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JURIJ TAMBOVCEV (Novosibirsk)

LANGUAGE PROPINQUITY FROM THE POINT OF VIEW OF PHONOLOGICAL FEATURES

Every language has its own sound colouring expressed in the mosaic of the phonemic properties. Usually man feels the differences of the sound tenor of this or that language well and can tell one language from another without resorting to the meaning of the words. In our study phonological characteristics are chosen as the basic linguistic features for measuring the phonic similarity of languages.

The analysis of sound colouring of a language is possible only if some reliable and universal device is introduced. In this study this tool is the set of distinctive features which are defined on the articulatory basis as well. The phonological systems of languages tend to be symmetrical and a limited number of phonetic parameters taken from a fairly small universal set recur in a variety of combinations in different languages. These basic phonological ingredients are called distinctive features. The journal space does not permit us to dwell on them but one can find the details elsewhere (e.g. Crystal 1980 : 117—119; A Grand Dictionary of Phonetics 1981 : 165—168).

An adequate theory of phonological distinctive features must meet four criteria: 1) It must have a relatively consistent and direct relation to the phonetic properties of speech sounds; 2) It must be able to describe all and only the distinctions made by the sound systems of any of the languages; 3) It must be able to characterize all and only the natural classes of sounds that recur in the phonological phenomena of different languages; and 4) It must correctly characterize the subgrouping of features by recurrent phonological phenomena. The third criterion is the most important one and probably the hardest to achieve. The fourth has assumed greater importance in the last five years or so in the context of work on feature geometry (McCarthy 1994 : 191).

Actually, our consonantal classification defines: 1) Labials; 2) Front; 3) Palatal; 4) Back; 5) Sonorant; 6) Occlusive; 7) Fricative; 8) Voiced. We calculate the per cent of consonants to all the phonemes in the sound chain, therefore, the values of the frequency of occurrence of non-consonants, i.e. vowels are also taken into account automatically. We consider glides (/j/ and /w/), nasals and liquids consonants and put them into the group called "sonorants". It is not a bad idea to consider the frequency characteristics of the sum of dental, alveolar, alveo-palatal, retroflex and palatal sounds under the term "coronal". Such combination may yield some important phonostatistical results. Actually, O. S. Širokov (Широков

1985) investigated this group of consonants functioning in Russian poetry. The other interesting parameter which could be used in our studies is called "anterior-nonanterior". In the production of anterior sounds, the main obstruction of the stream of air is at the point no father back in the mouth than the alveolar ridge. Labial, dental and alveolar consonants are anterior (A Grand Dictionary of Phonetics 1981 : 166—167). In our classification the sum of the labial and front consonants are anterior.

Actually, the distance between two languages is equal to the sum of the differences between the frequency of occurrence of the eight consonantal groups. It can be shown by the simple formula of analytical geometry:

$$d = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + (x_3 - y_3)^2 + \cdots (x_8 - y_8)^2}\,,$$

where x_1 is the frequency of labials in language X with respect to all phonemes in the phonemic chain of language X; analogically, y_1 is the frequency of labials in language Y; x_2 is the frequency of the front consonants in language X; analogically y_2 is the frequency of the front consonants in language Y; x_3 is the frequency of the mediolingual consonants in language X; analogically, y_3 is the frequency of mediolingual consonants in language Y; etc. However, this formula does not take into account the probability of this or that event and does not say how reliable the measurement is. Therefore, in this research we use a more complex tool which can answer the question if a particular distance is the result of variance and in fact should be considered as non-significant. So, we must introduce some measure which can tell us where the threshold of the significant distance begins. It was reasonable to introduce the value of the chi-square test as the reliable measure. Basically, the chi-square test allows us to assess the significance of differences between two sets of eight features each. It is non-parametric, which means that one can use it to any distribution of variables without investigating its form. The chi-square test enables us to compare the variables we actually observe with those that we should expect on the basis of some theoretical model. The formula shows us some similarity with the previous formula in the sense that we add the results of the substraction between the variables X and Y; though C. Butler accepts a different notation:

$$x^2 = \sum \frac{(O - E)^2}{E}$$

where Σ is the sum; O is the observed frequency; E is the expected frequency

Christopher Butler warns us that chi-square must be calculated using frequencies, not the proportions or per cents (1985 : 113). That is why we use 1355 of the labials in the sound chain of the Northern dialect of Mansi, instead of 13.55% to all the phonemes in the Mansi phonemic chain. In fact, we multiplay our mean in per cents by 100 in order to find the actual frequency of labials in the ideal sample of 10 000 phonemes ideally taken randomly from the Mansi sound chain. The other very important problem is that the samples are equal in size. It is possible to use chi-square on the samples of different size but then the formular equalizes the samples proportionally. Very often the formular mechan-ically distorts the real proportions. Therefore, we decided to normalize the samples before using the chi-square test. Another good property of chi-square is that it is additive. It means that it is possible to add the chi-square values obtained on different samples (especially of the same size) and the number of the degrees of freedom should be also added (Bailey 1959 : 107—110). After calculating the value of the chi-square test between some two languages, one must use the chi-square table. At this point, it is important to realise what level of significance one should choose. We always

chose the 0.05 level or 5%. Thus, the reliability is 95%. Very often this level is used in linguo-statistical studies (Herdan 1966 : 38—39). The number of the degrees of freedom here is 7, i.e. 8 – 1 = 7. To be significant the critical distance between the two languages should be greater than 14.07, i.e. the critical value in the chi-square test table. If the value is less than 14.07, it means that there is no difference between the two languages, or in terms of the distance, the distance is 1. We propose to divide the values of chi-square by 14.07 in order to calculate the number of units between the languages, denoting it by T. If T is less than 1, then it means that the languages may be considered as one and the same object or two subobjects, i.e. two dialects in our case. However, this condition may be too strict since two dialects cannot be so similar as to tend to be one and the same object.

The other important problem is that the same genres should be taken in all the compared languages. We chose everyday talk.

Our study is typological. The main assumption is the more similar two languages sound, the closer they are from the point of view of phonostatistics. We took two languages and two dialects for our study: Mansi (Vogul) with two dialects: Northern and Konda dialects, and Hanty also represented by two dialects: Northern or Kazym and Eastern dialects. Linguistics supposes that the dialects should be more similar than two, even related, language. Our study will enlighten how similar these two languages and their dialects sound. Discussing language propinquity G. Doerfer (1981) remarks that closeness of some linguistical characteristics may denote that 1) languages are genetically related; 2) there was a great lexical borrowing between them; 3) both languages had a common substratum. In our case one can suppose that dialects are more genetically related, there was a greater lexical borrowing between them and they have one and the same substratum. All in all, one should expect a greater phonological similarity which results in similar sound coloring. Our phonostatistical investigations of the Northern dialect of Mansi and the Northern (Kazym) dialect of Hanty showed a great similarity in their phonological systems and phonemic frequencies (Tambovtsev 1982). It should be mentioned that K. Rédei and N. I. Terjoškin shared with me their belief that the Kazym dialect of Hanty and the Sośva (Northern) dialect of Mansi are phonologically close at present due to the close cultural contacts of the Ob region Mansi and Hanty. (I am thankful to them for their generous advice and linguistic material on the Hanty language.) Actually, our phonostatistical method can verify what is felt by the speakers of two particular languages. Every language utilizes its sound matter by selecting some patterns and rejecting others. Actually, we suppose the closer the languages, the more similar sound matter they select and reject. The typological distances that we calculate on the material of modern languages may give good clues for genealogical studies, establishing proper genetical propinquity. Typological studies of this sort may serve as an accurate compass for indicating the direction in which scholars should search for genetical relatedness. One cannot help agreeing with W. E. Welmer that phonological features of a language are more stable and less changed than lexical by external influences (Welmer 1970 : 4—5).

Our phonostatistical investigations in Finno-Ugric and other languages showed that certain phonemes, particular phonemic combinations and groups have a higher frequency of occurence than some others. However, in one language they may be different from the other. The frequency of phonemes is called redundancy from the point of view of the theory of information. In fact, redundancy plays a great role in shaping speech and must be accounted for while analysing a language. Phonemic group spectrum of the frequencies in a

particular language increases the reliability of communication in this language since it makes it resistant to distortion. There is a hidden spirit inside every language which sets up certain typological constraints, which in their turn help the language to maintain itself as a unity against different influencies (Thomason, Kaufman 1988 : 14—19). It is interesting to note that like the author of the present article, S. Thomason and T. Kaufman discuss the notion of typological distance by which they mean "a measure of structural similarity that applies to linguistic categories and their combinations, including ordering relations" (1988 : 16). It is in the line with our ideas on measuring linguistical similarity in the form of phonological distances (Tambovtsev 1983; 1984; 1986; 1987; 1988; 1989; 1990; 1992; 1993; 1995; Тамбовцев 1985; 1994; 1994a).

To my mind, it is high time to introduce to linguistics in general and to Finno-Ugric studies in particular some exact methods. For instance, in linguistics it is necessary to put forward hypophyses and then test them basing on some features and some numerical data in the way it is done in natural science disciplines. The American linguist Victoria Fromkin seems to have expressed this concern about the experiments and testing in linguistics in the same way as I would: "We have been weaving speculative theories without the necessary empirical validation of our hypotheses" (Fromkin 1973 : 43). One should agree with her claim that a healthy development in linguistics should be only then when they comply with the three major criteria of the experimental method: 1) The experiment must be valid — it must test the hypothesis and not a similar but unrelated one; 2) It must be reliable, the subjects must be a true sample of the population, the degree of experimental error must be known and considered, and the conclusions must be independent of the procedures; 3) Lastly, the experiment must be significant statistically and its outcome not due to chance (Fromkin 1973 : 43—44). Unfortunately, linguists often do not show how reliable their study is, thus they do not care if their subjects are a true sample of the population, they do not provide the degree of their possible error and almost never calculate the statistical significance of their results. It is especially true when the sample is small, then the result may be due to chance. To avoid it the researcher must calculate at least the confidence interval of his statements.

Let us take, for instance, the data of Wolfgang Veenker who studied the phonostatistics of two dialects of Mansi: the Northern (Sośva) and the Konda dialects. We shall compare his data with our analogical data taking into account the confidence intervals. Confidence intervals show the limits within which the frequences fluctuate. The narrower the confidence interval, the less diviation from the mean. One should remember that on small samples the confidence intervals are wide, and, on the contrary, on big samples they tend to be narrow. Unfortunately, in his very interesting work W. Veenker calculated small samples: 3020 phonemes in the Northern and 2911 phonemes in the Konda dialect of the Mansi (Vogul) language (Veenker 1979 : 323—324). Our samples are much bigger: we took 276 284 phonemes of the Northern and 19 287 phonemes of the Konda dialect. Table 1 shows the comparison of consonantal groups of the Northern dialect by the chi-square test. The total of the values of the chi-square test is 188.15 which is by 15 times greater than the critical value (12.59) at the 5% level of significance for 6 degrees of freedom. It means that the fluctuations of this small sample were in the wrong direction. The fluctuations of labials of this small sample were in the right direction. Thus, the values of labials in both samples are statistically the same (cf. 2220 and 2107 labial consonants in the ideal sample of 10 000 phonemes). The values of all other consonantal groups show significant statistical diviations.

In Table 2 one can see that the differences are even greater. The total of all chi-square values is 922.24 which is by 73 times greater than the theoretical value (12.59). None of the consonantal group values are statistically the same.

Now, let us take some other language to see if the small sample of 3000 phonemes can yield any reliable result. In an English newspaper labials show the confidence interval of 20.95 with the mean 116.00 consonants in 1000 phonemes. On the sample of 31000 phonemes the mean for labials is 130.47 and the confidence interval is 4.63. These values mean that actually the mean of labials fluctuate from 125.84 to 135.10. The value that was obtained on the sample of 3000 phonemes fluctuates from 95.05 to 136.95 in the English newspaper. Thus, the confidence interval is too wide to be of actual help to define the true mean for labials. Actually, the true value of 130 labials stabilizies only on the sample of 30000 phonemes, i.e. 10 times greater than was taken by W. Veenker. Small samples may show such values that are not true for the particular language at all. We shall spare words to show further that small samples may lead the linguist astray. However, sometimes when the linguist is lucky, the values of the small sample may fluctuate in the right direction and show statistically similar results, though to be on the safe side, the linguist must take samples which are big enough to yield statistically stable results we have discussed it in detail elsewhere (Tambovcev 1986). However, the small sample of W. Veenker may be as far way from the true consonantal group values as the other dialect (Konda Mansi) or the other language (Kazym dialect of Hanty). Therefore, our strict demand is that there should be no small samples.

Analysing the tables and the figure, one can come to a conclusion that the Sośva dialect of Mansi is closer to the Kazym dialect of Hanty than to the Konda dialect of Mansi (cf. 5.30 and 13.83).

Thus, one can see that the phonological distances add a lot to the classical positions of the dialects and languages in the Ob-Ugrian branch of the Ugric group of Finno-Ugric languages. My informant Petr Šeškin, the native Mansi, told me in 1974 during my expedition to Sośva and Berjozovo that Mansi men in the old times went to Kazym Hanty summer camps to marry. It looks that these mass inter-marriages gave a lot to the similarity of Sośva and Kazym dialects, making them phonologically closer than the dialects of their own languages.

Table 1

The values of the frequency of occurrence of consonantal groups in per cent to the consonants in the phonemic chain of the Vogul (Mansi) language: Sośva (Northern) dialect

The data of W. Veenker (1979) has 3020 phonemes. The data of Jurij Tambovcev — 276284 phonemes. The value of the chi-square test at 0.05(5%) level of significance with 6 degrees of freedom is equal to 12.59. An ideal sample of 10000 consonants.

	Veenker	Tambovcev	Chi-square	Significance
1. Labial	2107	2220	2.95	no
2. Front	6044	4926	113.94	yes
3. Medioling.	406	1112	328.35	yes
4. Back	1443	1743	28.25	yes
5. Sonant	3828	5692	861.61	yes
6. Occlusive	3072	2783	14.26	yes
7. Fricative	3099	1525	535.79	yes

The total of chi-square is 188.15; TQ = 188.15 : 12.59 = 14.94.

Table 2

The value of the frequency of occurrence of consonantal groups in per cent to the consonants in the phonemic chain of the Vogul (Mansi) language: Konda dialect

The data of W. Veenker (1979) has 2911 phonemes. The data of Jurij Tambovcev — 19287 phonemes. The value of the chi-square test at 0.05 (5%) level of significance with 6 degrees of freedom — 12.59. 10000 consonants.

	Veenker	Tambovcev	Chi-square	Significance
1. Labial	1822	1958	4.89	yes
2. Front	5939	4735	135.81	yes
3. Medioling.	759	1959	529.80	yes
4. Back	1479	1349	5.98	yes
5. Sonant	3747	4790	127.43	yes
6. Occlusive	2842	2637	7.67	yes
7. Fricative	3385	2573	110.66	yes

The total of chi-square is 922.24; TQ = 922.24 : 12.59 = 73.25.

Table 3

The values of the Chi-square test comparing the frequency of occurrence of consonantal groups in an ideal sample of 10000 phonemes in the phonemic chain of the dialects of Mansi (Vogul): Sośva (Northern) and Konda

The total sample of Sośva is 276284 phonemes, the Konda sample — 19287 phonemes. The chi-square value at 5% level of significance with 7 degrees of freedom is 14.07. The data of Jurij Tambovcev.

	Sośva	Konda	Chi-square	Significance
1. Labial	1355	1229	6.14	yes
2. Front	3009	2972	0.23	no
3. Medioling.	679	1230	159.04	yes
4. Back	1064	846	24.88	yes
5. Sonant	3476	3007	33.93	yes
6. Occlusive	1700	1656	0.58	no
7. Fricative	931	1615	183.76	yes
8. Voiced	0	450	–	–

Front and occlusive consonants in both dialects have statistically similar frequencies. The total of chi-square is 408.56; TQ = 408.56 : 14.07 = 29.04.

Table 4

The values of the Chi-square test comparing the frequency of occurrence of consonantal groups in an ideal sample of 10000 phonemes in the phonemic chain of the dialect of Hanty: Kazym (Northern) and Eastern

The total sample of Kazym is 74762 phonemes, Eastern — 110990 phonemes. The data of Jurij Tambovcev.

	Kazym	Eastern	Chi-square	Significance
1. Labial	1260	1045	20.05	yes
2. Front	3063	3081	0.05	no
3. Medioling.	760	519	45.41	yes

	Kazym	Eastern	Chi-square	Significance
4. Back	861	1353	109.33	yes
5. Sonant	3096	2182	158.28	yes
6. Occlusive	1719	2420	118.72	yes
7. Fricative	1148	1396	24.18	yes
8. Voiced	0	806	–	–

Only the frequency of front consonants is the same in both dialects. The total of chi-square is 476.02; TQ = 476.02 : 14.07 = 33.83.

Table 5

The values of the Chi-square test while comparing the Frequency of occurrence of consonantal groups in an ideal sample of 10 000 phonemes in the phonemic chain of the Sośva (Northern) dialect of Mansi and the Kazym dialect of Hanty

	Mansi Sośva	Hanty Kazym	Chi-square	Significance
1. Labial	1355	1260	3.45	no
2. Front	3009	3063	0.48	no
3. Medioling.	679	760	4.56	yes
4. Back	1064	861	21.41	yes
5. Sonant	3476	3096	21.97	yes
6. Occlusive	1700	1719	0.11	no
7. Fricative	931	1148	22.65	yes
8. Voiced	0	0	–	–

The data of Jurij Tambovcev. Labial. front. occlusive and voiced consonants have statistically identical frequencies. The total chi-square is 74.63: TQ = 74.63 : 14.07 = 5.30.

Table 6

The values of the Chi-square test while comparing the frequency of occurrence of consonantal groups in an ideal sample of 10000 Phonemes in the phonemic chain of the Sośva (Northern) dialect of Mansi and the Eastern dialect of Hanty

	Mansi Sośva	Hanty Eastern	Chi-square	Significance
1. Labial	1355	1045	40.04	yes
2. Front	3009	3081	0.85	no
3. Medioling.	679	519	21.37	yes
4. Back	1064	1353	34.56	yes
5. Sonant	3476	2182	295.94	yes
6. Occlusive	1700	2420	125.83	yes
7. Fricative	931	1396	92.92	yes
8. Voiced	0	806	–	–

The data of Jurij Tambovcev. Only the frequency of front consonants is the same. The total of chi-square 611.51; TQ = 611.51 : 14.07 = 43.46.

Table 7

The values of the Chi-square test while comparing the frequency of occurrence of consonantal groups in an ideal sample of 10000 Phonemes in the phonemic chain of the Konda dialect of Mansi and the Kazym dialect of Hanty

	Mansi Konda	Hanty Kazym	Chi-square	Significance
1. Labial	1229	1260	0.39	no
2. Front	2972	3063	1.37	no
3. Medioling.	1230	760	111.00	yes
4. Back	846	861	0.13	no
5. Sonant	3007	3096	1.30	no
6. Occlusive	1656	1719	1.29	no
7. Fricative	1615	1148	78.93	yes
8. Voiced	450	0	–	–

Labial, front, back, sonorant and occlusive consonants have statistically identical frequencies. The total of chi-square is 194.41; TQ = 194.41 : 14.07 = 13.82.

Table 8

The values of the chi-square test while comparing the frequency of occurrence of consonantal groups in an ideal sample of 10000 phonemes in the phonemic chain of the Konda dialect of Mansi and the Eastern dialect of Hanty

	Mansi Konda	Hanty Eastern	Chi-square	Significance
1. Labial	1229	1045	14.89	yes
2. Front	2972	3081	1.96	no
3. Medioling	1230	519	289.03	yes
4. Back	846	1353	116.89	yes
5. Sonant	3007	2182	131.17	yes
6. Occlusive	1656	2420	143.20	yes
7. Fricative	1615	1396	15.93	yes
8. Voiced	450	806	100.90	yes

Only the frequency of the front consonants is statistically identical. The total of chi-square is 813.97; TQ = 813.97 : 14.07 = 57.85.

Table 9

The distances between the dialects and languages of the Ob-Ugrian branch of the Ugric group of the Finno-Ugric family according to the value of coefficient of similarity (TQ)

			Distance (TQ Value)
1.	Sośva dialect of Mansi	— Kazym dialect of Hanty	5.30
2.	Sośva dialect of Mansi	— Konda dialect of Mansi	13.82
3.	Konda dialect of Mansi	— Kazym dialect of Hanty	29.04
4.	Sośva dialect of Mansi	— Eastern dialect of Hanty	33.83
5.	Kazym dialect of Hanty	— Eastern dialect of Hanty	43.46
6.	Konda dialect of Mansi	— Eastern dialect of Hanty	57.85

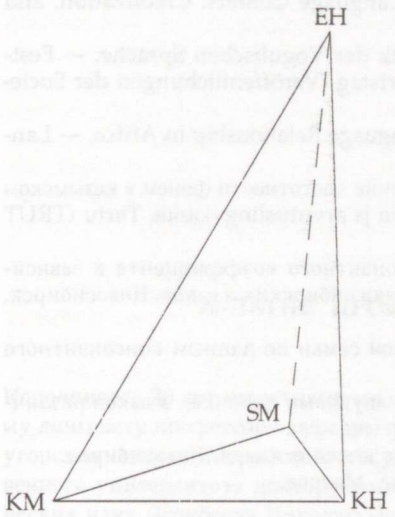

Figure 1. **Distances between the dialects and languages of the Ob-Ugrian branch of the Ugric group of the Finno-Ugric family based on phonological features. SM — Sośva (Northern) dialect of Mansi, KM — Konda dialect of Mansi, KH — Kazym dialect of Hanty, EH — Eastern dialect of Hanty.**

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ЮРИЙ ТАМБОВЦЕВ (Новосибирск)

БЛИЗОСТЬ ЯЗЫКОВ В СВЕТЕ ФОНОЛОГИЧЕСКИХ ЯВЛЕНИЙ

Исходя из фоностатистических данных о согласных звуках, автор определил степень взаимной близости двух хантыйских (казымский и восточный) и двух мансийских (кондинский и сосьвинский) диалектов. Выяснилось, что в этом отношении особенно близки между собой казымский диалект хантыйского языка и сосьвинский диалект мансийского языка. Казымский диалект хантов и мансийский сосьвинский диалект тоже ближе один к другому, чем оба рассматриваемых хантыйских диалекта между собой.