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METRICAL AND NON-METRICAL ANALYSIS OF POLISH CRANIA FROM EARLY MEDIEVAL TO MODERN TIMES

ABSTRACT: The main idea of the article is an analysis of the question: what is the cognitive value of metrical traits of a cranium as compared with the non-metrical traits and whether the model of morphological variability described by means of these two sets of features is identical or different? Eleven populations were selected for the study. They came from the area of Poland and were dated from early medieval to modern times. The main factor which creates the gradient of variability of non-metrical traits is the geographical factor and the main factor which forms the gradient of variability of metrical traits is the one connected with the chronology of the groups.

KEY WORDS: Metrical traits – Non-metrical traits – Morphological analysis.

INTRODUCTION

In the studies of morphological differentiation of human groups metrical and/or non-metrical features of crania are used (Corruccini 1976, Ossenberg 1977, Cheverud et al. 1979, Rösing 1982, Rosenberg et al. 1983). The cognitive value of metrical and non-metrical features may differ because of the set of factors which form gradients of variability of features. A question arises therefore: what is the cognitive value of metrical features of a cranium as compared with the non-metrical features and whether the model of morphological variability described by means of these two sets of features is identical or different?

MATERIAL AND METHODS

Eleven populations were selected for the study (*Table 1*). They came from the area of Poland and were dated from early medieval to modern times (*Figure 1*).

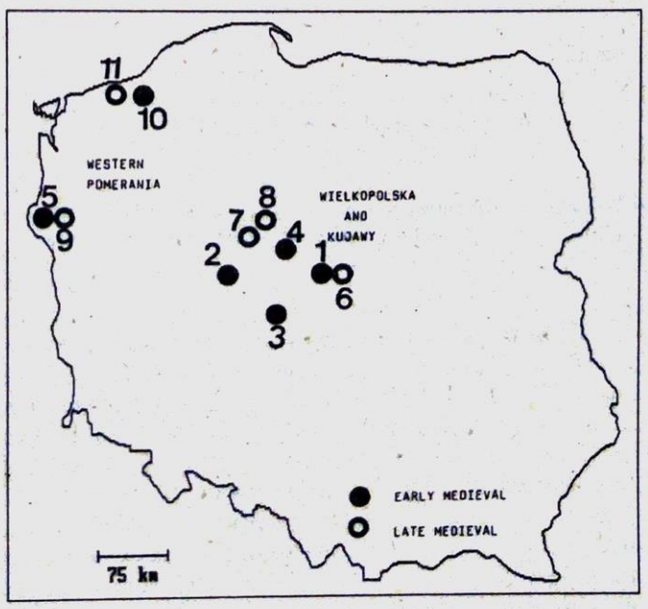

FIGURE 1. *Localization of the populations.*

TABLE 1. *List of the populations.*

Populations	Chronology	N	Metrical traits Authors of data	N	Non-metrical traits Authors of data
1. Brześć Kujawski	10 – 13 cent.	95	Serafin (1986)	58	Piontek (1979)
2. Ostrów Lednicki	11 – 14 cent.	452	Strzałko (1970)	200	Piontek (1979)
3. Ląd	10 – 12 cent.	53	Malinowski (1986)	53	Kaczmarek (1986)
4. Kruszwica	10 – 12 cent.	23	Piontek (1979)	26	Piontek (1979)
5. Cedynia I	10 – 12 cent.	333	Piontek (1979)	71	Miłosz (1989)
6. Brześć Kujawski II	14 – 19 cent.	456	Serafin (1986)	60	Piontek (1979)
7. Jaksice	14 – 17 cent.	37	Piontek (1981)	40	Piontek (1979)
8. Słaboszewo	14 – 17 cent.	174	Piontek (1981)	104	Piontek (1979)
9. Cedynia II	14 – 18 cent.	55	Piontek, Mucha (1987)	34	Miłosz (1989)
10. Góra Chełmska 1	2 – 14 cent.	154	Piontek, Mucha (1987)	58	Piontek, Mucha (1987)
11. Kołobrzeg	13 – 18 cent.	363	Piontek, Mucha (1987)	289	Piontek, Mucha (1987)

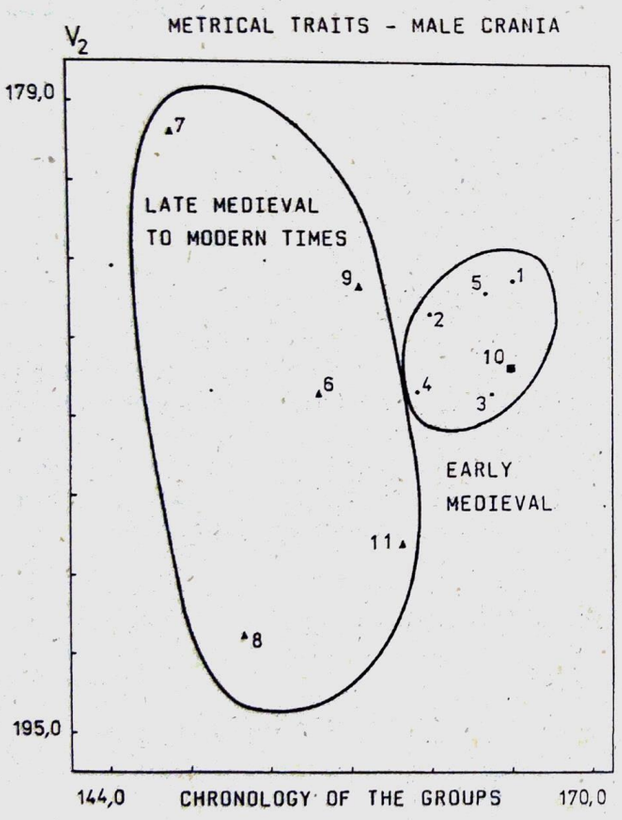

FIGURE 2. *Distribution of the populations described by the first and second principal components: male crania — metrical traits.*

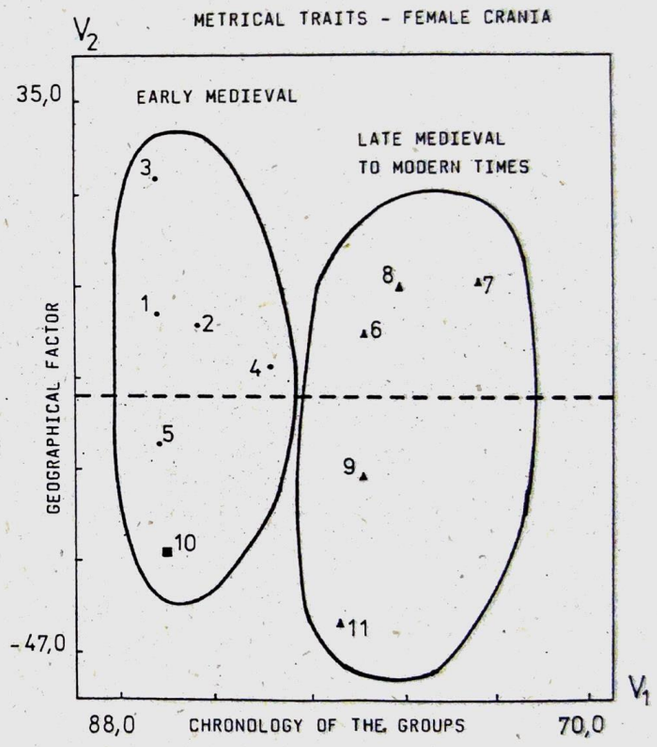

FIGURE 3. *Distribution of the populations described by the first and second principal components: female crania — metrical traits.*

RESULTS

Metrical traits

For the selected populations data on the average values of nine metrical traits were available (*Table 2* and *Table 3*) as well as the frequency of occurrence of 24 non-metrical traits (*Table 4*). These data were used for the determination of the structure of morphological differentiation using the method of principal components analysis (Mackiewicz, Ratajczak 1990) and the method of evaluation of the Penrose biological distance – metrical traits and that of Sjøvold – non-metrical traits (Penrose 1954, Sjøvold 1937, Piontek 1990).

Table 5 presents the values of the principal components calculated on the basis of metrical traits of male crania, whereas *Table 6* those of female crania. Correlation coefficients between the original variables and the principal components are given in *Table 7* and *Table 8*.

The first two principal components were taken into account in the analysis (*Figures 2, 3*). With regard

TABLE 2. *Arithmetic means of cranial metrical traits of male skulls.*

Populations/Traits	g-op	eu-eu	ba-b	zy-zy	n-pr	n-ns	mf-ek	OH	BAP
1. Brześć Kujawski I	188.0	138.0	137.0	132.0	66.0	51.0	42.0	32.0	25.0
2. Ostrów Lednicki	185.0	140.4	136.0	132.5	65.2	49.6	40.8	31.8	24.6
3. Ląd	188.6	142.5	137.9	133.5	68.5	51.1	43.1	33.2	25.9
4. Kruszwica	185.1	142.6	134.0	133.2	67.0	51.3	41.5	32.3	25.3
5. Cedynia I	187.8	138.8	134.4	131.8	67.8	51.0	40.1	33.0	24.4
6. Brześć Kujawski II	181.0	144.0	131.0	133.0	67.0	51.0	42.0	32.0	25.0
7. Jaksice	172.9	143.3	132.9	128.3	68.2	49.1	38.2	32.5	23.2
8. Słaboszewo	178.3	146.7	133.5	140.0	65.8	49.1	39.5	32.0	24.2
9. Cedynia II	182.5	141.1	130.5	131.1	67.7	50.9	41.0	34.8	23.3
10. Góra Chełmska	189.9	139.5	133.1	132.9	67.3	50.9	38.3	33.7	24.2
11. Kołobrzeg	186.0	143.2	129.2	136.1	67.3	52.7	38.5	33.5	25.0

TABLE 3. *Arithmetic means of cranial metrical traits of female skulls.*

Populations/Traits	g-op	eu-eu	ba-b	zy-zy	n-pr	n-ns	mf-ek	OH	BAP
1. Brześć Kujawski I	179.0	136.0	132.0	126.0	63.0	49.0	40.0	32.0	24.0
2. Ostrów Lednicki	177.6	136.0	130.0	125.0	61.6	47.1	39.4	31.9	23.9
3. Ląd	177.5	134.2	131.7	121.4	61.0	45.9	40.3	31.0	25.7
4. Kruszwica	176.3	137.6	127.6	124.3	62.2	47.9	39.5	32.1	23.4
5. Cedynia I	179.9	134.7	128.9	124.8	63.0	48.4	38.7	33.0	23.3
6. Brześć Kujawski II	173.0	140.0	127.0	126.0	63.0	49.0	40.0	32.0	25.0
7. Jaksice	169.8	141.2	123.6	125.7	63.1	45.4	42.0	33.3	24.1
8. Słaboszewo	171.9	141.8	127.4	125.6	63.0	46.7	38.6	32.2	24.1
9. Cedynia II	176.9	141.0	124.3	124.2	63.1	47.9	39.7	33.1	22.6
10. Góra Chełmska	181.0	135.1	127.3	125.0	63.8	49.0	37.3	33.0	24.6
11. Kołobrzeg	176.9	139.4	122.5	124.8	62.5	49.7	36.9	33.3	24.8

to the first principal component the early medieval populations are grouped within a distinct cluster, separated from the late medieval populations. The factor which forms their differentiation according to the first principal component is the chronology of the group.

Because of the second principal component populations are grouped according to the territory from which they came as the series from the Western Pomerania are distinctly separated from groups coming from Wielkopolska and Kujawy region.

The analysis of correlation coefficients between the principal components and the original variables showed that: the first principal component describes the differentiation of populations with respect to the shape of the cranium (traits: g-op, eu-eu, ba-b, the breadth of apertura piriformis), whereas the second principal component with respect to the size of the cranium (traits: eu-eu, ba-b, ft-ft, n-pr, n-ns, mf-ek).

The analysis performed by means of the methods of principal components has been confirmed by the results of studies of the differentiation of the investigated populations by the methods of Penrose biological distance. *Table 9* presents the matrix of the Penrose general distance for male crania, *Table 10* that for female crania. The distance matrices were

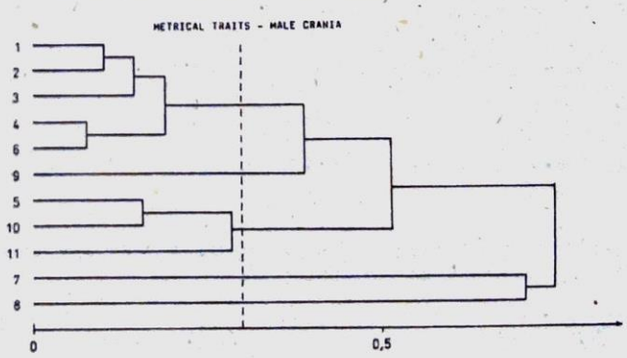

FIGURE 4. *Dendrogramme arranging the differentiation of male crania (metrical traits).*

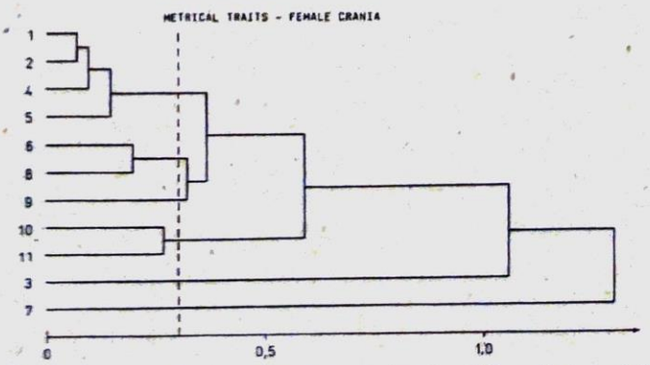

FIGURE 5. *Dendrogramme arranging the differentiation of female crania (metrical traits).*

TABLE 4. *Frequency of non-metrical traits (part I).*

Traits/Populations	Brześć Kujawski I			Ostrów Lednicki			Ląd			Kruszwica			Cedynia I			Brześć Kujawski		
	n_1	n_2	p	n_1	n_2	p	n_1	n_2	p	n_1	n_2	p	n_1	n_2	p	n_1	n_2	p
1. Sutura metopica	5	58	0.086	11	199	0.055	8	53	0.150	4	26	0.150	3	71	0.042	7	60	0.117
2. Foramen supraorbitale	31	114	0.272	66	394	0.168	14	106	0.132	10	52	0.192	32	142	0.225	32	120	0.276
3. Sulcus supraorbitalis	79	114	0.693	248	394	0.629	48	106	0.452	16	52	0.307	126	142	0.887	84	120	0.700
4. Sulcus and foramen supraorbitale	7	112	0.062	76	394	0.193	40	106	0.377	8	52	0.153	11	142	0.098	5	120	0.042
5. Ossa intersut. sut. coronalis	6	110	0.054	19	374	0.051	8	104	0.076	4	52	0.076	44	142	0.310	0	112	0.000
6. Os bregmatica	1	56	0.018	3	190	0.016	6	52	0.115	2	26	0.077	0	71	0.000	0	56	0.000
7. Ossa intersut. sut. sagittalis	1	56	0.018	11	175	0.063	3	52	0.057	3	26	0.115	5	71	0.070	0	55	0.000
8. Foramen parietale	42	112	0.375	186	398	0.467	33	106	0.311	13	52	0.250	60	142	0.422	29	114	0.254
9. Os lambdae	9	56	0.161	48	177	0.271	6	53	0.113	2	26	0.076	20	71	0.282	9	50	0.161
10. Ossa intersut. sut. lambdoideae	61	112	0.545	180	366	0.492	45	106	0.424	21	51	0.411	84	142	0.591	43	116	0.371
11. Linea nuchae suprema	54	104	0.514	293	390	0.751	38	100	0.380	37	52	0.711	92	142	0.648	60	118	0.508
12. Canalis condylaris	54	88	0.614	273	354	0.771	67	90	0.744	16	52	0.307	42	142	0.296	56	104	0.538
13. Canalis hypoglossi	12	90	0.133	28	356	0.078	17	92	0.184	6	50	0.120	46	142	0.324	25	106	0.236
14. Facies condylaris	7	82	0.085	8	328	0.022	11	90	0.122	6	52	0.115	24	142	0.169	6	98	0.061
15. Foramen ovale	16	94	0.170	34	378	0.090	1	104	0.009	1	52	0.019	0	142	0.000	17	108	0.157
16. Os epiptericum	19	108	0.176	49	364	0.134	18	104	0.173	9	51	0.176	36	142	0.253	15	116	0.129
17. Sutura frontotemporalis	7	108	0.065	4	358	0.011	5	106	0.047	1	52	0.019	6	142	0.042	4	118	0.034
18. Foramen mastoideum	54	106	0.509	179	378	0.473	76	102	0.745	20	52	0.384	92	142	0.648	69	116	0.594
19. Torus acusticus	38	110	0.345	152	376	0.404	61	104	0.585	40	52	0.769	118	142	0.831	58	120	0.483
20. Foramen infraorbitale	10	106	0.094	37	304	0.122	18	106	0.150	8	50	0.160	80	142	0.563	2	102	0.019
21. Torus palatinus	19	52	0.365	26	153	0.170	24	52	0.461	14	26	0.538	29	71	0.408	21	47	0.447
22. Foramen zygomaticofaciale	49	110	0.445	107	278	0.384	59	104	0.567	17	52	0.326	68	142	0.479	50	102	0.490
23. Processus marginalis	56	108	0.519	82	278	0.295	12	104	0.125	11	52	0.211	106	142	0.746	68	100	0.680
24. M3	16	70	0.228	26	244	0.106	23	104	0.221	7	51	0.137	30	142	0.211	24	72	0.333

Significance: n_1 – number of skulls with a trait; n_2 – number of skulls classified; p – frequency of traits

TABLE 5. *The first and second principal components for male populations (metrical traits).*

Populations	Principal components	
	V_1 (57%)	V_2 (21%)
1. Brześć Kujawski I	164.0	–183.4
2. Ostrów Lednicki	159.9	–184.5
3. Ląd	163.4	–186.4
4. Kruszwica	159.2	–186.3
5. Cedynia I	162.7	–183.8
6. Brześć Kujawski II	154.3	–186.4
7. Jaksice	147.0	–179.8
8. Słaboszewo	150.9	–192.5
9. Cedynia II	156.4	–183.7
10. Góra Chełmska	163.9	–185.8
11. Kołobrzeg	158.5	–190.2

TABLE 6. *The first and second principal components for female populations (metrical traits).*

Populations	Principal components	
	V_1 (64%)	V_2 (21%)
1. Brześć Kujawski I	–86.4	–39.6
2. Ostrów Lednicki	–84.6	–39.4
3. Ląd	–86.7	–36.7
4. Kruszwica	–81.7	–40.7
5. Cedynia I	–86.3	–42.4
6. Brześć Kujawski II	–77.8	–40.0
7. Jaksice	–72.9	–38.9
8. Słaboszewo	–76.3	–39.1
9. Cedynia II	–77.8	–43.1
10. Góra Chełmska	–86.1	–44.7
11. Kołobrzeg	–78.8	–46.3

TABLE 4a. *Frequency of non-metrical traits (part II).*

Traits/Populations	Jaksice			Słaboszewo			Cedynia II			Góra Chełmska			Kołobrzeg		
	n_1	n_2	p	n_1	n_2	p	n_1	n_2	p	n_1	n_2	p	n_1	n_2	p
1. Sutura metopica	3	40	0.075	5	104	0.048	0	34	0.000	6	58	0.103	24	289	0.083
2. Foramen supraorbitale	33	80	0.413	16	206	0.077	16	68	0.235	32	116	0.276	162	578	0.280
3. Sulcus supraorbitalis	38	80	0.475	80	206	0.388	52	68	0.765	100	116	0.862	470	578	0.813
4. Sulcus and foramen supraorbitale	5	80	0.125	60	206	0.291	0	68	0.000	16	116	0.138	52	578	0.090
5. Ossa intersut. sut. coronalis	5	76	0.066	5	208	0.024	8	68	0.118	4	116	0.034	36	578	0.062
6. Os bregmatica	0	40	0.000	0	104	0.000	0	34	0.000	0	58	0.000	0	289	0.000
7. Ossa intersut. sut. sagittalis	3	40	0.075	1	104	0.009	1	34	0.029	1	58	0.017	4	289	0.014
8. Foramen parietale	25	78	0.321	63	208	0.302	5	68	0.588	60	116	0.517	276	578	0.477
9. Os lambdae	3	36	0.083	8	103	0.078	7	34	0.206	9	58	0.155	40	289	0.138
10. Ossa intersut. sut. lambdoideae	29	74	0.391	72	206	0.349	34	68	0.500	50	116	0.431	294	578	0.509
11. Linea nuchae suprema	8	78	0.102	80	196	0.408	18	68	0.265	30	116	0.259	246	578	0.426
12. Canalis condylaris	32	60	0.533	74	172	0.430	22	68	0.323	42	116	0.362	208	578	0.360
13. Canalis hypoglossi	4	52	0.077	41	172	0.238	8	68	0.118	14	116	0.121	94	578	0.163
14. Facies condylaris	5	52	0.096	7	170	0.041	18	68	0.265	2	116	0.017	90	578	0.156
15. Foramen ovale	0	58	0.000	2	178	0.011	10	68	0.147	4	116	0.034	48	578	0.083
16. Os epiptericum	9	68	0.132	49	198	0.247	12	68	0.176	14	116	0.121	112	578	0.194
17. Sutura frontotemporalis	3	70	0.042	45	198	0.227	0	68	0.000	4	116	0.034	2	578	0.003
18. Foramen mastoideum	28	64	0.437	112	202	0.554	24	68	0.353	46	116	0.396	300	578	0.519
19. Torus acusticus	17	72	0.236	76	198	0.384	58	68	0.853	56	116	0.483	418	578	0.723
20. Foramen infraorbitale	3	44	0.068	10	136	0.073	20	68	0.294	12	116	0.103	90	578	0.156
21. Torus palatinus	5	23	0.217	20	70	0.286	13	34	0.382	22	58	0.379	112	289	0.387
22. Foramen zygomaticofaciale	20	52	0.385	35	140	0.250	28	68	0.412	52	116	0.448	266	578	0.460
23. Processus marginalis	14	50	0.280	62	146	0.426	42	68	0.618	94	116	0.810	466	578	6.806
24. M3	12	36	0.333	12	114	0.105	8	68	0.118	12	116	0.104	144	578	0.249

Significance: n_1 – number of skulls with a trait; n_2 – number of skulls classified; p – frequency of traits

TABLE 7. *Coefficients of correlations between principal components and original traits (male crania: metrical traits).*

Traits		Principal components		
		V_1	V_2	V_3
		50.1%	21.0%	13.4%
x1	g-op	0.985***	0.138	0.094
x2	eu-eu	0.740**	0.577*	0.131
x3	ba-b	0.467	0.226	0.838**
x4	ft-ft	0.024	0.977***	0.139
x5	zy-zy	0.029	0.316	0.349
x6	n-pr	0.565*	0.229	0.562*
x7	n-ns	0.377	0.049	0.519
x8	mf-ek	0.192	0.074	0.688**
x9	APB	0.572*	0.398	0.355

Significance * – for p = 0.1; ** – for p = 0.01; *** – for p = 0.001

TABLE 8. *Coefficients of correlations between principal components and original traits (female crania: metrical traits).*

Traits		Principal components		
		V_1	V_2	V_3
		64.2%	21.6%	6.5%
x1	g-op	0.908***	0.407	0.009
x2	eu-eu	0.963***	0.055	0.163
x3	ba-b	0.777**	0.579*	0.228
x4	ft-ft	0.388	0.207	0.803**
x5	zy-zy	0.296	0.505	0.514
x6	n-pr	0.276	0.738**	0.462
x7	n-ns	0.291	0.763**	0.079
x8	mf-ek	0.426	0.744**	0.020
x9	APB	0.161	0.241	0.233

Significance * – for p = 0.1; ** – for p = 0.01; *** – for p = 0.001

TABLE 9. *Matrix of Penrose distances (C^2_R) between male populations (metrical traits).*

Populations	1	2	3	4	5	6	7	8	9	10	11
1. Brześć Kujawski	–	0.13	0.13	0.17	0.27	0.41	1.49	1.33	0.66	0.84	1.13
2. Ostrów Lednicki		–	0.26	0.10	0.20	0.30	0.94	0.72	0.54	0.59	078
3. Ląd			–	0.16	0.41	0.31	1.52	1.31	0.60	1.08	1.26
4. Kruszwica				–	0.21	0.10	0.95	0.76	0.40	0.67	0.64
5. Cedynia I					–	0.51	0.86	1.03	0.33	0.20	0.47
6. Brześć Kujawski						–	0.93	0.74	0.43	1.10	0.86
7. Jaksice							–	0.90	0.73	1.00	0.96
8. Słaboszewo								–	1.10	1.12	0.73
9. Cedynia II									–	0.64	0.70
10. Góra Chełmska										–	0.27
11. Kołobrzeg											–

TABLE 10. *Matrix of Penrose distances (C^2_R) between female populations (metrical traits).*

Populations	1	2	3	4	5	6	7	8	9	10	11
1. Brześć Kujawski	–	0.07	0.39	0.13	0.18	0.33	1.15	0.49	0.54	0.53	1.05
2. Ostrów Lednicki		–	0.31	0.07	0.15	0.28	0.96	0.31	0.43	0.45	0.87
3. Ląd			–	0.53	0.74	0.61	1.26	0.83	1.16	1.06	1.65
4. Kruszwica				–	0.14	0.17	0.74	0.22	0.17	0.45	0.67
5. Cedynia I					–	0.49	1.31	0.47	0.38	0.19	0.60
6. Brześć Kujawski						–	0.59	0.19	0.35	0.68	0.67
7. Jaksice							–	0.73	0.56	1.86	1.76
8. Słaboszewo								–	0.31	0.60	0.57
9. Cedynia II									–	0.72	0.66
10. Góra Chełmska										–	0.27
11. Kołobrzeg											–

TABLE 11. *The first and second principal components for male and female populations (non-metrical traits).*

Populations	Principal components	
	V_1 (40%)	V_2 (20%)
1. Brześć Kujawski I	0.827	0.221
2. Ostrów Lednicki	0.619	0.454
3. Ląd	0.450	0.609
4. Kruszwica	0.674	0.849
5. Cedynia I	1.518	0.705
6. Brześć Kujawski II	0.932	0.214
7. Jaksice	0.473	–0.009
8. Słaboszewo	0.561	0.360
9. Cedynia II	1.328	0.365
10. Góra Chełmska	1.183	0.013
11. Kołobrzeg	1.298	0.280

reduced by means of the closest neighbourhood methods and dendrogrammes were constructed (*Figures 4, 5*). In these dendrogrammes populations create clusters with respect to the factor of chronology of the group both in case of the male and female crania.

Non-metrical traits

In *Table 11* are contained values of the first two principal components. Correlation coefficients between the original variables and the principal components are given in *Table 12*. The arrangement of the investigated groups in relation to the two first principal components is presented in *Figure 6*.

In relation to the first principal component (V_1) populations are arranged with respect to the factor of geographical position, whereas in relation to the second principal component (V_2) with respect to the factor of chronology of the group.

The analysis of the arrangement of populations in relation to the two first principal components showed, therefore, that in case of the differentiation of populations with respect to non-metrical traits the factor of geographical position is the most important one. It can be seen that non-metrical traits may show certain gradients of variability in geographical space which are more distinctly expressed than the geographical variability of the metrical traits. Due to this, these traits may be useful for the analyses of migration intensities (gene flow) between the populations, measuring the degree of their isolation, when the metrical traits seem to be more useful for the analysis of microevolutionary trends, or more gene-

rally, in the evaluation of the role of natural selection on the formation of processual changes.

The analysis of biological differentiation of the studied groups was carried out using the method of biological distance by Sjøvold (*Table 13*) and the dendrograme method (*Figure 7*) confirmed the results obtained by the method of principal components. The Wielkopolska and Kujawy populations were grouped within a cluster that was distinctly separated from the set of populations from Western Pomerania.

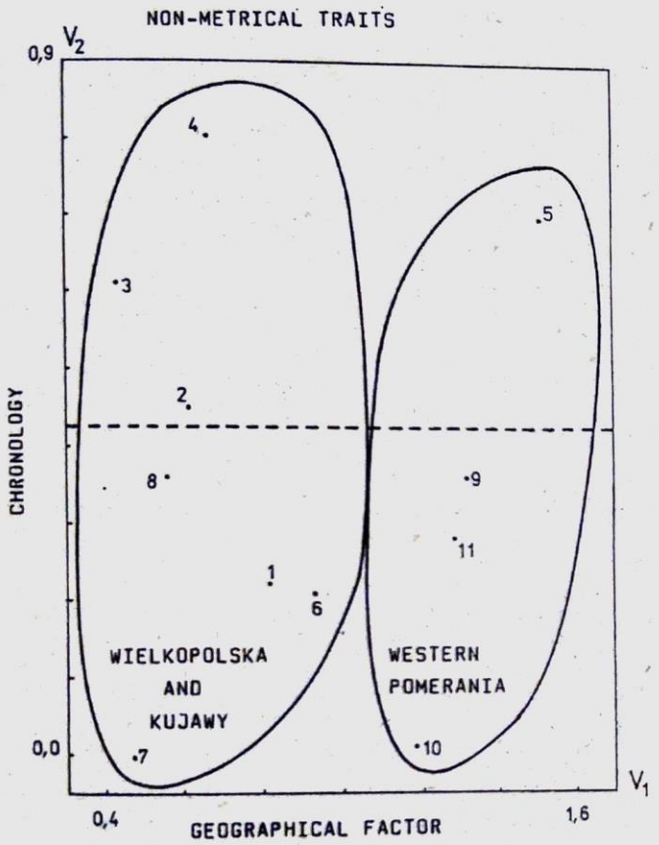

FIGURE 6. *Distribution of the populations described by the first and second principal components: non-metrical traits.*

TABLE 12. *Coefficients of correlations between principal components and original traits (male and female crania: non-metrical traits).*

Traits	Principal components		
	V_1	V_2	V_3
	40.1%	20.4%	12.1%
1. Sutura metopica	0.438	0.184	0.003
2. Foramen supraorbitale	0.219	0.618*	0.151
3. Sulcus supraorbitalis	0.864***	0.315	0.359
4. Sulcus & foramen supraorbitale	0.653*	0.302	0.056
5. Ossa intersut. sut. coronalis	0.554*	0.501	0.029
6. Os bregmatica	0.504	0.601*	0.064
7. Ossa intersut. sut. sagittalis	0.283	0.611	0.229
8. Foramen parietale	0.647*	0.237	0.057
9. Os Lambdae	0.566*	0.164	0.635*
10. Ossa intersut. sut. lambdoidea	0.668*	0.356	0.455
11. Linea nuchae suprema	0.036	0.707*	0.523*
12. Canalis condylaris	0.668*	0.112	0.644*
13. Canalis hypoglossi	0.373	0.345	0.168
14. Facies condylaris	0.512	0.319	0.404
15. Foramen ovale	0.248	0.280	0.351
16. Os epiptericum	0.266	0.517	0.113
17. Sutura frontotemporalis	0.363	0.062	0.101
18. Foramen mastoideum	0.129	0.289	0.471
19. Torus acusticus	0.662	0.636*	0.277
20. Foramen infraorbitale	0.655*	0.535*	0.004
21. Torus palatinus	0.275	0.486	0.294
22. Foramen zygomaticofaciale	0.293	0.028	0.402
23. Processus marginalis	0.878***	0.370	0.088
24. M3	0.081	0.311	0.101

Significance * – for p = 0.1; ** – for p = 0.01; *** – for p = 0.001

TABLE 13. *Matrix of Sjøvold distances (C^2_R) between male and female populations (non-metrical traits).*

Populations	1	2	3	4	5	6	7	8	9	10	11
1. Brześć Kujawski	–	0.053	0.143	0.122	0.199	0.097	0.063	0.088	0.147	0.025	0.063
2. Ostrów Lednicki		–	0.125	0.131	0.266	0.131	0.155	0.161	0.259	0.138	0.168
3. Ląd			–	0.094	0.319	0.123	0.238	0.177	0.309	0.224	0.245
4. Kruszwica				–	0.236	0.119	0.207	0.172	0.186	0.177	0.165
5. Cedynia I					–	0.296	0.173	0.343	0.176	0.257	0.098
6. Brześć Kujawski						–	0.135	0.112	0.268	0.130	0.178
7. Jaksice							–	0.131	0.158	0.074	0.036
8. Słaboszewo								–	0.224	0.144	0.178
9. Cedynia II									–	0.165	0.092
10. Góra Chełmska										–	0.065
11. Kołobrzeg											–

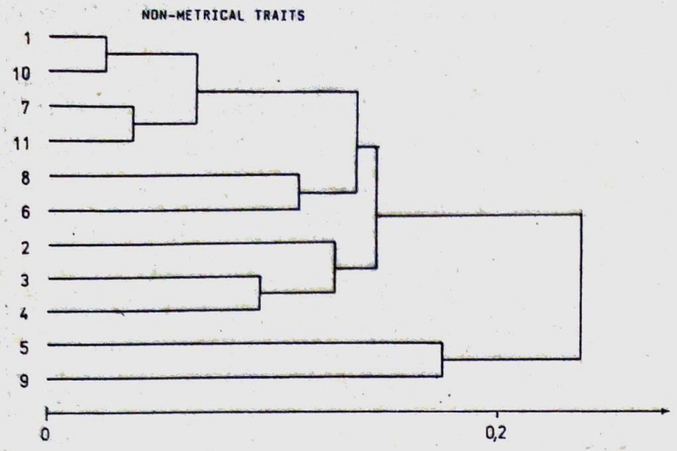

FIGURE 7. *Dendrogramme arranging the differentiation of male and female crania (non-metrical traits).*

DISCUSSION

The cognitive value of metrical traits in the studies of interpopulational differentiation is of a different character than the cognitive value of non-metrical traits. The results obtained using the method of the principal components confirmed the earlier observations concerning variability of metrical traits of crania in the Middle Ages and in modern times. These traits show a strong gradient of microevolutionary variability and that is why the main factor which forms their processes is the factor of the chronology of the group.

The model of interpopulational differentiation according to the non-metrical traits is different, the main factor which forms the variability of the investigated populations (independent of their chronology) being the factor of geographical position of the populations.

CONCLUSIONS

The metrical traits are characterized by a different cognitive value in the studies of interpopulational differentiation than the non-metrical ones. It was shown that the main agent creating the gradient of variability of non-metrical traits are the geographical factors (processes of migration and/or hybridization), whereas the main factor which forms the gradient of variability of metrical traits is the one connected with the chronology of the group. This factor seems to be more significant in case of the studied groups as compared to the geographical differentiation of metrical traits.

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