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Let us remark here that a negative D_2 refers to the ascending slope of the curves on the left being steeper than the descending slope on the right and that a positive sign of D_4 means that small deviations appear in greater number than would be the case in accordance with the simple exponential law.

In order to show clearly the part played by the various terms of the series in the composition of the curve of distribution a comparison has been given in table VIII, as in table VI, of the observed and calculated frequency-numbers of the last series of table IV; the number of observations 4516 has here been reduced in the first column under O to 1000.

From this table is evident that, if only a great number of observations is at hand, the frequency-curve of the air-temperature can be very satisfactorily determined by the three constants of the series of BRUNS, the total of the differences between observation and calculation amounting in round numbers to 4 %.

Anthropology. — “*Is red hair a nuance or a variety?*” By Prof. L. BOLK.

Concerning the anthropological importance of red hair the literature relating to it contains up till now little more than opinions based upon general impressions or suppositions, founded on statistical data, which when looked at more closely are open to more or less unfavourable criticism. There is in those opinions and suppositions a definite main current according to which it is generally assumed that a closer affinity of redhairiness exists to what, for the sake of brevity, I shall indicate as the blonde race, characterized as to the pigmentation by blonde hair and blue eyes.

The nature of the relation between blonde and red-haired people is expressed by TOPINARD¹⁾ as follows: the red-haired type has arisen from the blonde type “*par une action des milieux*”. Also BEDDOE and RIPLEY, to mention the principal English and the best known American anthropologist, assume a closer connection between blonde and red hair. VIRCHOW looks upon the subject from a somewhat different standpoint, when he says that redhairiness probably arises in two manners, viz. by a decrease of pigment in brown hair or an increase in blonde hair²⁾. This opinion of VIRCHOW is based upon

¹⁾ *Éléments d'Anthropologie générale*. Paris 1885 p. 334

²⁾ Das jedoch scheint mir nicht unwahrscheinlich zu sein, dass es eine doppelte Art von Rothhaarigkeit giebt, von denen die eine als eine Steigerung des Pigments bei den Blonden, die andere als eine Verminderung desselben bei den Braunen anzusehen ist. *Archiv für Anthropol.* XVI Bnd. p. 338.

his statistics of the extension of redhaired people in Germany. Now it would not be difficult to prove that VIRCHOW was in no way entitled to such a conclusion on the ground of his statistics; his data were very incomplete and the relations found by him he himself calls "ganz unzutreffend". I intend to revert to this in another place, but would like to examine another side of VIRCHOW'S conclusion somewhat more closely. For where he says that redhairiness arises, either by an increase or by a decrease of the hair-pigment, this implies that in VIRCHOW'S opinion redhairiness is the consequence of quantitative difference, and that, in other words, this quality is consequently only a question of gradation. Moreover I do not wish to enter into the question whether VIRCHOW has a right to place blonde or brown over against each other as primary or pure hair-colours. Let it suffice for the present to state that VIRCHOW sees no contrast between red and blonde hair, but that the former is only a nuance, either of blonde or of brown. I know only one anthropologist who, in contradistinction to the great majority, raises his voice against the existence of a closer relationship between red and blonde hair, viz. AMMON, who in his Anthropology of the Baden population hazards the suggestion that the difference between blonde and red hair is not founded on a quantitative difference of the pigment, but on a qualitative distinction. So AMMON is more inclined to the opinion that in redhairiness not a nuance, but a variety renders itself manifest ¹⁾.

In working up my anthropological material concerning the population of Holland I have naturally come to the question about the importance of redhairiness, and the conclusion at which I have arrived deviates from the general opinion. The extension of redhairiness in our country causes me to deny every closer relationship with the blonde race.

Let me begin by pointing out that the composition of our population is very favourable for an answer to this question. A few years ago I had the pleasure in this meeting to throw light upon the main features of the composition of our population from the so-called blonde and brown-haired race. And I could then establish how the composition of our population differs, if the northern part of our country is compared with the southern. The blonde type decreases regularly in a southern direction, going hand in hand with an increase of mixed types, and though of course in a smaller proportion, an increase of the pure brown type. The differences

¹⁾ Die von manchen Anthropologen beliebte Vereinigung der roten Haare mit den blonden, halten wir für unzulässig, denn die roten stehen in vielen Fällen den braunen näher und sind jedenfalls stärker pigmentiert, haben vielleicht ein Pigment von anderer Beschaffenheit. Zur Anthropologie der Badener. blz. 129.

between the northern and southernmost parts of our country are in the end rather considerable, and it is for this very reason that our population is so extremely fit to answer a question like this. If it should after all be true that redhairiness is more closely related to blondness, then the variation in the number of blondes cannot but cause a similar change in the number of redhaired people.

The materials for the following illustration have again been borrowed from my inquiry made at the time into the distribution of the colour of hair and eyes among the population of Dutch schools. On the schedules that were distributed for that purpose I distinguished four colours of hair: blonde, brown, red and black, and four colours of eyes: blue, grey, brown and brownish-green. The total number of children examined, amounted, with the exception of the Israelites, to 478.976. The total number of redhaired individuals among them is 11772, so that there are on an average 2.45% redhaired children. The figures from which this proportion has been borrowed, are high enough to consider this as the exact average.

The first question we shall answer is: in what proportion do red-haired persons occur in the different provinces of our country. This appears from Table I. In the first column is found the total number of the children examined in each province, in the last the number of red-haired ones among them, also in the proportion expressed by the percentage. What appears from this last column? Suppose that in round numbers the general average is 25 red-haired individuals in 1000 inhabitants, then we see that in four provinces: Friesland, Gelderland, N. Holland and Utrecht the same proportional number appears, that there occurs in Z. Hollând only one in 1000, in Groningen 2 in 1000 and in Overijsel and Limburg 3 in 1000 less — in N. Brabant 1 and in Drenthe 2 more in 1000 inhabitants. These figures differ so little, also from the general average, that we are in my opinion fully entitled to conclude that in the provinces mentioned the extension of red-haired persons is much the same everywhere.

This slight difference in the percentage of redhaired persons in our country is corroborated by Table II in which the absolute numbers and the proportions are mentioned of all the places in our country in which the number of the children examined was more than 2500. It was to be expected that where the absolute numbers are sometimes relatively low here, the variation of the percentage would be greater. But yet nowhere does the proportion fall below 2% and only once a percentage of 2.9 is reached as the most favourable proportion. Where the absolute figures are high, as in Amsterdam and Rotter-

TABLE I.

Province	Total	Blondhaired- blue-eyed	Blackhaired brown-eyed	Redhaired
Friesland	33.053	14.282=43.2%	566=1.7%	857=2.5%
Groningen	32.223	13.401=41.3	446=1.4	755=2.3
Drenthe	15 169	5.959=39.4	205=1.3	422=2.7
Overijssel	41 389	14.713=35.5	689=1.6	919=2.2
Gelderland	46 786	16 078=34.4	1340=2.8	1198=2.5
Zuid Holland	108 073	33.043=31.4	2 712=2.5	2640=2.4
Noord Holland	97 050	30 291=31.2	1791=1.8	2472=2.5
Utrecht	22 017	6.626=30.1	528=2.4	545=2.5
Zeeland	20.986	5.707=28.4	834=4.1	395=1.8
Noord Brabant	41.155	9 173=22.3	1661=4.0	1072=2.6
Limburg	21.902	4 790=21.8	1013=4.7	497=2.2

TABLE II.

Municipality	Total	Redhaired	Percent.
the Hague	13.184	276	2.01
Enschede	3 667	77	2.1
Maastricht	3.812	86	2.2
Utrecht	8 668	205	2.3
Haarlem	9 908	229	2.3
Hengelo	2.876	68	2.3
Rotterdam	25 828	647	2.5
Amsterdam	44.118	1164	2.6
Dordrecht	4.586	123	2.6
Zwolle	3.618	101	2.7
Deventer	3.754	105	2.7
Leeuwarden	3 562	102	2.8
Leiden	5.648	161	2.8
Gouda	3.640	102	2.8
Groningen	5.039	142	2.8
Arnhem	6.269	170	2.9

dam, the general figure of proportion, which has been found, reappears again.

Thus far I have left one province out of consideration, Zeeland. There is no denying that this province takes up a place somewhat separated from the others, since here the number of redhaired persons falls suddenly to 1.8%. This contrast with the other provinces is too great not to see here the influence of a definite cause. Yet this decrease in redhairiness in Zeeland, as will be proved higher up, cannot be attributed to a rise in the number of brunettes, which really occurs here, for N. Brabant, which is no less brunette than Zeeland, does not show this decrease. I will not enter into the cause of this decrease, I only wish to point out that already repeatedly both by Belgian and Dutch investigators attention has been drawn to the fact that from an anthropological point of view our Zeeland population takes up quite a peculiar place among the inhabitants of our country. It seems to me that this opinion is corroborated by the proportion found for the redhaired persons.

This much concerning the extension of redhaired persons in our country in general. The general conclusion to which we come, may be expressed thus, that with the exception of Zeeland this extension is a very regular one all through the country. This fact was really contrary to my expectation, as I myself, when beginning to work up my data, held the general opinion that there was a closer relationship between redhairiness and blondness. So I expected that, where in our country the blonde type varies so strongly, the influence of this would also come forth in the variation of redhairiness. Let us now, in order to prove the independence of the two phenomena, pay some more attention to Table I. For through this table we also get an insight into the decrease of the blonde and the increase of the brunette race, in a direction from North to South. As I said before, I distinguished on the schedules sent round four colours of hair and four of the eyes, making together 16 combinations. Of these combinations there are two which are really characteristic for the race, namely the combination blonde hair and blue eyes for the blonde race and the combination black hair and brown eyes for the brunette race. The other 14 combinations may be considered as mixed forms between the two races. Now, in order to keep the foundation of my reasoning as pure as possible, I have inserted in Table I only these two combinations to mutually compare them.

In the third column we find the number and percentage of blond-haired blue-eyed individuals in the different provinces. Now it appears that the number of pure blondes decreases very regularly from North

to South. The number is greatest in Friesland, viz. 43.8%, smallest in Limburg 21.8%, so reduced to half of the number for Friesland. The fourth column affords a survey of the increase of pure brunettes. Herein Drente shows the smallest number, 1.3%, Limburg the greatest 4.6%. The figures in this column point to a distinct increase in a southern direction. From this table something else appears that is important for the characterisation of redhairiness. If namely the percentages of the "pure" types are added up, so the blondes and the brunettes, this gives for Friesland a total of 44.9%, for Limburg only 26.4%, while between these two numbers those of the other provinces are regularly grouped. So the number of mixed types is in the south of our country nearly 20% higher than in the north. As a general result we may state a decrease of the pure blondes, an increase of the pure brunettes and the mixed types in a southern direction.

And notwithstanding in Friesland twice as many pure blondes are found as in Limburg, a change in the number of redhaired individuals is not perceptible. Therefore I think I am entitled to deny the existence of any relation between the two phenomena on the ground of the figures found. But my table also induces me to reject the opinion which is sometimes given, that redhairiness should be a consequence of a crossing between a blonde and a brunette individual. If this were the case, an increase might be expected of the number of redhaired persons in a southern direction in connection with the increase of mixed types.

Have I therefore to deny relationship between the blonde and the redhaired type on the ground of the data mentioned, a still stronger proof for this is afforded by another fact, which I had expected as little as the others which have been explained. It is namely the extension of redhairiness among the Jewish school-population. The total number of Jewish children examined at Amsterdam, the Hague and Rotterdam amounted to 9155. Of these 228 were redhaired, i.e. 2.47%, whilst for the not Jewish population a proportion of 2.45% had been found. The agreement between the two figures is surprising and the importance of the fact for the question put by us, shows itself clearly, when I point out the fact that pure blondes i.e. blondhaired blue-eyed Jews occur only in a proportion of 8.2% pure brunettes, i. e. black-haired brown-eyed in 18.1%. From this it proceeds that in our country among the Jewish schoolpopulation with 8.2% pure blondes, there occur as many redhaired persons as in Friesland with 43.2% pure blondes. A stronger proof that there is no direct relation between redhairiness and blondness cannot be desired.

Thus far we examined redhairiness with regard to the increase or decrease of the number of blondes among our population, and we came to the conclusion that the two phenomena are independent of each other. We can now look upon the phenomena from another point of view. If it were true that redhairiness showed a preference for the blond race, the consequence of this must needs be that among the children who, as to pigmentation, belong to the blonde race, accordingly such as have blue or grey eyes, there are more redhaired individuals than among those with brown or brownishgreen eyes.

How far this is true is shown by Table III.

TABLE III.

Colour of eyes.	Total	Blondhaired	Brown	Black	Red
Blue . . .	186 033	83 340%	11 81%	2.38%	2 470%
Grey . . .	152.072	79 67	14 66	3.06	2.63
Brownish-green	58.531	60.68	28 64	8.—	2.55
Brown . .	82 338	45 05	38 61	14 28	2.03

The first column mentions the total number of children with one of the four different iris-colours, and in the four following columns we find consecutively the percentage of the combination of the iris-colour with one of the four haircolours. Phenomena make themselves manifest therein, which were to be expected beforehand. Of the blue-eyed individuals for example, 83 % have blonde hair, of the brown-eyed only 45 %; on the other hand the number of brown-haired persons with the last is more than three times as large as with the blue-eyed, and a relatively still stronger rise is found with the blackhaired. Generally speaking, it appears that with an increase of the pigmentation of the iris also the pigmentation of the hair increases. This holds good for blonde, brown and black hair. But in contradistinction to this there appears to be no relation between the degree of pigmentation of the iris and the hair with redhaired individuals. For of the blue-eyed 2.47 % are redhaired, of the grey-eyed 2.63 %, of the brownish-green-eyed 2.55 %, and of the brown-eyed 2.03 %. It is true, this last figure is the lowest, but it seems to me that the difference is not so great that therein the proof may be seen that redhairiness shows less relationship to the brunette race. Moreover, this opinion could directly be refuted by the fact that I

find a somewhat lower percentage of redhaired individuals among the blue-eyed children than with the grey or brownish-greeneyed.

Red hair is therefore a quality altogether independent of the degree of pigmentation of the iris. No matter from what side we look upon the redhairiness with regard to the other phenomena of pigmentation of hair or eyes, there is — at least on the score of my-researches -- not a single proportion to be alleged on behalf of the opinion that redhairiness should by preference occur in the blonde race. So I cannot but reject as incorrect the opinion of those who, reducing redhairiness to a quantitative difference of pigment, see in it nothing but a nuance. And these results of our investigation naturally lead to considering red hair as a variety, in which the pigment is qualitatively different from that in blonde and black hair. Between these two last there is properly speaking no real difference; gradually, through numerous shades, flax-blonde hair passes into jet-black, by an increase of the quantity of pigment; also in red hair a great number of shades can be distinguished; in proportion to the quantity of pigment the colour varies between gold-blonde and fiery red.

How is the appearance and the regular extension of redhaired individuals among our population to be accounted for? It need hardly be said that, on the ground of the proportions found, I am not entitled to give any explanation. For this purpose anthropological researches of another nature would be necessary. Only for the sake of completeness I mention the opinion of TOPINARD, who explains redhairiness from a former mixing with an originally redhaired race, which in pre-historic times is said to have inhabited the plains of Russia, Siberia and Turkistan and of which one of the groups of the Finnish population (the Letts and the Esths) are said to be the purest descendants ¹).

¹) L'histoire de cette race est à faire. Jusqu'à nouvel ordre j'admets qu'elle a occupé le sol de la Russie aux époques préhistoriques, antérieurement à l'invasion des Asiatiques, répondant à l'un des deux types finnois actuels, je n'ose dire de celui qui a apporté la langue du Kalevala. Elle est représentée dans la plupart des kourgans anciens de la Russie. Le type en est signalé dans les annales des Han antérieurement à l'ère chrétienne en Sibérie et dans le Turkestan Chinois — *Éléments d'Anthrop. générale.* p 334.

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