4	105.6	-13.2	147.6
1160. A	O ₂	15.0?	26?	7.1	47.3	64.4	-17.1	73.3
1160. G		13.0	32	11.7	90.0	104.9	-14.9	146.2
1160. D		12.5	33	11.7	93.6	114.4	-20.8	164.0
1163. C		12.0	26	8.4	70.0	88.9	-18.9	116.7
1136		9.8	34	12.0	122.4	157.9	-35.5	246.9
D. 1	O ₂	15.0	28	9.3	62.0	72.1	-10.1	86.7
D. 2		15.0	32?	10.0	66.7	87.0	-20.3	113.3
2		14.7?	32	10.3	70.1	89.4	-19.3	117.7
A		17.5	43	15.7	89.7	104.6	-14.9	145.7
1 ^a		11.0	27	8.4	76.4	104.5	-28.1	145.5
2043 ^a		9.0	28?	10.1	112.2	139.2	-27.0	211.1
2043		14.7	41?	15.3	104.1	122.3	-18.2	178.9
1		15.7	35.5	11.9	75.8	94.0	-18.2	126.1

Nasal Bridge in the Orang-utan.

Locus					Remarks
Royal College of Surgeons	...	...	...	...	Split skull with ill-fitting halves
"	"	"	...	...	Sutures very vague
"	"	"	...	...	Sutures clear
"	"	"	...	...	Sutures clear
"	"	"	...	...	Sutures clear
"	"	"	...	...	Sutures clear
"	"	"	...	...	Sutures clear
"	"	"	...	...	Sutures vague. Teeth misplaced
"	"	"	...	...	Sutures clear
"	"	"	...	...	Young. Sutures clear. Third molars erupting
"	"	"	...	...	Adult, but one third molar never erupted. Sutures clear
"	"	"	...	...	Sutures clear
"	"	"	...	...	Sutures clear
University College, Zoology Department	...	...	...	...	Lacrymo-maxillary suture not very clear
Natural History Museum	...	...	...	...	Sutures clear [side
"	"	"	...	...	No nasal bones. Maxillary bones meeting with ossicle on right
"	"	"	...	...	Sutures fairly clear. Unusually broad nose for an orang
"	"	"	...	...	Very aged. A large skull with broad nose and much developed crests. Sutures vague
"	"	"	...	...	Fragment only. Sutures clear
"	"	"	...	...	In the Whale Room
"	"	"	...	...	In the Whale Room
"	"	"	...	...	Sutures clear
"	"	"	...	...	Sutures clear
"	"	"	...	...	Aged. Sutures rather vague
"	"	"	...	...	Lacrymo-maxillary suture obliterated
"	"	"	...	...	Lacrymo-maxillary suture obliterated
"	"	"	...	...	Sutures clear. No nasal bones
"	"	"	...	...	Aged. Sutures clear [much developed crest
"	"	"	...	...	Aged. Sutures clear. Very long "spindle" nasal bone and
"	"	"	...	...	A large skull with rather vague sutures
"	"	"	...	...	Lacrymo-maxillary suture obliterated
"	"	"	...	...	Sutures clear
"	"	"	...	...	Sutures clear
"	"	"	...	...	Sutures clear. Nasal bones very narrow
"	"	"	...	...	Lacrymo-maxillary suture obliterated
"	"	"	...	...	Sutures clear. Very wide nose [bones extremely narrow
"	"	"	...	...	Broken orbits and therefore measurements uncertain. Nasal
"	"	"	...	...	Sutures clear. Very large skull
"	"	"	...	...	Sutures clear
"	"	"	...	...	Young adult. Sutures clear
Cambridge Anthropological Laboratory	...	...	...	...	Young adult. Sutures clear
"	"	"	"	"	Sutures clear
"	"	"	"	"	Young adult. Sutures clear
"	"	"	"	"	Lacrymo-maxillary suture absent, other sutures clear
"	"	"	"	"	Young. Third molar and canine erupting. Split skull and therefore uncertain measurements. Believed to be large species. Omitted from statistical reductions
Cambridge Zoological Laboratory	...	...	...	...	Right lacrymo-maxillary suture obliterated, left placed high on
"	"	"	"	"	Sutures clear [side of nose
"	"	"	"	"	Young adult. Four upper molars on both sides and four lower
"	"	"	"	"	Sutures clear [molars on left side
"	"	"	"	"	Young. Third molar and canines erupting. Believed to be large species. Omitted from statistical reductions
Dr Duckworth	...	...	...	...	Sutures clear
"	"	...	...	...	Sutures clear
"	"	...	...	...	Sutures clear
"	"	...	...	...	No nasal bones. Maxillary bones much developed
"	"	...	...	...	Sutures clear [incisors and canines
Oxford Museum	...	...	...	...	Young adult. Bicuspids on each side misplaced behind lateral
"	"	...	...	...	Young adult. Sutures clear
"	"	...	...	...	Sutures clear. ?Ossicle at dacryon on left side

444 *A Study of the Nasal Bridge in the Anthropoid Apes*TABLE D. *Characters of the Nasal Bridge*

Museum Number	Sex	Meso-daeryal Chord	Meso-daeryal Arc	Meso-daeryal Subtense	Mesodaeryal Indices				Simotic Chord	Simotic Subtense
					α	α'	$\alpha - \alpha'$	β		
6. 10. 4. 1	♂	13.2	20	4.3	32.6	51.2	-18.6	51.5	—	—
38. 3. 13. 7	♂	11.0	16	3.5	31.8	47.4	-15.6	45.5	5.5	.9
38. 3. 13. 5	♂	9.0	10	1.2	13.3	21.2	-7.9	11.1	4.3	.3
81. 3. 15. 1	♂	11.8	17	3.9	33.1	46.5	-13.4	44.1	6.6	.8
4 b	?♂	15.0	20	4.3	28.7	39.2	-10.5	33.3	5.4	.2
67. 11. 12. 5	♂	15.8	22	3.9	24.7	43.3	-18.6	39.2	—	—
8. 7. 201	♂	12.5	17.5	3.5	28.0	43.8	-15.8	40.0	—	—
58	♂	16.0 ?	23.8 ?	5.9 ?	36.9	49.5	-12.6	48.8	8.0 ?	.7 ?
59	♂	14.2	20.5	4.5	31.7	46.7	-15.0	44.4	6.2	.8
64	♂	10.0	15	3.3	33.0	50.3	-17.3	50.0	5.6	.5
65	♂	9.8	15	4.1	41.8	52.2	-10.4	53.1	5.5	.3
66	♂	9.9	15	4.3	43.4	51.2	-7.8	51.5	4.3	.4
70	♂	11.0	16.5 ?	3.6	32.7	50.3	-17.6	50.0	5.8 ?	.3
71	♂	9.8	13.5	2.8	28.6	42.3	-13.7	37.8	6.0	.4
72	♂	9.0	14.2	3.6	40.0	55.1	-15.1	57.8	4.0	.5
(5. a) 43. 12. 7. 5	♂	11.4	16.5	4.2	36.8	46.9	-10.1	44.8	4.0 ?	.5
11. 2. 24. 4	♂	9.9	20	5.7	57.6	80.8	-23.2	102.0	6.0	1.0
8. 11. 1. 1	♂	13.0 ?	22 ?	5.4	41.5	62.0	-20.5	69.2	—	—
90. 1. 28. 1	♂	12.0	15.5	1.7	14.2	36.3	-22.1	29.2	6.0	-.1
1097 a	♂	11.8	17.3	3.9	33.1	48.1	-15.0	46.6	5.3	.1
1097 c	♂	10.4	17.4 ?	4.6 ?	44.2	60.8	-16.6	67.3	—	—
9. 1. 51	♂	10.3 ?	17.3 ?	4.3	41.7	61.3	-19.6	68.0	4.3 ?	.2
1006 a	♂	9.3	17	4.0	43.0	69.9	-26.9	82.8	5.7 ?	.1
10. 10. 1. 8	♂	11.0 ?	18 ?	4.4	40.0	58.6	-18.6	63.6	—	—
10. 10. 1. 6	♂	10.7	18	3.1	29.0	61.4	-32.4	68.2	5.0 ?	.2 ?
79. 8. 30. 1	♂	11.3	16	3.5	31.0	44.8	-13.8	41.6	6.0	.8
10. 10. 1. 7	♂	11.4	16.6	3.0	26.3	47.5	-21.2	45.6	5.2	.5
54. 10. 5. 1	♂	12.8	20	3.7	28.9	54.2	-25.3	56.3	—	—
1006 d	♂	11.0 ?	19	4.5	40.9	64.0	-23.1	72.7	—	—
48. 1. 27. 46	♂	9.0 ?	16	3.7	41.1	67.0	-25.9	77.8	—	—
60. 5. 4. 48	♂	9.8	17	4.2	42.9	64.5	-22.6	73.5	—	—
60. 5. 4. 49	♂	9.0	12	2.4	26.7	39.2	-12.5	33.3	5.9	.9
1095 a	♂	11.0	17.5	3.7	33.6	55.9	-22.3	59.1	—	—
1095 c	♂	9.0	15.3	4.5	50.0	62.4	-12.4	70.0	6.6	.7

The symbol ♂ denotes sex unknown.

in the Gibbons, Hylobates and Symphalangus.

Simotic Index	Locus	Remarks
—	Natural History Museum	Hylobates syndactylus. From Pahang. Sutures obliterated
16.4	" " "	From Sumatra. Very young
7.0	" " "	Symphalangus. From Sumatra. Young adult
12.1	" " "	Symphalangus. From Sumatra. Asymmetric lacrymal bones
3.7	" " "	Symphalangus syndactylus. From Sumatra. Old. Sutures vague
—	" " "	Symphalangus syndactylus. Sutures vague. Nasals absent at the bridge
—	" " "	Symphalangus syndactylus. From Pahang. Very old. Sutures quite obliterated
8.8	Royal College of Surgeons	Symphalangus. Old. Sutures obliterated
12.9	" " "	Symphalangus. Old. Sutures rather vague
8.9	" " "	Hylobates sp.
5.5	" " "	Hylobates sp. Young
9.3	" " "	Hylobates lar. Adult
5.2	" " "	Hylobates sp. Old. Sutures vague, nasal sutures obliterated
6.7	" " "	Hylobates sp. Young
12.5	" " "	Hylobates sp. Very young [rated
12.5	Natural History Museum	Hylobates leuciscus from Malacca. Very old. Sutures obliterated
16.7	" " "	Hylobates hainanus from Hainan. Young. Peculiar lacrymal bones [rated
—	" " "	Hylobates gabriella from Annam. Old. Sutures quite obliterated
-1.7	" " "	Hylobates mulleri from N. Borneo. Nasal sutures vague
1.9	" " "	Hylobates agilis
—	" " "	Hylobates agilis from Sumatra. Sutures obliterated
4.7	" " "	Hylobates leuciscus from Java. Sutures obliterated
1.8	" " "	Hylobates hoolock. Young. Apparently no nasals, but process of frontal
—	" " "	Hylobates lar. From Malay Peninsula. Sutures obliterated
4.0	" " "	Hylobates lar. From Malay Peninsula. Sutures obliterated
13.3	" " "	Hylobates leuciscus from Borneo
9.6	" " "	Hylobates lar. From Malay Peninsula
—	" " "	Hylobates lar. From Malacca. Sutures obliterated
—	" " "	Hylobates sp. Ridge on maxilla. Nasal sutures obliterated
—	" " "	Hylobates lar. From Malacca. Sutures obliterated
—	" " "	Hylobates lar. From Malacca. Nasals broken
15.3	" " "	Hylobates lar. Young
—	" " "	Hylobates lar. Sutures obliterated, bisected skull
10.6	" " "	Hylobates sp. Very young