4. Man's Nasal Index in Relation to Climate

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Anthropology, Physical. Davies.

Man's Nasal Index in Relation to Climate.

By *Arthur Davies.*

4

I. INTRODUCTION.

For the purpose of distinguishing between various races certain physical characteristics are used as criteria. Most of these are specialisations of particular organs under environmental control for a considerable period, and once an organ becomes specialised it tends to remain so, *i.e.*, it does not evolve backward toward the unspecialised condition. It is essential to select as distinguishing criteria only those physical characteristics which persist in the race and are not subject to rapid alteration under influence of a change in environment. In this connection the nasal index, which approximately represents the ratio of the breadth of the nasal aperture to its height, has of late been regarded with some doubt because it appears to bear a marked relation to climate, broad noses everywhere being associated with hot moist climates and narrow noses with cool dry conditions. This relation of nasal index to climate needs investigation if it is still to be granted its former significance as an ethnic distinction.

In the *J.R.A.I.* for 1923, Professor Thompson and Mr. Buxton gave the results of their investigation into the correlation between Man's Nasal Index and Climate. This correlation was amply demonstrated. Following up their work, an investigation was made with special reference to Africa, with a view to examining the factors of climatic control on individual tribes and to obtain clearer ideas on the admissability of the nasal index as an ethnic distinction. In all, 220 tribes were considered. Temperatures and relative humidities were obtained and the product-movement method of correlation used. The conclusions arrived at in the correlation for Africa were applied to examples in Asia and Europe.

II. Conclusions of Article in "Journ. R. Anthrop. Inst.," Vol. LIII, 1923, p. 92 and Comments.

Professor Thompson's and Mr. Buxton's conclusions as to the correlation of nasal index and climate are clear and definite. They showed for the Old World that average climatic conditions correlates with nasal index to the extent of a correlation coefficient of ·721 where 1 is perfect correlation. If the population of the Old World had been shuffled about and mixed up on a huge scale within the past 2,000 years, it might well be argued that this demonstrated correlation with climate wipes out the racial persistence of the nasal index and so impairs its value as a criterion of race. The actual recent movement, however, in the populations investigated in Africa, India, and S.E. Asia is comparatively small. Where recent movement is evidenced, as in the case of the Jews and some Tartars, the correspondence between nasal index and climate is far from marked. Without further knowledge of the time taken for the nasal index to be adjusted to climate, no definite conclusion can be reached as to the persistence of this characteristic. In their summing up, Messrs. Thompson and Buxton draw attention only to the correlation without comment on the significance of the nasal index as a criterion of race.

The fact that climate correlates with nasal index in itself merely demonstrates that climate is responsible for making the nasal aperture broad in hot regions, a control that has long been suspected: it is not a proof that the nasal index is no longer of use to distinguish between races. It remains to prove that climate continues to alter the nasal index, to make it narrower under colder conditions and broader under warmer conditions. And also that this change takes place in a relatively short time. This implies a detailed investigation into the influence of climate on individual tribes.

III. Reconstruction Formulæ.

Before any attempt can be made to investigate control of climate, a reconstruction formulæ must be obtained whereby it is possible to calculate accurately for individual tribes the climatic index, *i.e.*, that value of the nasal index which local climate would determine. The reconstruction formulæ of Mr. Buxton confirm the correlation of climate, but are not accurate enough for individual application in every case. Actual nasal indices range from 55 to 110: these formulæ give climatic indices from 63 to 87. The calculated indices are too high for narrow noses and too low for broad ones. Evidently not enough allowance has been made for the effect of climate in hot regions and too much in cooler regions. This may be due to taking average climatic conditions as the climatic standard. To test this maximum conditions were tried in the formulæ, but the calculated indices are still too low, the actual index of 110 being calculated as 90. The other possibilities of error are in the regression coefficients of the formulæ used, which was nasal index = Temp. × ·46 + Rel. Humidity × ·22 + 24·9.

The coefficients ·46 and ·22 may be increased and the constant decreased. Nevertheless, when these coefficients of regression for temperature and humidity are increased to the optimum constant value, the formula is still unsatisfactory for the hottest and for the coldest regions, 110—93. The remaining possibility of correction is that the regression coefficients are not constant, but increase steadily with temperature and with relative humidity.

Regard it from another viewpoint. The regression coefficient for temperature was calculated by correlating temperature with nasal index and multiplying the correlation coefficient by a constant. Since all values of temperature were correlated with all values of nasal index in one correlation, there could obviously be only one correlation coefficient, and hence a constant regression coefficient. This, when substituted in the reconstruction formula, gives accurate results only for average

values of nasal index 68–84. Suppose temperature and nasal index be correlated in sections so as to discover if the correlation is more marked for higher values of temperature. Omitting details, the results of this sectional correlation for Africa showed that higher temperatures had a higher degree of correlation, the lowest degree of correlation being associated with lowest temperatures. Similar results were obtained in a sectional correlation between nasal index and relative humidity, the correlation being less marked and the variation in value of the regression coefficient being less rapid than in the case of temperature. This brings out the fact that temperature is a stronger influence than humidity in hot regions. From these results coefficients of regression were calculated which increased steadily with temperature and with humidity. Whereas the constant coefficient for temperature in Mr. Buxton's formula was ·46, the variable coefficient ranged from ·57 at 93° to ·33 at 75°. Four such values were plotted to form the graph of the temperature coefficient of regression: similarly for humidity. From these graphs the necessary coefficients can be substituted in the new formula nasal index = Temp. × CT + Rel. Hum. × C_H + 38. This formula when applied to Africa, and to European and Asiatic examples, gives suitable results for the entire range of indices. Using the selected climatic standards, man's nasal index in Africa correlated with climate to a coefficient of ·82, thus confirming the work of Professor Thompson and Mr. Buxton. The main value of this formula, however, is in the possibility of applying it to individual tribes with considerable chances of accurately determining the actual indices. The following test cases demonstrate this point:—

		Climatic Index.	
Tribe.	*Actual Nasal Index.*	*Constant Coefficient.*	*Variable Coefficient.*
Bambute (Congo)	110	95	112
Fertitawi (Sudan)	103	87	103
Battaks (Sumatra)	91	85	91
Ouled Said (Tunis)	64	76	63

In these cases maximum temperature and humidity have been used for the two highest indices and average conditions for the others. This leads to a discussion of the most suitable climatic standards to be adopted.

IV. Climatic Standards.

Professor Thompson and Mr. Buxton used average climatic conditions throughout the world. They were found unsatisfactory for the hottest and moistest regions, and for extreme climates in the interior of continents. Fifty per cent. of the examples were accurate for cool moist climates, 25–30 per cent. for hot climates, and 23 per cent. for extreme climates. In the investigation for Africa, maximum conditions (mean temperature and humidity for the typical summer month) gave 75 per cent. accurate; average conditions in the temperate climate of Algeria and coastal Tunis gave 80 per cent. accurate. These standards were tested to find the most suitable in examples from Asia also. It is of interest to note that in the case of extreme climates, minimum conditions are in no case an acceptable climatic standard. For Siberia, Arizona and Turkestan the following results are significant:—

		Climatic Index.	
Tribe.	*Actual Nasal Index.*	*Average Conditions.*	*Maximum Conditions.*
Altai Tartars	74	61	73
Arizona	78	66	84
Turkestan	78	65	82

Minimum conditions are quite useless. Average conditions are based partly on minimum conditions which for temperatures below 40° do not affect the nasal index, and so average conditions are unsatisfactory. A climatic standard based on the mean of monthly temperatures over 40° might be the most suitable. This has not yet been tested, however.

Summing up the evidence on climatic standards: For hot moist regions it appears maximum conditions are the chief control, and therefore the most reliable standard. For temperate and equable climates average conditions prove more satisfactory. For regions of extreme climates some standard between average conditions and maximum conditions seems to be in control.

What does this mean? Heat increases the width of the nasal aperture, and this operates without restraint to the highest temperatures experienced. On the other hand, the nasal index does not correspond with climate for low temperatures; once temperature passes below 60°, further narrowing of the nasal aperture is limited and ceases when temperature falls below 40°.

The nasal aperture adjusts readily to withstand conditions producing heat, but not to cold conditions. The same is true to a lesser degree of humidity conditions.

V. Effect of Climate on the Nasal Organ.

So far use has been made of mathematical evidence to try to find the factors of climatic control of the nasal organ. How do these conclusions conform with the physiological aspect? It was found:—

(1) Regression coefficients increased steadily with temperature and humidity.
(2) Correlation between nasal index and temperature is highest in hottest regions.
(3) Maximum conditions are the best standard in hot areas; mean conditions in temperate climates; minimum conditions of a dry cold nature, whether regional as in Greenland or seasonal as in Central Siberia, have little effect on the nasal aperture.

The functions of the nasal organ include (1) the admission of air to the lungs in sufficient quantity, and (2) the adjustment of this air to a temperature and a humidity suited to the lung tissue. Of these two functions, it is the second that is chiefly influenced by climate. The efficiency of the nose in its first function to admit air is not impaired by increased width and larger aperture (though it may result in slower breathing), and so it can freely keep on widening with increased temperature and humidity. On the other hand, the narrowing of the nose with lower temperatures and humidities results in the nasal aperture rapidly decreasing in volume. The lungs, however, must have sufficient air irrespective of the capacity of the nose to warm and moisten it, and so the narrowing of the nose is limited by this first function of the nasal organ. When the air is too cold and dry for the lungs, the nasal aperture adjusts to climate only to a certain stage; beyond that, colder conditions result in modification of other organs of the body, *e.g.*, changes in character of the skin and hair. Also, artificial aids are used—as, for instance, the wearing of furs over the face to form an outer warming chamber. When a body has to adjust to a hot climate, devices for cooling are neither so numerous nor so effective as devices for conserving heat, and so the widening of the nasal aperture and the consequent increase of the nasal index is pushed to the limit of efficiency. Thus the regression coefficients rapidly decrease, the climatic correlation is less marked, and minimum climatic conditions are of no use as an effective climatic standard.

Once the nasal aperture reaches its limit of narrowing, it is possible that further adjustment to climate may proceed in the lengthening of the nose and in the developing of unusual shape.

One point of considerable importance emerges from this argument: the broad nose is a highly specialised organ; the narrow nose is much less specialised since the adaptation to environment has in the main taken place in other organs.

VI. Application to Individual Tribes.

Using the reconstruction formula previously obtained and the climatic standards discussed, the control of climate may be investigated in the case of particular tribes. For any tribe the present climatic index can be calculated; also, if its former home be known, the original climatic index, which it possessed when it entered its present region, can be calculated. (It is probable, from an inspection of correlation coefficients, that this method of arriving at the original nasal index is more accurate than the use of cranial data.) Lastly, provided there is sufficient historical data, the period during which the present climate has been in control may be determined. It remains to select only those tribal migrations on a large scale which have been free from intermixture with other tribes and of whose migration the details are fairly reliable. Dr. Haddon's "Races of Mankind" and "Wanderings of Peoples" are the sources used.

(I.) The Narrowing of already Broad Noses.

Seventeen cases have been examined of tribes whose nasal index is at least 10 units above the climatic index for their locality, and where intermixture on the whole has been slight. Each has been in its present area from 4,000 to 15,000 years, *i.e.*, sufficiently long to have appreciably adjusted to climate. The original nasal index has been calculated for each. Of these examples, 14 show no evidence whatsoever of having narrowed from their original type. Three cases appear to have narrowed about 4 units in 6,000 to 8,000 years. This narrowing could easily be explained by intermixture with surrounding tribes. The weight of evidence is heavily in favour of the supposition that broad noses do not narrow under colder and drier conditions. It would be an interesting side-issue to follow from this conclusion to the reconstruction of the climates of byegone days which produced the broad noses of certain races.

(II.) The Widening of Noses.

In this connection instances are numerous of the nasal index increasing when exposed to warmer and moister conditions. Eight cases are considered which fulfil the requirements as to migration details; two are from Africa and six from Asia. In every case the nasal index has increased from its original calculated nasal index. The rate of change has been determined in the eight cases. The time taken to increase by one unit is as follows: 350 years, 600, 650, 400, 450, 450, 450, 420. These results are reasonably constant, and show an average increase of one unit in approximately 500 years.

The definitely broad nose does not narrow in response to climate, but the lower limit of the broad nose in this connection is not yet determined. Medium noses may narrow, as is shown by 14 cases from Western Europe. In all these cases the actual indices correspond closely with the calculated, indicating that adjustment does take place in medium and narrow noses.

The conclusion is reached that the narrow nose adjusts steadily to hotter and moister conditions, but the broad nose does not narrow in response to cooler and drier conditions. The previous section arrived at the conclusion that the broad nose is a specialisation to a far greater extent than the narrow nose. Combining the two, it seems that the specialisation tends to persist, in the nasal organ as in other organs, while the non-specialised organ adapts to environmental control.

These conclusions suggest that whereas the broad-nosed races may have originated from narrow-nosed types as a result of climate, the contrary at any rate does not obtain. The broad nose of the human race which is a result of climate does not narrow.

Yet it is suspected that man has a narrower nose than his ancestor. It has not narrowed as a result of climate: it may be found that this change in the nasal aperture is associated with diminution of jaws, growth of forehead, and other structural modifications.

VII. Significance of the Nasal Index as an Ethnic Distinction.

The broad nose is a specialisation that persists. The narrow and medium nose adapts to a change of climate at the rate of one unit in 500 years. Within 2,000 years it will differ appreciably from that of its racial and original stock, and serves only to distinguish between two tribes in the same locality. Eventually even this minor distinction is lost.

The broad nose, where it exceeds its climatic index, is a positive evidence of racial relationship; the narrow nose, except for recent migrations, can serve only to distinguish between two tribes in the same area. If its rate of change be taken into consideration, it may be of value as a confirmation of relationship. In no case can it be regarded as a reliable ethnological criterion unless it is considered in relation to the climate where it is found.

Adjustment of Medium and Narrow Noses.

Area.	*Actual Nasal Index.*	*Climatic Index.*
Mont de Marson	70	67
Landes (France)	70	70·7
Sarlat (Dordogne)	69·8	68·2
Paris	69·1	69
La Gironde	69	70
Italian soldiers	68·5	68
Soule (France)	69	70
Brussels	68	69
Basses Pyrénées	68	66·5
Bretons	67·5	69
Venetians	67	69
Auvergne	67	69
S. France	65·7	65
Tirolese	63	64

Narrowing of already Broad Noses.

Tribe.	*Date.*	*Climatic Index.*	*Actual Index.*	*Original Climatic Index.*
Samoyedes	5000 B.C.	69	77	78
Kamchatka	5000 B.C.	69	77	78
Chukchi	5000 B.C.	67	79	79
Australian	13000 B.C.	80	94	96
Tasmanian	18000 B.C.	77	98	98
Ulu Ayar (Borneo)	12000 B.C.	87	91	96
Murat (Sarawak)	1000 B.C.	87	99	96
Bushmen	10000 B.C.	82	94	95
Hottentots	3000 B.C.	83	92	95
Munda (Chota Nagpur)	1500 B.C.	84	91	92
Semang (Sumatra)	12000 B.C.	89	97	96

Narrowing of already Broad Noses—cont.

Tribe.		*Climatic Index.*	*Actual Index.*	*Original Climatic Index.*
Lissu (Yunnan)	2000 B.C.	70	86	90
Lolo (Szechwan)	2000 B.C.	72	87	90
Miaotse (Kwangsi)	2000 B.C.	84	89	90
Formosans	2000 B.C.	78	95	90
Mande (Assam)	2000 B.C.	85	94	90
Kachin (N. Burma)	2000 B.C.	87	90	90
Widening of Noses.				
Oraon (Chota Nagpur)	200 A.D.	83	85	78
Rajput (Kashmir)	1700 B.C.	72	72	65
Gujar ,,	450 A.D.	72	67	65
Bebhan (Bihar)	1400 B.C.	83	74	65
Kanets of Kulu Valley	1700 B.C.	74	73	65
Kababish (Sudan)	900 A.D.	79	71	69
Beni Amer (Sudan)	900 A.D.	79	71	69
Rajputs (Rajputana)	1700 B.C.	79	74	65

ARTHUR DAVIES.

Britain: France : Archæology. **Burkitt.**

Archæological Notes. *By M. C. Burkitt.* **5**

The Cleveland Hills.—May I draw the attention of the readers of MAN to the archæological investigations in the Cleveland Hills (Yorkshire) which are being carried out by the Curator of the Dorman Museum, Middlesbrough. Not only has Mr. Elgee been finding Bronze Age villages and burial-grounds on the moors, but pigmy industries are being collected at a number of sites. When studying these latter with Mr. Elgee at Middlesbrough, I was not able to distinguish the two series so clearly demonstrated in West Yorkshire by Mr. Buckley, but the Cleveland examples fall into line with many other sites in Eastern England where pigmy tools have been found. The industries occur on the surface of what seem to have been settlement sites. One of these is above Commondale and occurs on the end of a low spur near the top of the ridge towards Lockwood Beck. I collected flakes and small blunted backs over an area of at least 25 yards square. I fancy some small scrapers and cores have also been found at this site, though personally I had no luck in finding them. The micro-graver has yet to be discovered, but doubtless, as at Peacehaven, it will eventually turn up. At the other end of Commondale near Sleddale Beck, Mr. Elgee discovered an interesting burin (fig. 1). It is of the ordinary variety and has been resharpened in prehistoric times; it has also been fired, though probably only by moor fires due to natural causes or the burning of the heather. This burin is rather peculiar as not being one of the usual types of burin found with the pigmy tools. Mr. Buckley—to whom I showed it—could not find a parallel from Western Yorkshire. I felt, therefore, justified in presenting it to the readers of MAN, while at the same time drawing attention to the excellent work being undertaken in Cleveland in connection with the Dorman Museum.

FIG. 1.

Engraved Signs on the Monuments of Brittany.—Last year there was published by Monsieur and Madame Saint-Just Péquart in conjunction with Monsieur Le Rousic—the Curator of the Museum at Carnac—a work entitled "Corpus des