24. The application of some mathematical-statistical methods for the analysis of Slavic pottery

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24.1 Introduction

The study of pottery has taken a central place in archaeological research in recent years (alongside other 'exclusive' materials). Points of view, reasons for study, methods, approaches to the study of such problems and also the choice of the most suitable properties for studying ceramic finds — all these aspects vary and differ from one author to another. The choice of these aspects depends, of course, on the goal of a particular research project.

24.2 The use of indices

In this article we are concerned with some aspects of 9th–10th century Slavic pottery from the territory of Slovakia. During our work we studied many sets of properties of this pottery, but here we deal especially with choices of measurements of ceramics from cemeteries. In our case we analysed only vessels which were found intact or which were fully reconstructed.

24.2a Previous work

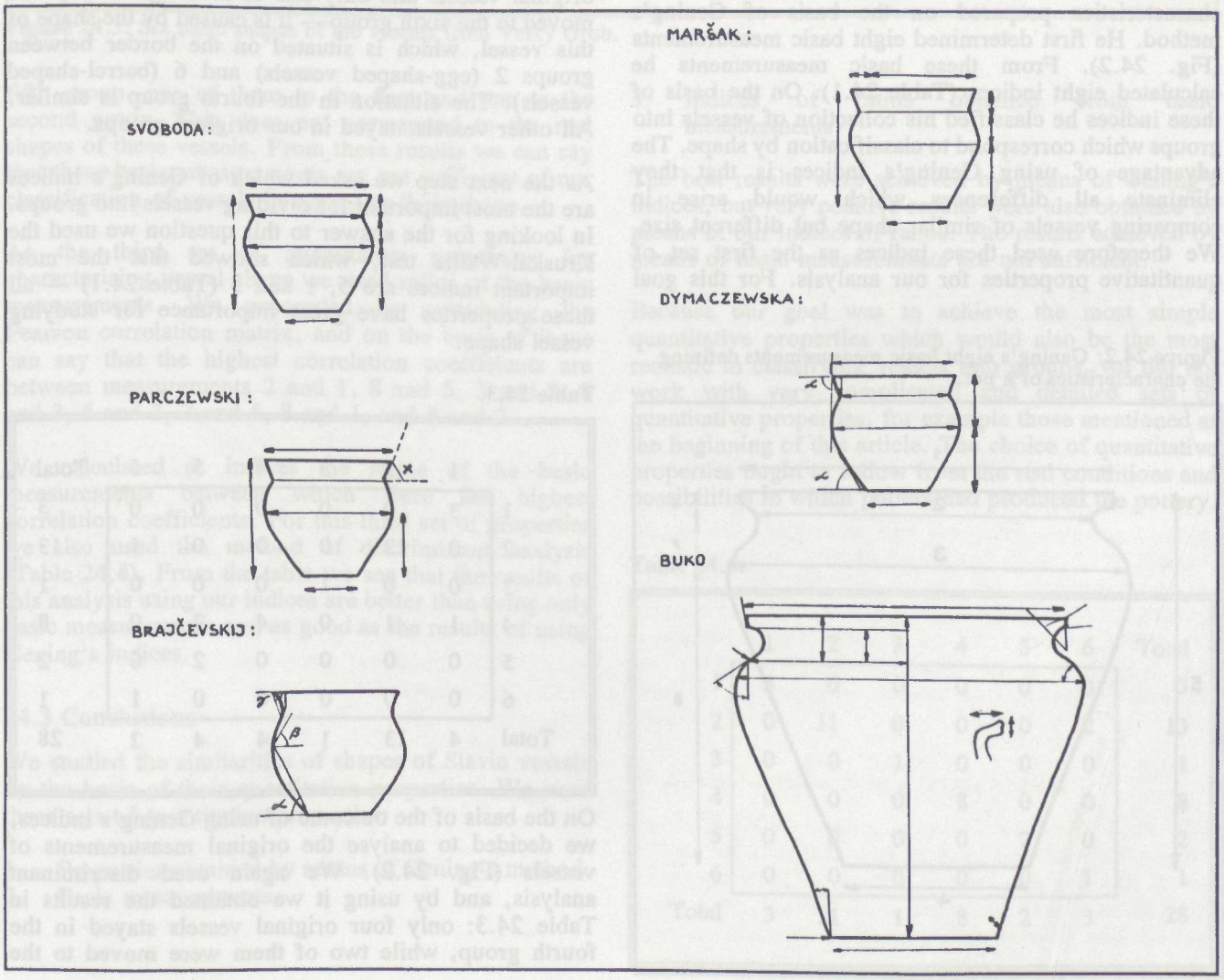
First we show some examples of the choices of measurements used to analyse Slavic pottery in the Czechoslovak, Polish and Russian literature (Fig. 24.1). Further references are available on request.

The research workers who are dealing with this topic use various measurements which vary in their structure, number, scale and range. But we must say that some of these suggestions for the morphometric characterisation of vessels (especially those with a large number of detailed properties) were used in practice in only a few cases, i.e. the authors used them only for the analysis of pottery from their localities.

24.2b A comparative study

Our goal in this article is to examine some possibilities for comparing the similarity of shapes of Slavic vessels

Figure 24.1: Examples of Slavic pottery.



by means of measurements. Slavic pottery of the 9th–10th centuries is not as varied as the ceramics of prehistoric cultures. It is consequently difficult to choose suitable measurements to characterise these vessels.

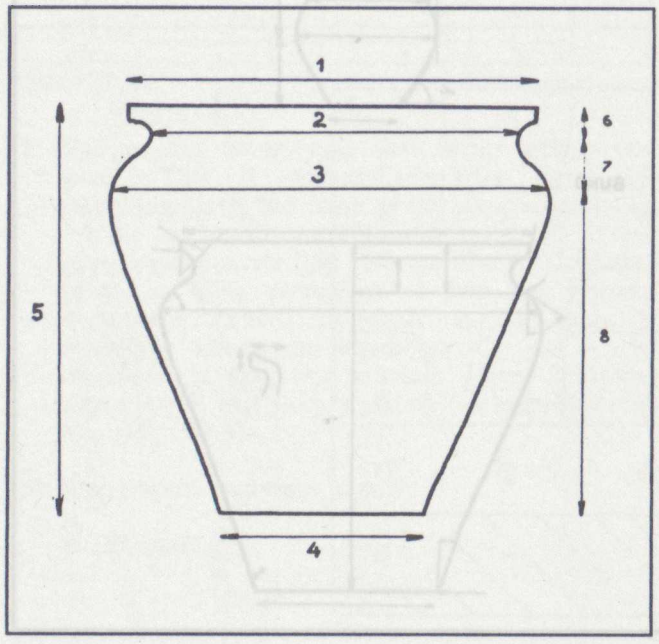
As an example of our analyses we used vessels from the Early Middle Ages cemetery in Velký Grob (Chropovský 1957). These 28 vessels were all found in the cemetery. On the basis of these vessels we studied and chose sets of quantitative properties (measurements, ratios and derived values) suitable for describing the shapes of this pottery. We cannot show here all the methods and choices of properties that were used, and therefore we shall show only optimal results.

1. 5 : 3
2. 6 : 1
3. 1 : 3
4. ((1 - 2) x 5) / 6
5. (7 + 8)/3
6. 7 : 9
7. (3 - 2) / (7 x 2)
8. (3 - 4) / (8 x 2)

Table 24.1: Gening's indices (after V.F.Gening, 1973, No. 1)

As the first set of quantitative properties there were the characteristics prepared on the basis of Gening's method. He first determined eight basic measurements (Fig. 24.2). From these basic measurements he calculated eight indices (Table 24.1). On the basis of these indices he classified his collection of vessels into groups which correspond to classification by shape. The advantage of using Gening's indices is that they eliminate all differences which would arise in comparing vessels of similar shape but different size. We therefore used these indices as the first set of quantitative properties for our analysis. For this goal we used mathematical-statistical methods: discriminant analysis (Anděl 1985) and the Kruskal-Wallis test (*ibid.*).

Figure 24.2: Gening's eight basic measurements defining the characteristics of a pot.



	1	2	3	4	5	6	Total
1	3	0	0	0	0	0	3
2	0	12	0	0	0	1	13
3	0	0	1	0	0	0	0
4	0	0	0	6	2	0	8
5	0	0	0	0	2	0	2
6	0	0	0	0	0	1	1
Total	3	12	1	6	4	2	28

Table 24.2.

We divided our 28 vessels from Velký Grob into six groups which were chosen on the basis of their shapes (Fig. 24.3). In the next step we verified whether discriminant analysis confirms our classification of vessels into chosen groups. On the basis of this analysis we see that its classification corresponds to our original classification (Table 24.2). Such small differences as exist can be explained relatively easily; for example discriminant analysis kept in the second group 12 of 13 original vessels and only one of them (grave 98) was moved to the sixth group — it is caused by the shape of this vessel, which is situated on the border between groups 2 (egg-shaped vessels) and 6 (barrel-shaped vessels). The situation in the fourth group is similar. All other vessels stayed in our original groups.

As the next step we asked which of Gening's indices are the most important for dividing vessels into groups. In looking for the answer to this question we used the Kruskal-Wallis test, which showed that the most important indices are 5, 1 and 3 (Table 24.1) — all these properties have great importance for studying vessel shape.

Table 24.3.

	1	2	3	4	5	6	Total
1	3	0	0	0	0	0	3
2	0	12	0	0	0	1	13
3	0	0	1	0	0	0	1
4	1	1	0	4	2	0	8
5	0	0	0	0	2	0	2
6	0	0	0	0	0	1	1
Total	4	13	1	4	4	2	28

On the basis of the outcome of using Gening's indices, we decided to analyse the original measurements of vessels (Fig. 24.2). We again used discriminant analysis, and by using it we obtained the results in Table 24.3: only four original vessels stayed in the fourth group, while two of them were moved to the

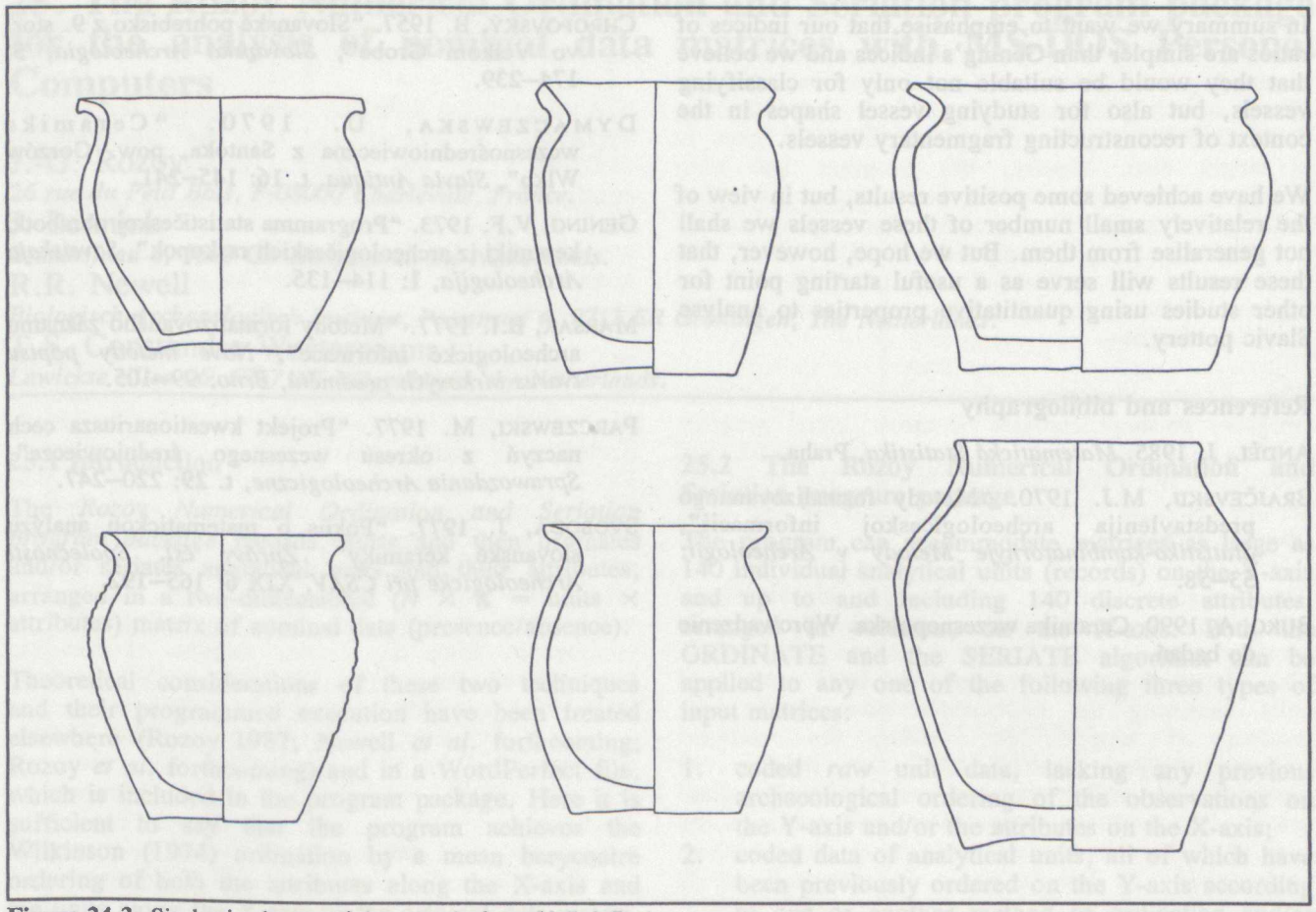


Figure 24.3: Six basic shapes of the vessels from Velký Grob.

fifth group, one of them to the first and one to the second group. This does not correspond to the real shapes of these vessels. From these results we can say that these basic measurements are not sufficient of our classification of vessels in regard to their shape.

As the third set of quantitative properties for characterising vessel shape we used ratios of the basic measurements. We proceeded by calculating the Pearson correlation matrix, and on the basis of it we can say that the highest correlation coefficients are between measurements 2 and 1, 8 and 5, 3 and 2, 8 and 3, 5 and 3, 7 and 5, 8 and 1, and 8 and 2.

We calculated as indices the ratios of the basic measurements between which were the highest correlation coefficients. For this third set of properties we also used the method of discriminant analysis (Table 24.4). From the table we see that the results of this analysis using our indices are better than using only basic measurements and as good as the results of using Gening's indices.

24.3 Conclusions

We studied the similarities of shapes of Slavic vessels on the basis of their quantitative properties. We used three sets of quantitative properties:

1. Properties obtained by means of Gening's method.
2. Basic measurements.
3. Indices of ratios obtained from basic measurements.

The best results were achieved by means of Gening's indices, but very positive results were also obtained by means of our indices of ratios. The results achieved by means of basic measurements are not sufficient.

Because our goal was to achieve the most simple quantitative properties which would also be the most realistic in classifying vessels into groups, we did not work with very complicated and detailed sets of quantitative properties, for example those mentioned at the beginning of this article. The choice of quantitative properties ought to follow from the real conditions and possibilities in which potters had produced the pottery.

Table 24.4.

	1	2	3	4	5	6	Total
1	3	0	0	0	0	0	3
2	0	11	0	0	0	2	13
3	0	0	1	0	0	0	1
4	0	0	0	8	0	0	8
5	0	0	0	0	2	0	2
6	0	0	0	0	0	1	1
Total	3	11	1	8	2	3	28

In summary we want to emphasise that our indices of ratios are simpler than Gening's indices and we believe that they would be suitable not only for classifying vessels, but also for studying vessel shapes in the context of reconstructing fragmentary vessels.

We have achieved some positive results, but in view of the relatively small number of these vessels we shall not generalise from them. But we hope, however, that these results will serve as a useful starting point for other studies using quantitative properties to analyse Slavic pottery.

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