PERCENTAGE REPORTS IN THE ARCHAEOLOGICAL RESEARCH

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Abstract: In the study of archaeological, paleozoological, anthropological, and other data, scientists often use percents and percentage reports. At the same time they do not take into account that the studied samples represent only a fraction of the total samples of the objects and their interest and calculated percentages contain probable errors, which ultimately leads them to mistakes and incorrect conclusions. In order to avoid similar situations in the future, the authors propose to use the method of percentages reports at which the calculated probable errors and confidence intervals.

Cuvinte cheie: marjă de eroare, rapoarte procentuale, eroare probabilă, eşantion, intervale de încredere, procente, metode statistice.

Rezumat: În studiile de arheologie, paleozoologie, antropologie, şi altele, cercetătorii folosesc adesea procente şi rapoarte procentuale. În acelaşi timp, ei nu iau în considerare faptul că eşantioanele studiate reprezintă doar o fracţiune din unităţile generale ale obiectelor şi procentele calculate de ei conţin erori probabile, care în cele din urmă duc spre tragerea unor opinii nejustificate şi concluzii incorecte. Pentru a evita în viitor situaţii similare, autorii propun să fie utilizată metoda rapoartelor procentuale prin care se calculează erorile probabile şi intervalele de încredere.

Beginning with the first stages in the development of archaeology and often in modern archaeological publications there are found direct or indirect references about the quantity of the artefacts, events or phenomena like: much-less, often-seldom, typical-exceptional and others. This level of making a general inference about the data and the volume of artefacts quantity, the archaeologist demands an initial collectivity, its systematization in the form of statistical reports.

But, it is out of our intention now to draw attention of the researchers upon the methods of percentage using. In archaeology there are not rare cases of inadequate utilisation of statistics. This situation may be due to the fact that the archaeologist who use the mathematical statistics are not trained enough in this field. Still the attempt of finding an unique general scheme which can be fit to all scientists and cases, cannot be designed.

In our everyday life, in business, but also in the scientific research the percentages play an important role, as they offer a possibility of comparing the parts of a whole between them and they simplify the calculation. The percentage is the hundred part of a unit, which is designated by the sign "%" and it is meant to show a part of a whole and its report with it. The term "percentage" comes from the Latin "*pro centum*", namely the hundred part, that was used in the Ancient Rome. These parts of a hundred from a specific number are comfortable to use in the practical activity and this is why people have started to utilize them for a very long time.

The percentages are widely used in mathematics and statistics. Such calculations are employed not only in the exact sciences, but also in archaeology, history, as well as in other interdisciplinary domains. Very popular is the operation of transforming the quantity data into percentages. In this case the numeric data are being transformed into percentages based upon the empirical percentages, yet without taking into account the possible existence of some errors, that depends upon the volume of studied units or upon the samples of the materials investigated. Most probably, do not exist researcher which had never used percentages or percentage reports in their studies.

In archaeology, the same like in other scientific fields, the researchers had used directly or indirectly the percentages, percentage comparisons and percentage reports. This aspect can be noticed in almost any article that discusses a large quantity of material, no matter if archaeological, arheozoological, anthropological or another kind. It could refer to pottery, burial orientation, flint implements, decorations and others. The mathematical method of percentage reports which is usually not perceived by archaeologists as a method, it is still used widely by them. Usually it helps when discussing trends which law character or when converting the quantity/quality features of: *"much/less, "more/lesser"* for drawing important conclusions of the type: *"on the first rank …. "*, *"main orientation"* or other similar ones.

A large interest in using mathematical methods and especially the mathematics statistics for processing large archaeological samples could be notices in the European archaeology between 1970-1980. In Romania, Poland, Russia and Ukraine had been organized conferences, symposia and seminars dedicated to the application of the physical and mathematical methods in the field of archaeology. A number of monographs and volumes of scientific volumes have been published on this topic. The interest became even more acute when the PC extended on an international scale.

But, we have to notice here that the problems that existed in archaeology in the times before computing the data could not be solved by the simple presence of such equipment. It is a fact that each scientist uses in his work certain indices, dimensions and parameters chosen by him and not always his choice could be satisfied completely or at all by the typical computer programs used for the statistic processing of the materials that he has to analyse. This is maybe the reason why some researchers had adopted their own way of creating such programs. Thus, in Romania and elsewhere some informatics products had been created, among which we could mention here "Zeus"[1], "Compas"[2], informatics systems, expert-systems, etc.[3]

Yet, it seems that until the archaeological materials could be widely computed is a long way and this is why the scientist have focused themselves upon simple statistical methods, the main one of them being the percentage reports. What we really have to point out here is that the often use of this method is done without keeping with the specific rules, fact which results in incorrect conclusions, sometimes even to absurd ones.

As an example, we will take a study of the Russian archaeologist Igor Kamenetskyi[4]. A pottery sample that he took for comparison, considered by him as reaching 100% had equaled a single (1) unit. The archaeologist Oleg Prihodniuk from the Ukraine in a study regarding the osteological materials had taken the sample comprising two (2) units, which he estimated to be of 100%[5].

Still, we have to observe that in such cases the conclusions of the researchers based upon the percentages analysis when indicating the sample amount, gives us the possibility of judging the credibility of the opinions based upon such facts. It is even worse when the archaeologists draw their conclusion considering the percentages reports of the studies materials without indicating the real quantity (n) of the units they used. For instance, the conclusion regarding the main rank of the bovids in the Euro-Asian steppe of the Andronovo[6] or Srubnaya[7] cultures are being based on samples, whose exact figure is not known by the readers of the respective papers. We should keep in mind that the small quantity samples, comprising just several units or tens have a large margin of error.

The research methods based upon the statistical data of a large number of objects/subjects are called statistical methods. They are used in different science domains and in fact have the purpose of numbering the objects/subjects that entered in some or other groups of study regarding the qualitative indices distribution, of using the partial sampling method, of employing the probabilities theory in the evaluation of the suffice observation in drawing one or other conclusions and so on.

This is a format facet of the statistical methods of research which is independent from the nature of the studies objects/subjects and is part of the mathematical statistics.

Unfortunately, there is a trend of considering the statistics is a science which could prove anything. Yet, it is also true that sometime the methods of the mathematical statistics are used with the purpose of misleading people. As the English man of state and writer Benjamin Disraeli has said it, there

[1] Lazarovici 1996.

[2] Teodor 1996.

[3] *New tools ....* 1990; *Archaeometry in Romania* 1990; Pislary 1989a. 60-61; Pislary *et alii* 1989b, 123-126; Voorrips 1990. 115-121.

[4] Kamenetskyi 1965.

[5] Prihodniuk 1993.

[6] Kuz'mina 1986.

[7] Buniatean, Otroščenko 1993.

are three kinds of lying: the customary lie, the unlimited lie and statistics.

Still, the main task and purpose of the statistic are meant to facilitate a better understanding of the issue that people have in a certain time.

Many examples of correct and incorrect use of the statistical methods could be given. It all depends upon the person that uses them. We should not neglect also the fact that statistics has two main functions: a descriptive and an explicative one.

The value of the descriptive function gives the short and concentrated characteristic of the studied phenomenon. As usual, in many cases the situation is not clear and determined even if the researchers operated with customary characteristics, like average and others. Due to the multi-semantic interpretations, such values (indices) could be used for proving contradictory opinions. The evaluation of the credibility level for such opinions, in its turn, poses a long series of specific problems.

In examples that we would use below we are firstly interested in the logic of thinking, a fact which is even more important than examples themselves.

Very often, the percentages are used for solving the aspects of classification and typology of the archaeological monuments. In the example given here, the authors, based upon the automatic classification and typology of the archaeological monuments from Altai, had emphasized two main groups of the population in that region and tried to describe the differences between them[8]. According to the authors, the best used method in this purpose became the calculation of the percentage reports for each type of ornament in each archaeological site. As a result of this information each site it is rendered in a line of the table, while the columns contain the data about the ornament types for all the sites. The corresponding column is dedicated to the fire that indicates the percentage part of the respective ornament in a specific site. After the analysis of the materials in the settlements from the 6th-2nd c. BC., the author had pointed out the existence of 12 ornament types, which are characteristic in a certain degree for all or most of the site, each of them with its own weight. For all 39 studied sites had been established the percentages for each ornament type. We should point out here the fact that in the table created by the authors are not given the data about the quantity of the materials which was the base of the percentage calculation. After the table being completed it was automatically processed by the use of a special module of the SYSTAT package.

We render below a table, created by the authors of the study and to which we added the figures representing the number of ceramic fragments for each site (the last column – "N") and we also established a margin of error (ΔP) just for a single parameter (3) from the percentages calculated by the authors. It is obvious that, without being considered the possible mistakes for the established percentages, the authors have used these empirical percentages for a further statistical processing.

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From the analysis of the table we could observe that the minimal quantity of the ceramic fragments from the sites is rather different, and the authors

©	Settlements ……	1	2	3	ΔP(±)	4	5	6	7	8	9	10	11	12	N
1.	Novo-Altaiskoe	5.1	11.8	62.6	8,72	1.7	0.0	0.0	0.0	2.5	5.9	0.0	0.0	0.0	118
2.	pf 6	2.8	28.7	58.3	8,01	3.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	145
3.	pf 10	4.0	26.0	43.6	8,72	0.8	0.0	2.4	0.0	1.6	5.6	0.0	0.8	0.8	124
4.	pf 17	2.1	25.0	43.2	8,21	0.0	0.0	0.0	0.0	16.4	8.4	0.0	0.0	0.0	140
5.	be 12	3.6	34.7	50.7	5,58	0.0	0.0	0.0	0.0	5.1	0.0	1.2	0.0	0.0	308
6.	be 1	1.3	14.4	75.3	2,64	0.3	0.0	0.0	0.0	3.6	0.0	0.2	0.0	0.1	1020
7.	mgk 1	3.8	12.0	35.2	6,36	8.5	1.8	3.1	0.0	3.2	3.1	0.0	4.0	0.0	216
8.	pb 3	13.2	11.9	4.0	2,82	20.3	1.0	2.6	0.0	0.5	0.0	0.0	19.6	0.0	192
9.	Kost	4.2	11.2	51.1	5,58	0.0	0.0	0.6	0.0	8.4	4.4	4.1	0.6	4.8	308
10.	Dmgr	1.0	4.2	52.1	8,33	0.0	0.0	0.0	0.0	14.5	0.0	13.6	0.0	0.7	138

[8] Abdulganeev, Vladimirov 1997.

11.	Kipr	11.3	9.1	22.7	7,64	27.3	0.0	9.1	0.0	0.0	0.0	0.0	11.4	2.3	115
12.	ostr 3	13.5	9.7	17.6	4,25	15.5	4.5	6.5	0.0	0.3	1.4	0.0	8.3	0.0	310
13.	krest 3	3.1	1.0	8.5	5,30	64.4	2.1	3.1	0.0	0.0	0.0	0.0	5.2	0.0	106
14.	pt 1	34.5	13.5	15.5	5,80	0.0	0.0	0.0	0.6	0.6	0.0	0.0	4.6	18.6	149
15.	pt 3	28.9	11.7	1.8	2,18	0.0	22.6	0.0	3.0	0.0	0.0	0.0	13.6	6.0	154
16.	pt 8	56.4	7.0	11.9	5,37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	7.7	137
17.	enis 1	16.9	13.6	25.4	7,85	0.0	0.0	0.0	3.0	8.7	0.0	13.6	0.0	9.2	118
18.	sol 1	25.2	2.4	27.2	4,94	0.0	0.0	0.0	0.0	33.1	0.0	1.7	0.0	0.9	310
19.	maima 1	16.9	29.0	26.9	7,62	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	2.4	130
20.	novoz 3	7.0	7.0	50.5	6,94	0.0	0.0	0.0	0.0	28.0	0.0	0.0	0.0	1.5	199
21.	Mal	12.6	17.4	27.1	8,59	3.8	0.0	0.0	0.9	1.8	0.0	6.7	0.0	15.5	103
22.	maima 3	28.7	13.1	0.0	0.0	0.0	0.0	3.2	4.4	0.0	8.4	0.0	0.0	5.9	153
23.	Zar	20.7	17.4	25.8	9,22	0.0	0.0	0.0	0.0	9.7	0.0	0.0	15.2	10.5	86
24.	ber 2	19.3	9.2	17.0	7,85	1.1	0.0	0.0	29.5	0.0	0.0	0.0	0.0	0.0	88
25.	pt 7	26.0	16.0	2.0	3,88	0.0	2.0	0.0	14.0	0.0	0.0	0.0	6.0	8.0	50
26.	Stan	20.0	5.3	34.6	10,77	8.0	0.0	0.0	0.0	9.3	0.0	1.3	0.0	13.3	75
27.	uisha 3	9.1	18.2	29.5	11,05	0.0	0.0	0.0	0.0	0.0	0.0	20.4	0.0	15.9	65
28.	Step	24.2	17.5	22.5	9,15	0.0	0.0	0.0	0.0	1.2	0.0	6.2	0.0	10.0	80
29.	maima 2	24.0	6.5	38.2	11,82	0.0	0.0	0.0	0.0	12.6	0.0	3.3	0.0	7.0	65
30.	maima 12	25.0	18.1	39.2	11,90	0.0	0.0	0.0	0.0	5.7	0.0	5.7	0.0	1.9	65
31.	bor 3	9.8	19.6	34.4	11,92	0.0	0.0	0.0	0.0	4.9	0.0	11.5	0.0	1.7	61
32.	pf 4	3.4	2.8	68.9	10,05	2.4	0.0	0.0	0.0	4.9	7.4	0.0	0.0	1.2	81
33.	pf 15	1.7	20.0	67.6	10,87	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.0	0.0	70
34.	kz 1	10.0	38.5	27.1	10,41	1.5	0.0	0.0	0.0	1.5	0.0	0.0	17.7	0.0	70
35.	vozn 1	10.5	5.5	10.5	6,46	10.5	0.0	47.5	0.0	0.0	0.0	0.0	0.0	0.0	86
36.	olg 1	4.2	12.5	62.4	11,18	0.0	0.0	0.0	0.0	11.1	2.8	0.0	0.0	1.4	72
37.	vas 2	3.9	11.7	68.4	10,45	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.0	0.0	76
38.	lespas 1	2.5	12.4	53.7	8,88	0.0	0.0	0.0	0.0	6.6	0.8	0.0	0.0	1.7	121
39.	turgor 1	1.9	36.9	17.5	7,33	1.9	0.0	5.8	0.0	11.6	0.0	1.0	6.8	1.0	103
															6007

Fig. 1. The initial data in % (*apud* Abdulganeev and Vladimirov, 1997).

compared them just like being absolute values without taking into account that they could have a possible mistake. The margin of error, as we could find, is rather high. Therefore in sample no. 6 that comprised 1020 units and the percentage of “75.3%” the margin of error is of ±2.646895%. while for the smallest sample no. 25 with the percentage of “2.0%” the margin of error reaches ±3.8806%. Generally, the empirical percentages calculated by the authors for the parameter no. 3 have a margin of error which varies between ±2.18% and ±11.92%. This fact cast a great doubt upon the results rendered by those researchers that used the data in such a manner for the statistical processing.

Description of the method

In another article we had advanced the proposal of using the percentage reports method and we demonstrated the advantage of the employment of the possible error calculation for any sample. as well as the methodology for establishing the margin of error[9].

We will try to show here the procedure and formula for the calculation of the margin of error (±ΔP) or the mistake of the empirical percentage (P), which can easily be established even by the use of a simple, regular computer, which in our

[9] Pislary. Pozhidaev 1982.

times is a small thing and which all student have. Moreover, the computers are also present in the mobile telephones.

The formula for establishing the margin of error - $\pm\Delta P$ - is, where

$$\Delta P = t\sqrt{\frac{P(1-P)}{N}}$$

At the level of significance $\alpha = 0,05$ that is with 95% certainty for the width of the confidence interval is valid calculation formula

$$\Delta P = 1.96\sqrt{\frac{P(1-P)}{N}}$$

In general, the value *t* is equal quantile of the Student distribution. With values $N \to \infty$ according to the Central Limit Theorem (CLT), the quantity $t \to 1.96$. Coefficient $t = 1.96$ corresponds to the so-called large sample $N > 30$ with the Student distribution in the limit tends to the normal (Gaussian distribution).

P – notation of the empirical percentage

ΔP – delta P or the margin of error for the empirical percentage (P)

N – quantity of the materials based upon which the percentage had been established

1 – 100%

1.96 – the coefficient that conforms the authenticity level of 95%, which means that the probability that a certain event might occur equals 95% (in the statistics this percentage is a very high level), the same as it is also possible that in 5% of the cases the same event could not occur.

But, what happens if we consider the level of probability at 50%? This means that the event could occur or not in the same percentage.

Now we must calculate the possible error (Δ – delta) of the empirical percentage (P) or the margin of error (ΔP – delta P) based upon the up mentioned formula, by using the help of a customary calculating machine or the one on the computer.

Algorithm for calculating the margin of error and construction of veridicity intervals. We will take an example in order to explain the construction of the algorithm for establishing the margin of error.

Exemple no. 1

Adrian Bălăşescu, in one of his articles describes and analyses the fauna materials coming from a tumulus near Ciulniţa, Ialomiţa County[10]. Among the animal bones belonging to the Coslogeni culture of the Late Bronze Age, the author said that out of 312 bones (NR=312) the large majority represents the following species, belonging to 26 individuals (NMI=26):

Bovids – 78 bones – 6 individuals

Caprine – 39 bones – 10 individuals

Suides – 32 bones – 10 individuals

Equides – 21 bones – 1 individual.

The numeric data are also accompanied by percentages 45, 24, 20 and 12% corresponding to the bones (NR) and 23, 38, 23 and 4% for the number of individuals (NMI).

No. of the operation	Operation	Result on the screen
1	We press the key with figure "**1**"	1
2	We press sign "-"	1
3	We establish the empirical percentage **0,25**	0,25
4	We press the key with the sign "-"	0,75
5	We press the key with the sing "**x**"	0,75
6	We establish the empirical percentage **0,25**	0,25
7	We press the key with the sign "="	0,1875
8	We press the key with the sign "**:**"	0,1875
9	We create number ***N***, namely **312**	312
10	We press the key with the sign "="	6,009615384
11	We press the key with the sign "√"	0,02451451689
12	We press the key with the sign "x"	0,02451451689
13	We create number **1,96** (probability of 95%)	1,96
14	We press the key with the sign "x"	0,0480484531
15	We create the figure 100 (transformation in %)	100
16	We press the key "="	4,80484531088

Fig. 2. Algorithm for establishing the margin of error.

[10] Bălăşescu 2000, 169-176.

The final conclusion of the researcher sounds like that: "*the bovids rank the first (45%), the caprines rank the second (24%), while the suids rank the third and the Equides rank the fourth*"[11].

On a first sight, this opinion seems to be plausible. Yet, after analysing the margin of error and constructing veridicity interval for the established percentages, we have reached the conclusion that the results of A. Bălăşescu did not enable him to get such a result, because the sample didn't comprise a sufficient number of units and this is why the margin of error is a considerable one. On the other side, even if the author had determined the bones by the minimal number of individuals, he had decided to use just the number of bones (NR) for the final conclusion. Further one, we will give our analysis concerning the data advanced by A. Bălăşescu.

If you follow our advice, by using a regular calculating machine, we will start in this way (Fig. 2).

Therefore, it was taken the sample of 312 units and it was established the margin of error for the empirical percentage of 25% (n=78). At the end of the calculation it resulted the figure of **4.804845** ... which means that the margin of error (ΔP) delta P for 25% equals ±4.804%, which, for group no. 1 (bovids), comprising 78 units, the likely percentage is 25.0%±4.80% or 20.19% **–** 29.8%.

The same procedure we apply to the other figures of the groups. Afterwards the obtained results are the following ones: 1 – 25.0 ± 4.8%; 2 – 12.5 ± 3.66%; 3 – 10.25 ±3.36%; 4 – 6.73 ±2.78%.

In these times, when most of the archaeologists have computers with the "Excel" program, we advance a data processing by establishing the margin of error according to the model given below (Fig. 3):

We should start with the first upper line on each column.

Column - A – for the total number of the studied sample - *N*

- B – for the number of units in each group - *n*

- C – the empirical percentage (n/N*100) or P: in cell ***C*** *we write a formula:* ***=(B1/A1)*100***

- D – transformation of the empirical percetange (P) into a number in cell ***D*** *we write a formula:* ***=C1/100****")*

- E – the probability coeficient of 95%: in cell ***E*** *we write figures: "****1.96****")*

-F – part of the formula for calculating the margin of error (ΔP): in cell ***F*** *we write a formula:* ***=sqrt((D1)*(1-D1)/A1)***

	A	B	C	D	E	F	G	H	I
1	N	n	(n/N*100) sau P =(B1/A1)*100	P / 100 C1/100	1.96 1.96	√(P*(1-P) /N) =sqrt((D1)* (1-D1)/A1)	ΔP F1*100	Min C1-G1	Max C1+G1
2	312	78	25	0.25	1.96	0.0120789	4.804845	20.19515	29.80485

Fig. 3. Preparations for the calculation of the margin of error by using the "Excel" computer program.

	A	B	C	D	E	F	G	H	I
			P	*P%/100*		*√P*(1-P)/N*	*ΔP*	*min*	*max*
	N	***n***	***=(B1/A1)*100***	***C1/100***	***1.96***	***=sqrt((D1) *(1-1)/A1)***	***F1*100***	***C1-G1***	***C1+G1***
1	N1=312	78	25	0.25	1.96	0.024515	4.804845	20.19515	29.80485
2	312	39	12.5	0.125	1.96	0.018723	3.669761	8.830239	16.16976
3	312	32	10.25641	0.102564	1.96	0.017176	3.366497	6.889914	13.62291
4	312	21	6.730769	0.067308	1.96	0.014185	2.780227	3.950542	9.510997
1	N2=174	78	44.82759	0.448276	1.96	0.037702	7.389501	37.43809	52.21709
2	174	39	22.41379	0.224138	1.96	0.031614	6.196285	16.21751	28.61008
3	174	32	18.3908	0.183908	1.96	0.029369	5.756405	12.6344	24.14721
4	174	21	12.06897	0.12069	1.96	0.024696	4.84047	7.228495	16.90944
1a	n1 = 27	6	22.22222	0.222222	1.96	0.080009	15.68179	6.54043	37.90401
2a	27	10	37.03704	0.37037	1.96	0.092935	18.21524	18.8218	55.25228
3a	27	10	37.03704	0.37037	1.96	0.092935	18.21524	18.8218	55.25228
4a	27	1	3.703704	0.037037	1.96	0.036345	7.12356	-3.41986	10.82726

Fig. 4. The result of the calculation made by using the "Excel" computer program.

[11] Bălăşescu 2000, 173.

- G – margin of error – ΔP: In cell ***G*** *we write:* ***"F1*100"***

- H – the minimal possible value (*min)* of the empirical percentage(P): In cell ***H*** *we write a formula:* ***=C1-G1***

- I – the maximal possible value (*max)* of the empirical percentage(P): In cell ***I*** *we write a formula:* ***= C1+G1***

Interpretation of the results

From the total number (NR=312) of the bones just 174 (55.76%) had been determined, out of which:

Bovids – 78 bones, (45%) 44.827±7.392% or 7.438 – 52.217 %

Caprines – 39 bones, (24%) 22.413±6.3459% or 16.217 – 28.610%

Suids – 32 bones, (20%) 18.390±5.756% or 12.634 – 24.147%

Cabalines – 21 bones, (12%) 12.068±4.840% or 7.228 – 16.909%.

Among the determined bones had been identified a number (n1=27) of individuals (NMI):

Bovids – six individuals, 22.222%±15.681% or 6.540 – 37.904%

Caprines – 10 individuals, 37.037%±18.215% or 26.4684 – 49.5316%

Suids – 10 individuals, 37.037%±18.215% or 26.4684 – 49.5316%

Cabalines – one individual, 3.703%±7.123% or 0.0 – 10.827%.

	Animal species	NR	%	ΔP (±)	Interval (min-max)	NMI	%	P (±)	Interval (min-max)
1	Bos taurus	78	78	44.82759	37.438-52.217	6	22.222	15.681	6.540-37.904
2	Ovis aries\Capra hircus	39	39	22.41379	16.217-28.610	10	19.565	14.963	18.821-55.252
3	Sus domesticus	32	32	18.3908	12.634-24.147	10	19.565	14.963	18.821-55.252
4	Equus caballus	21	21	12.06897	7.228-16.909	1	7.123	10.628	0.0-10.827
5	???	4	4	2.298851	0.072-4.525				
	Total	174	100			27	100		

Fig. 5. The presence of animal bones (*apud* A. Bălăşescu).

For a better presentation we transform these data into the following table:

From the analysis of this table results that by using the number of individuals (NMI=27) we cannot establish the ranking of the animals for the tribes of the Coslogeni culture. But, if we used on the same purpose the number of bones (NR=174) we can find that just the bovid bones (37.438 **–** 52.217%) could be interpreted as being the preferred species, ranking the first. Concerning other species, they take the following positions.

Example no. 2

In the Preliminary study of the faunal materials discovered in the site from Feteşti (comm. Adâncata, Suceava County) paleozoologists tell us that they, by "*using the customary methodology, that specific to archaeozoology*" they studied the "*archaeozoological material recovered after the first five consequent archaeological campaigns (2000-2004), undertaken in this site and belonging to the Cucuteni culture, phase A and B and Horodiştea-Erbiceni*"[12].

The Cucuteni A layer was represented by bones with species determination (NR=104), out of which n=79 (75.96%) had been assigned to the domestic animals and n=24 (24.04%) belonging to the wild species. The Cucuteni B layer, according to the data contained bones with species determination (NR=269), out of which n=221 (82.16%) of domestic mammals and n=48 (17.84%) belonging to the wild ones. The Horodiştea-Erbiceni layer had bones with species determination (NR=76), out of which n=60 (78.95%), being assigned to the domestic mammals and n=16 (21.05%) to the wild mammals. Calculating the percentages from different samples, the authors had done a comparison between them as being equally[13]. But, the truth is that this empirical percentages (P) had a different margin of error (ΔP), being of ± 4.19% for the Cucuteni A layer, of ± 2.334% for the Cucuteni B one, for Horodiştea-Erbiceni reaching ± 4.67% (Fig. 6).

Then, comparing the data about the main ranking animals in the investigated cultural layers, the authors tell us that in the Cucuteni A layer the suids have the main rank (25%), being followed by the ovicaprines (24.03%) and bovids (23.07%). the dog (3.84%) ranking the last. We have calculated ΔP for these percentages (P) and we had

[12] Cavaleriu, Bejenaru 2007.

[13] Cavaleriu, Bejenaru 2007, 499, fig. 2.

		N	NR	%	ΔP (±)	min	max
1	The Cucuteni A layer	104	79	75.96154	4.190188	71.77135	80.15173
		104	24	23.07692	4.131432	18.94549	27.20836
2	The Cucuteni B layer	269	221	82.15613	2.33447	79.82166	84.4906
		269	48	17.84387	2.33447	15.5094	20.17834
3	The Horodiştea-Erbiceni layer	76	60	78.94737	4.676439	74.27093	83.62381
		76	16	21.05263	4.676439	16.37619	25.72907
	Total	449	448				

Fig. 6. The presence of the animal bones discovered in the site from Feteşti (*apud* Cavaleriu and Bejenaru).

		N	NR	%	ΔP (±)	min	max
1	The Cucuteni A layer	104	26	25	8.322236	16.67776	33.32224
		104	25	24.03846	8.212769	15.82569	32.25123
		104	24	23.07692	8.097607	14.97932	31.17453
		104	4	3.846154	3.696035	0.150119	7.542189
			79				

Fig. 7. The presence of the animal bones in the Cucuteni A layer (*apud* Cavaleriu and Bejenaru).

reached the conclusion that none of the mammals was ranking the first. Here is the percentage of the margin of error: 25 ± 8.32%, 24.03±8.21%, 23.07 ± 8.09%, 3.84 ± 3.69% (Fig. 7).

We can notice the same thing in the Cucuteni B layer, where the authors considered that bovids were ranking the first (29.36%), being followed by the suids (27.13%) and ovicaprine (24.16%). We add ΔP and we notice that we cannot make a clear distinction the ranking of a certain animal species among those mentioned above: bovids – 29.36±5.44%, suids – 27.13±5.31%, ovicaprines – 24.16±5.11% (Fig. 8).

Just for the Horodiştea-Erbiceni layer the authors were right, when mentioning that the bovids had reached a high percentage (44.73±11.17%) being followed by the suids (18.42±8.71%) and ovicaprines (13.15±7.59%) both of them ranking the second (Fig. 9).

Much seldom the investigators of the archaeological sites of the stone age had used percentages or their reports for making a description of the discovered materials. Sometimes, even if the collections are not extensive, the researchers start calculating the percentages.

Example no. 3

Therefore, in an article[14] where the sample contained 98 units, the authors had rendered the discovered objects in a table where, besides the amount of the finds, they also established the empirical percentages. We had added the margin of error and the trusting intervals (Fig. 10).

The analysis of table 10 shows that the most numerous are the categories no. 5, 11, 7 and. At first sight, by the empirical percentages, these categories had the following positions: category 5 the first one, category 11 the second, category 7 the third

		N=269	NR	%	ΔP (±)	min	max
2	The Cucuteni B layer	bovids	79	29.36803	5.442745	23.92528	34.81077
		suids	73	27.13755	5.313946	21.8236	32.45149
		ovicaprines	65	24.16357	5.115633	19.04794	29.2792
			217				

Fig. 8. The presence of the animal bones in the Cucuteni B layer (*apud* Cavaleriu and Bejenaru).

		N=76	NR	%	ΔP (±)	min	max
3	The Horodiştea-Erbiceni layer	bovids	34	44.73684	11.17892	33.55792	55.91576
		suids	14	18.42105	8.715565	9.705488	27.13662
		ovicaprines	10	13.15789	7.599896	5.557999	20.75779
	Total		58				

Fig. 9. The presence of the animal bones (*apud* Cavaleriu and Bejenaru).

[14] Britiuk, M. Udovichenko, O. Udovichenko 2005, 42-53.

Categories	N	P (%)	ΔP (±)	min	max
1	6	6.122449	4.746642	1.375807	10.86909
2	4	4.081633	3.917517	0.164116	7.99915
3	1	1.020408	1.98977	-0.96936	3.010178
4	4	4.081633	3.917517	0.164116	7.99915
5	30	30.61224	9.124983	21.48726	39.73723
6	8	8.163265	5.421047	2.742218	13.58431
7	10	10.20408	5.993193	4.210888	16.19728
8	4	4.081633	3.917517	0.164116	7.99915
9	3	3.061224	3.410668	-0.34944	6.471892
10	1	1.020408	1.98977	-0.96936	3.010178
11	26	26.53061	8.741176	17.78944	35.27179
12	1	1.020408	1.98977	-0.96936	3.010178
Total	98	100%			

Fig. 10. The presence of the animal bones (*apud* Britiuk *et alii*).

and category 1 the fourth. But, after establishing the margin of error and the trusting intervals we can say that the flints in the category no. 5 are the first, category 11 is the second, wile the others are on the third position.

In another article[15], the lithic inventory, comprising 185 units, had been rendered by the number of the discovered items, while the percentages are used by the researchers just to render the size of the lack of patina.

Example no. 4

The well known Russian archaeologists, investigators of the stone age monuments had described on one of their articles what they experienced by statistical grouping of the Upper Paleolithic of the Eurasia, in which percentages had played a significant role. By percentages had been rendered not only the number of artefacts in the complexes, but also some categorizations. In their work they give an example of such a group and reveal the mechanism of creating the data bases used for processing by using the computer[16]. The authors had also advanced a method for an optimal grouping as a variant among the options of processing the archaeological data by using statistical-mathematical methods. For the statistical analysis the scientists had used the data about 54,945 stone implements in 308 Paleolithic complexes in Northern Asia, Central Asia, Siberia, Middle East, Ural the plains of the Eastern Europe, Caucasus and some other territories. By this grouping 29 categories had been created, in which had been included an average of 177 artefacts. For more comfortable presentation of the proportion for each group of implements in the entire sample, the percentages had been used (empirical percentage). With a uniform distribution of implements in 29 categories, each of the latter could contain 1,895 artefacts, or 3.47% out of the total. Therefore, according to the author, the implements of the 9th category comprised 11,435 racloirs, which represented 20.81%. Still, there are also categories with very few artefacts, like the polishers **–** 7 items or 0.01%. Despite that, we should observe that, even with such a large sample used by the authors for the operational procedures, it has a margin of error that was not considered and could subsequently affect the general conclusions and other inferences. This is why, for the communities and samples of the authors we have established and added the possible margin of error for a probability level of 95%.

Thus, 1,895 implements didn't reach 3.47%, as showed by the authors, but 3.448903%. The margin of error is of ± 0.152585% while the real values are encompassed in the interval of 3.29% - 3.60%. The implements of the 9th category -11 435 raclettes reached 20.81%, while the margin of error is of ± 0.339%, in the interval 20.472% - 21.151%. Regarding the seven polishers that, according to the authors reached 0.01274%, their margin of error is of ±0.009437% in the interval 0.003303% - 0.022177%.

Example no. 5

By analysing the repertory of the flint finds (N=1,492) in the stone age settlements of the Ingul river basin (Nikolaev region, Ukraine), the specialists had noticed that the richest category was represented by the splinters with 66.8±3.39%, out of which some are small "nappes" (707) and small splinters (290)[17]. The main category of all implements (N1=69) is represented by microlithes (n=22). They are the first rank among the implements. As another important group the authors

[15] Shestakov, Vybornyi 2005, 54-60.

[16] Derevianko, Felinger, Holyushkin 1989.

[17] Stanko, Grigorieva 1977, 37-51.

had mentioned the scrapers (n=12). To this they added the retouches blades (n=32), about which they said that "*they are of different types and character*". Therefore, at the implements the authors had assigned 69 items that we should consider as being 100%. Then, each group should have its own percentage (Fig. 11):

	Artifacts	n	P	ΔP(±)	min – max
1	-microlithes	22	31.88	± 10.99%	20.89 – 42.87
2	-scrapers	12	17.39	± 8.94%	8.45 – 26.33
3	-retouches blades	32	46.38	± 11.75%	34.63 – 58.13
4	-retouches splinters	3	4.35	± 4.8%	0 – 9.15
	total	69	100%		

Fig. 11. The presence of the flint artifacts in the settlement from Ingul river (*apud* Stanko, Grigorieva).

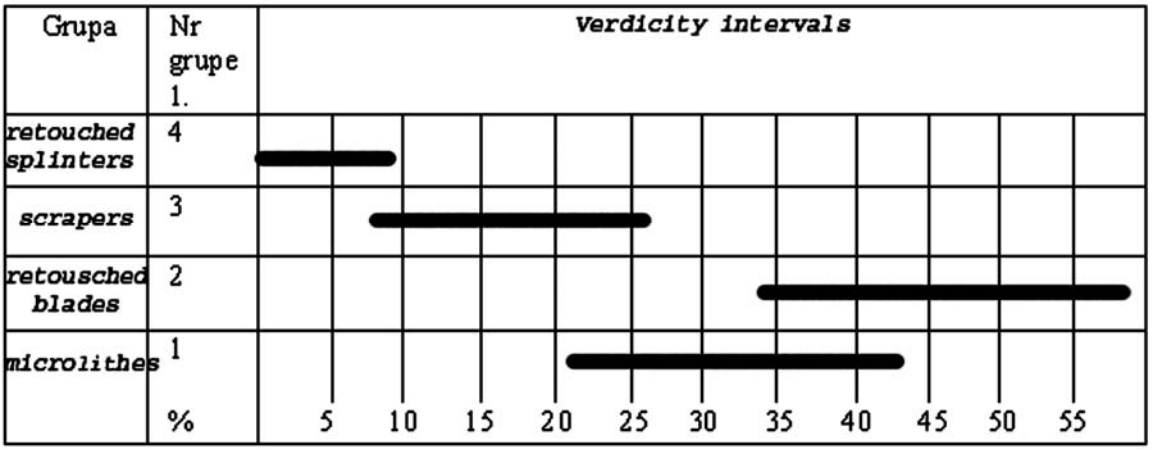

Fig. 12. Veridicity intervals for the flint artifacts in the settlement from Ingul river.

The sample is not too big and the credibility of the provided percentages is doubtful. We will create here veridicity intervals by using the up mentioned mode (Fig. 12).

From the analysis of table no. 12 we could infer, on a hand that the retouched splinters and scrapers could not be distinguished between them and this is why they formed a single group. On the other side, the retouched blades are well distinguished compared with the retouched splinters and scrapers. If we put in a single group the microblades and scrapers (the most frequent implements in the opinion of the authors) this group will be also not able to be distinguished from the one of the retouched blades.

The analysis of the table does not enable us to draw a conclusion as any of the studied groups could rank first. Better said, the idea of the authors that the microblades are mainly statistical could not be certified.

Example no. 6

In the Măgura commune, Teleorman county it was discovered a complex, N 13, containing lithic material, belonging to the Criş culture[18]. It comprised 40 items. The archaeologist had understood that the sample was very small yet, by using percentage calculations, he expressed his opinions, like: "*the largest part of the complex (40%) had been retouched", or "in the complex predominated …*". For a sample comprising just 40 items the margin of error is very large. Concerning these 40%, in reality these are just the empirical percentage, to which we need to add the margin of error of ±15.18% and then we can have a picture closer to the truth. The interval of the values is 24.72 % – 55.18%, which means that the "*retouched part of the complex*" renders 40% ±15.18% or varies between the values of 24.72 % and up to 55.18%.

Example no. 7

During the archaeological campaign of the year 2004 on the Popina Borduşani, Ialomiţa county were been discovered 114 items made of flint and other rocks. From the analysis of the data, it could be observed "*a predominance of the retouched blades, followed by the gratoires on the blade and the simple splinters with use traces*"[19]. From the presented table results that the retouched blades are in number of 24 and they reach 21.5%, the gratoires on the blade are 19 (16.66%) while the simple splinters are 14 (12.28%). We have calculated ΔP for these percentages the following: ±7.48%, ±6.84%, ±6.025%. A comparison of the value inter-

[18] Pannett 2005, 231-234.

[19] Popovici *et alii* 2005, 69-72, 477-478.

vals show that they could be easily distinguished and it is sure that any category could be placed in the first position:

- The retouched blades n=24 – 21.5% ±7.48% = 14.02% - 28.98%.

- Gratoires on the blade n=19 – 16.66% ±6.84%= 9.82% – 23.5%.

- Simple splinters n=16 – 12.28% ±6.02%= 6.26% – 18.3%.

Example no. 8

In a collaboration paper between archaeologists from Kiev and Sankt-Petersburg it is presented a detailed characteristic of the research in the region of the Ingul river, undertaken between 1966-1976[20]. Based upon them it was made a classification of the burials belonging to the Yamnaya culture in the basin of the Ingul river. A number of 216 burials of this culture were parted by the authors of this study into six main types (Fig. 13).

Checking the data by using the veridicity intervals we could find that the categories 1 and 4 could be easily distinguished, but we cannot say the same thing about the types 2, 3, 5 and 6, which cannot be differentiated. We should point out here that:

- type 1 is represented by burials with skeletons laid on their back and slightly flexed legs, whose pits had been covered with stone;

- type 4, burials with skeletons laid on their back and slightly flexed legs, in pits covered with wood;

- types 2, 3, 5, 6 are burials with skeletons flexed on a side, in pits covered with stone or wood.

For this table, we have rendered the results by using a graph, showing the veridicity intervals (Fig. 14).

From the table below we can infer that just the burials specific to the types 1 and 4 with skeletons laid on their back and slightly flexed legs could be distinguished from the other types. Moreover, the burials of type 1 covered with stone predominate over those of type 4, while those with skeletons flexed on a side in pits covered with stone (2, 3) or wood (5, 6) could not be distinguished.

Further on, the authors, relying upon the percentage calculations (Fig. 15), mentioned that among the burials of the Yamnaya burials with grave goods could be distinguished those of the types 5 and 6, which reached 36% and 23% respectively. However, the empirical percentages

N=216

	Burials covered with stone n1=119					Burials covered with wood n2=97				
Type	n1	P(%)	ΔP(±)	min	max	n2	P(%)	ΔP(±)	min	max
1	81	37.5	6.456317	31.04368	43.95632	-	-			
2	21	9.72	3.950958	5.771264	13.67318	-	-			
3	17	7.87	3.591091	4.279279	11.46146	-	-			
4	-	-				52	24.07	5.70163	18.37244	29.7757
5	-	-				19	8.79	3.777334	5.018963	12.57363
6	-	-				26	12.03	4.339492	7.697545	16.37653
Total	119	55.09	6.633379	48.45921	61.72597	97	44.89	6.633379	38.27403	51.54079
%	55.09					44.89				

Fig. 13. Burial types of the Early Bronze Age.

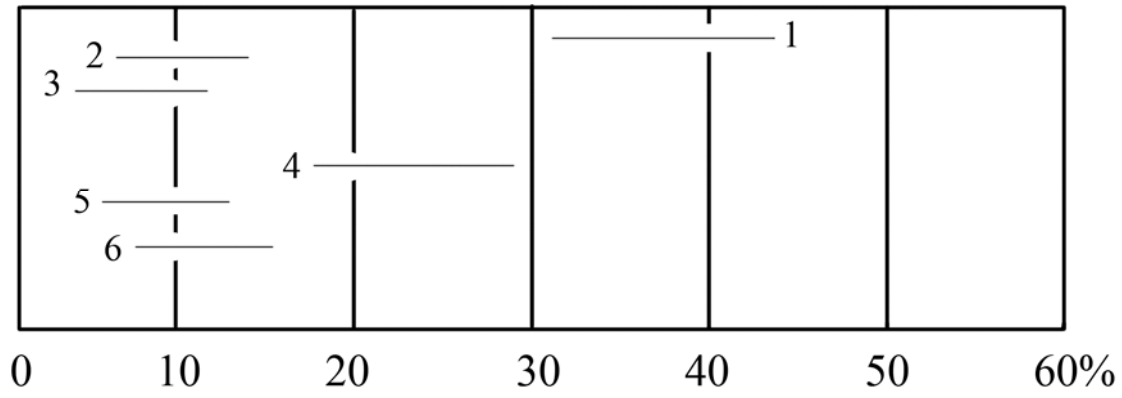

Fig. 14. Distribution of the Bronze Age burials by using the veridicity intervals, 1, 2, 3 – burials covered with stone; 4, 5, 6 – burials covered with wood; 1, 4 – burials with skeletons laid on their back and slightly flexed legs; 2, 3, 5, 6 – burials with skeletons flexed on side.

[20] Shaposhnikova, Bočkarev, Sharafutdinova 1977, 7-36.

	Grave goods of the burials with stone						Grave goods of the burials with wood					
Tip	N	n	P(%)	ΔP(±)	min	max	N	n	P(%)	ΔP(±)	Min	max
1	81	10	12.34	7.1640	5.18	19.50	-		-			
2	21	4	19.04	16.79	2.25	35.84	-		-			
3	17	2	11.76	15.31	0	27.08	-		-			
4	-		-				52	8	15.38	9.80	5.57	25.19
5	-		-				19	7	36.84	21.69	15.15	58.53
6	-		-				26	6	23.07	16.19	6.88	39.27
Total	119	16	13.44	6.12	7.31	19.57	97	21	21.64	8.19	13.45	29.84

Fig.15. The Yamnaya culture burials with grave goods.

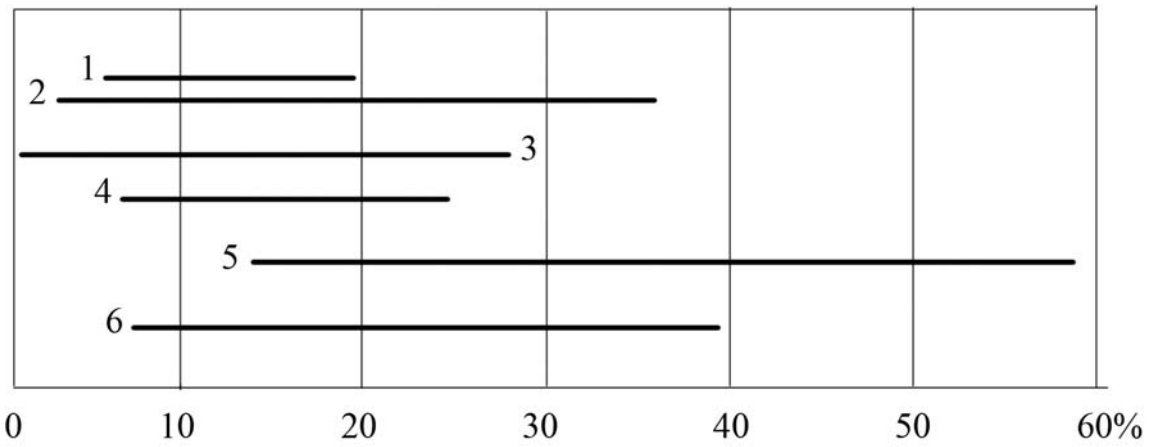

Fig. 16. Distribution of the Yamnaya culture burials with grave goods after the analysis of the veridicity intervals.

which were established upon insufficient samples and this is why the margin of error (ΔP) is a considerable one, varying between ±7% until ±21%.

The analysis by the "*presence of the grave goods*" that we carried out pointed out that any type was distinct from the others and could not be done any differentiation between the intervals of the types, all of them being crossed with each other. The visual representation demonstrates this situation (Fig. 16).

Example no. 9

The archaeologist Kovaleva Irina from the Ukraine had discovered on the banks of the Oreli river – the left tributary of the Dnepr a Neo-Eneolithic necropolis[21]. It contained 90 burials belonging to the Neolithic time. Part of them (n1=58) were situated on a line, while the other one (n2=32) was out of it. As an important aspect, the researcher has noticed the presence of the double "marital" burials (man and woman). Comparing their weight in a line (9 of 58) with those similar ones out of the line (of 32) she considered that the percentage of those in the line is "*essentially bigger*" than those out of the line. We have established the margin of error and the trusting intervals for that:

3 of 32 = 9.37% ±10.09% = 0-19.46%

9 of 58 =15.51% ±9.31%= 6.2-24.82%.

Now it is easy to get convinced that this opinion has literally no statistical basis. The situation is not changed even if we would calculate the percentage of the double "*marital*" burials in the general number of all burials of the necropolis (N=90):

3 of 90 = 3.33% ±6.7%= 0-10.3%

9 of 90 = 10.0 % ±6.2% =3.8-16.2%.

Bronze Age	*Burials*	*Collective*			*Individual*			*Total* **N**
	Culture	**n**	**P or %**	**DP**	**n**	**P sau %**	**DP**	
Early period	Yamnaya	4	5.8	5.51	65	94.2	5.51	69
Middle period	Catacombnaya	2	9.53	12.55	19	90.47	12.55	21
Late period	Srubnaya	6	2.7	2.12	217	97.3	2.12	223
	Total	12	3.8	2.11	301	96.16	2.11	313

Fig. 17. Distribution of the collective burials of the Bronze Age (*apud* the data of N. Ryčkov).

[21] Kovaleva 1977, 46-49.

Thus, we could not discuss about the "*essential prevalence of the marital burials in the line*". Still, we could notice the existence of a trend in making "*marital*" burials (n=12), which reaches 13.33%±7.02% or 6.31%-20.35% and this is what we can statistically prove. The trusting intervals of the individual burials group (n=78 reaches 86.67±7.02% or 79.64%-93.68%) and the "*marital*" ones (n=12 reached 13.33%±7.02% or 6.31%-20.35%) and do not cross with each other.

Example no. 10

Here we will refer to the aspect regarding the study of the collective burials of the Bronze Age as tackled by the archaeologist Nikolai Ryčkov from the Ukraine[22]. He had reached the conclusion that the number of collective burials in the Eastern region (Volga) increased beginning with the Yamnaya culture (the Early Bronze Age) towards the Catacombnaya culture (the Middle Bronze Age) and then briskly decreased in the Srubnaya culture (the Late Bronze Age). We relied in that assumption by establishing the empirical percentages (Fig. 21). with a general sample of 313 units (Fig. 17).

In order to check the truthfulness of these conclusions, based upon the percentage reports we have calculated and added the ΔP reaching the conclusion that Ryčkov was mistaken and his conclusion was not correct. A graph could rightfully proof this thing (Fig. 18).

All intervals are being crossed with each others, which means that the difference between the empirical percentages (P) without the margin of error (ΔP) is just an imaginary one(Fig. 18). Still, it is interesting that the same author, in another paper[23] had suggested that we should consider the error of any percentage calculations and recommended the quantity of the archaeological material of at least 381 units that, in his opinion, was the optimal sample for the research.

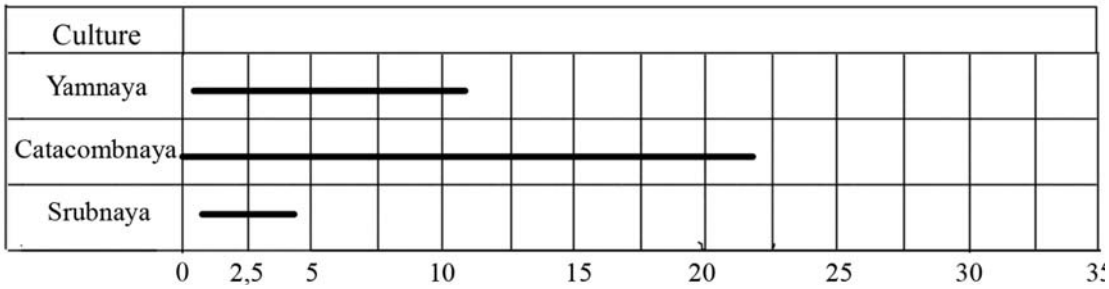

Fig. 18. Checking the veridicity intervals for the collective burials of the Bronze Age.

Example no. 11

In a monograph dedicated to the study of the Andronovo culture of the Late Bronze Age, its author V. S. Stokolos considered the orientation of 260 burials[24]. He had divided all of them into three categories:

1 – with a north-south orientation (N-S).

2 – with a parallel orientation (E-V).

3 – with an intermediate orientation, under the angle of 45°.

The author had created for them a special table, where all burials had been included, according to their orientation and the necropolis to which they had belonged, also keeping with the chronological order. The quantity of burials had been transformed into empirical percentages. The next step of the scientist was the comparison of the empirical percentage between them and based on this analysis he drew the conclusion that the increasing number of the parallel burials in the early phase (Alakul') towards the late one (Alexeevka) could be interpreted as a trend with the character of a rule[25].

	Necropolises	Alakuli	Cerneaki-I	Cerneaki-II	Tastî-Butak	Alexeevka
Orientation	**N**	40	156	31	78	16
N-S	**P şi ΔP**	37.5 ±15.33	26.7± 6.94	6.8 ±8.86	14.4 ±7.79	12.5±16.2
E-W	**P şi ΔP**	27.5±13.84	36.3 ±7.55	67.4±16.5	72.3± 9.93	75.0± 21.22
SE-NW SW-NE	**P şi ΔP**	35.0 ±14.78	27.0 ±6.97	25.8 ±15.4	13.3 ±7.54	12.5 ±16.20

Fig. 19. Orientation of the Andronovo burials.

[22] Ryčkov 1982, 85-103.

[23] Ryčkov 1982, 16-178.

[24] Stokolos 1972, 105-110.

[25] The trend with the character of a law, based on the studied materials, means the discovery of some more or less veridical dependencies.

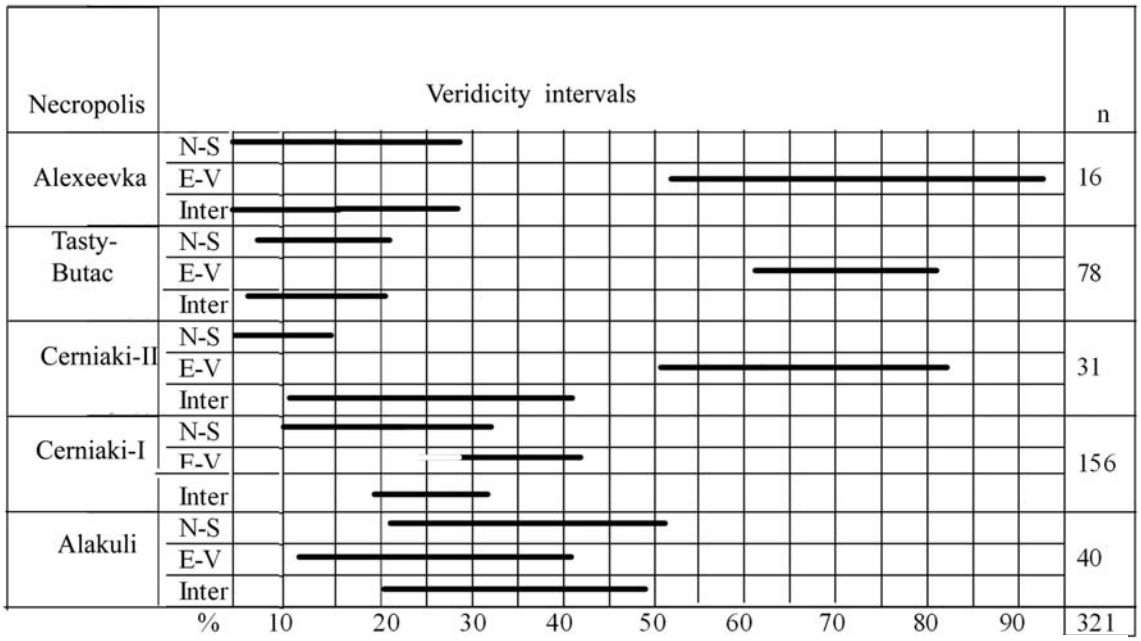

Fig. 20. Veridicity intervals for the burials of the Andronovo culture burials.

Dwelling	*No of fragments*	*Rims*	*Bottoms*	*Ornamented walls.*	*Estimated no. of vessels*	*%*		*Undecorated fragments*
	A	**B n/ %**	**C n/ %**	**D n/ %**	**E**	**E/A**	**A/E**	**F=A-(B.C.D)**
2	120	31/25.8	8/6.666	20/16.66	15	12.5	8	61/50.833
3	251	69/27.49	22/8.764	37/14.74	30	11.95	8.366	123/49.00
4	280	171/61.07	42/15.0	124/44.28	40	14.28	7	57/20.357
5	399	102/25.56	28/7.017	76/19.047	50	12.531	7.98	193/48.37
6	210	37/17.619	15/7.142	54/27.142	35	16.666	6	104/49.52
7	150	54/36.0	24/16.0	30/20.0	27	18.	5.555	42/28.0
8	124	31/25.0	10/8.064	47/37.9	26	20.967	4.769	36/29.032
9	473	64/13.53	36/7.61	107/22.62	45	9.513	10.51	266/56.236
10	509	90/17.681	36/7.072	68/13.359	50	9.823	10.18	315/61.886
Total	**2516**	**649**	**221**	**563**	**318**	**12.639**	**7.911**	**1083/43.044**

Fig. 21. Distribution of the pottery in the Bronze Age dwellings of the Pustynka settlement.

We will further study the data of the author, to which we will also add the margin of error (Fig. 19).

Now we calculate the trusting intervals for the percentages in the table and we create a new table containing them (Fig. 20).

The analysis of this table enables us to draw the following conclusions:

– in the necropolises Alakuli and Cerneaki-I the burials with different orientations could not be distinguished from each other;

– in the necropolises Cerneaki-II, Tasty-Butak and Alexeevka we could see that the burials with a parallel orientation predominate and seem to be clearly differentiated from the burials with other orientations;

– the trend of increasing the number of burials with a parallel orientation with the character of a rule from Cerneaki-II to Alexeevka could not be baked up by the existing results;

– regarding their number, the burials with a north-south orientation and the intermediary ones from the necropolises Cerneaki-II, Tasty-Butak and Alexeevka would stay behind those with a parallel orientation but they are not distinguished from each other.

Further on, V. S. Stokolos, maintaining its division of three main orientation, brings variants of the absolute orientation, where he sees an essential fact – the impetuous increase of the orientation to the West, which is completely missing in the necropolis from Alexeevka.

Upon the data of the author we have calculated the trusting intervals, and have created a table and reached the conclusion that this is now way to obtain a more clear image about orientation. This is why we studied separately the parallel orientations, leaving aside the others. In the end we have found that the necropolis from Alexeevka was represented just by burials with an eastern orientation. Tasty-Butak – just by a western one,

	Dwelling	No. of fragments	Rims	Buttoms	Decorated walls	Estimated number of vessels	Reports				Undecorated fragments	Estimated number of vessels
		A	**B**	**C**	**D**	**E**	**E/A ± ΔP**	**A/E**	**B/E**	**D/E**	**n /P%**	**A/8**
1	2	120	31	8	20	15	12.5±5.917 6.583-18.417	8	3.875	1.33	61/50.83	15
2	3	251	69	22	37	30	11.95±4.012 7.938-15.962	8.366	2.3	1.23	123/49.00	31.37
3	4	280	171	42	124	40	14.28±4.098 10.182-19.26	7.0	4.275	3.1	57/20.35	35
4	5	399	102	28	76	50	12.531±3.248 9.283-15.779	7.98	2.04	1.52	193/48.37	49.87
5	6	210	37	15	54	35	16.666±5.040 11.626-1.706	6.0	1.057	1.54	104/49.52	26
6	7	150	54	24	30	27	18. ± 6.148 11.852-24.148	5.555	2.0	1.11	42/28.0	18.75
7	8	124	31	10	47	26	20.967±7.165 13.802-28.132	4.769	1.192	1.80	36/29.03	15.5
8	9	473	64	36	107	45	9.513±2.644 6.869-12.157	10.51	1.422	2.37	266/56.236	59
9	10	509	90	36	68	50	9.823±2.585 7.238-12.408	10.18	1.8	1.36	315/61.886	63
	Total	2516	649	221	563	318	12.639±1.298 11.34-13.937	7.911	12.98	1.77	1083/43.04	314.5

Fig. 22. Looking for a way of rendering the estimated number of vessels of the Bronze Age in the settlement from Pustynka.

while in the Cerneaki-I and Cerneaki-II the western orientation predominated, but also existed a smaller group of burials with a slight orientation to the east. In the necropolis from Alakuli the eastern and western orientations are equally present. Therefore, the opinion of V. Stokolos about the trend with the character of a rule about the change of orientation from west to east could not be statistically be proven yet.

Example no. 12

In the analysis for the excavations the pottery has a great importance but, usually, it is seldom represented by complete vessels. The archaeologists normally work with ceramic fragments. A very interesting trial had been done by Sofia Berezanskaya who had tried, by using the percentages, to establish the quantity of vessels in the settlement of the Eastern Tshtsinetskaya of the Bronze Age[26]. The author had counted the general quantity of fragments, out of which the rims, bottoms and decorated walls had been emphasized and afterwards it was estimated the number of vessels[27]. Still, for the readers of that paper remained unclear the procedure used for obtaining that result. We will further try to decipher the respective method used by the mentioned author. We will present below the data of the scientist, by adding several new reports (Fig. 21):

Firstly, we have calculated the empirical percentages (P) for each category of objects (B, C, D) as well as the percentage of the estimated quantity of the vessels compared to the one of the fragments (E/A and A/E). Figure 22 has also included the percentages reports between the rims and the estimated number of vessels (B/E), walls and vessels (D/E). We have assumed that the report A/C for the dwelling no. 2 was used by the author as a reference point and this is why we have introduced the report A/8 for calculating the estimated number of vessels. The procedure was probably used for dwellings no. 2, 3, 4 and 5, but not for the dwellings no. 6-10. By comparing the figures in column E with those in column A/8, we could see that the

[26] Berezanskaya 1974.

[27] Berezanskaya 1974, 105, tab. 3.

Grave types	N	%	ΔP	min	max
1a	84	68.85246	4.15221	68.43724	69.26768
1b	38	31.14754	6.17344	30.5302	31.76489
2	3	100	0		
3a	10	83.33333	21.0859	62.24743	100.
3b	2	16.66667	21.0859	0.	37.75257
4a	6	66.66667	5.92716	60.73951	72.59383
4b	3	33.33333	8.382271	24.95106	41.7156
5	2	100	0		
6a	1	50	34.64823	15.35177	84.64823
6b	1	50	34.64823	15.35177	84.64823
7	1	100	0	100	
8a	3	21.42857	5.092011	16.33656	26.52058
8b	11	78.57143	2.659216	75.91221	81.23064
9a	1	50	34.64823	15.35177	84.64823
9b	1	50	34.64823	15.35177	84.64823
10	1	100	0		
11	1	100	0		
12	1	100	0		
13	2	100	0		
14a	16	55.17241	2.250424	52.92199	57.42284
14b	13	44.82759	2.496622	42.33096	47.32421
15	1	100	0		
16	4	100	0		
Total	206				

Fig. 23. Distribution of the medieval graves by types (*apud* Ivanov and Kriger).

Grave types	N	%	DP	min	max
1a	84	40.7767	6.710808	34.06589	47.48751
1b	38	18.4466	5.296655	13.14995	23.74326
2	3	1.456311	1.635927	0.	3.092238
3a	10	4.854369	2.934832	1.919537	7.789201
3b	2	0.970874	1.339015	0.	2.309888
4a	6	2.912621	2.296391	0.61623	5.209013
4b	3	1.456311	1.635927	0.	3.092238
5	2	0.970874	1.339015	0.	2.309888
6a	1	0.485437	0.949144	0.	1.434581
6b	1	0.485437	0.949144	0.	1.434581
7	1	0.485437	0.949144	0.	1.434581
8a	3	1.456311	1.635927	0.	3.092238
8b	11	5.339806	3.070216	2.26959	8.410022
9a	1	0.485437	0.949144	0.	1.434581
9b	1	0.485437	0.949144	0.	1.434581
10	1	0.485437	0.949144	0.	1.434581
11	1	0.485437	0.949144	0.	1.434581
12	1	0.485437	0.949144	0.	1.434581
13	2	0.970874	1.339015	0.	2.309888
14a	16	7.76699	3.655039	4.111951	11.42203
14b	13	6.31068	3.320516	2.990164	9.631196
15	1	0.485437	0.949144	0.	1.434581
16	4	1.941748	1.884347	0.0574	3.826095
Total	206				

Fig. 24. Distribution of the medieval graves by their types.

method had not been used by the author for all the dwellings. It seems that the estimated number of vessels (30) for dwelling no. 3 resulted from the formula (C+D)/2=59:2=30. For the dwellings no. 6, no. 7, no. 8 and no. 10 the estimated number of vessels (35, 27, 26 and 50) it was calculated by using the same formula like the one employed for the dwelling no. 3-(C+D)/2. In order to understand the way the calculation of the estimated number of vessels had been done, we have also established the quantity of ceramic fragments without decoration (E) (Fig. 22).

Analysing the tables, we could say that we understood the "*scientific kitchen*" of the author and we have reached the conclusion that the respective scientist had done the estimated quantity of the vessels in an arbitrary way, without a clear procedure, which could have been followed. This means that in fact the method advanced by the author does not exist and it misleads other researchers as well.

Example no. 13

The Russian specialists, when arranging chronologically the graves of the nomadic populations in the 12th-14th centuries in the southern Ural region and in the region of the Ural Mountains, analysed just those containing grave goods. In a table they brought together the data, afterwards distributing the graves by their typology[28].

Using the data of the authors, we have calculated for them the margin of error as well as the trusting intervals (min.-max.) (Fig. 23). Still, we should note here the fact that in this table the authors had used the incorrect procedure when they took into consideration some samples containing a single unit (types 6, 7, 9, 10, 11, 12, 15) as 100%. Twelve out of those 23 types and subtypes had insufficient samples, which casts doubt about the typology used by the authors.

It would be probably more correct if the authors would have referred to the general sample of 206 units when calculating the percentages. Then we could have found that the graves of the type 1 (1a and 1b) predominated, those of types 2, 3, 4, 5, 8, 13, 14, 16 rank the second place, the third one being of the types 6, 7, 9, 10, 11, 12, 15 (Fig. 24).

Example no. 14

A Russian researcher, who studied the presence of the grave goods in the interments of the Saltov-Maiaki culture of the middle 8th c. AD reached the conclusion that two distinct trends had existed[29].

[28] Ivanov, Kriger 1988, 52, tab. 5.

[29] Savchenko 1986, 70-101.

The first was the lack of the grave goods in the interments (43%) and the second with the presence of the grave goods (57%). At first sight, the trend of putting grave goods was more significant.

By constructing the veridicity intervals we have checked the conclusion of the researcher. By comparing the intervals for graves without goods 34.49% – 51.51% with those with grave goods 48.49% – 65.51% we could find that these trends could not be distinguished and we should admit that there is no back up for the conclusion of the author regarding the existence of these two categories. This idea is not acceptable. Most probably, the lack or presence of the grave goods require other explanations.

Example no. 15

The mathematical statistics is also used for the demographic analysis of the paleoanthropological materials. Unlike in archaeology, in paleoanthropology for the study of the data, there are customary used the statistical processing of the craniometric indices, the analysis of the average values by biometrical methods for the comparison of the skeletal series, the emphasizing of the morphological types based on a combination of indicators more often found etc.

In an article of Gh. Romanova, a Russian archaeologist from Sankt-Petersburg, when analysing the paleoanthropological materials discovered in a necropolis, he reached the conclusion that for a population group dated in the 4th c. BC "*the average level of mortality for the adults increases by all means for the adults between the age of 20-24 years and with the risk of possible death after the age of 40 years*"[30]. The author, according to the rules existing in anthropology, had emphasized five age groups: 1) 1-14 ani; 2) 15-34; 3) 35-44; 4) 45-54; 5) 55-65 (Fig. 25).

After constructing the veridicity intervals (Fig. 26) we could notice just two (2) clear groups: group no. 1 – included the age categories from 1-14 and 15-34, for which the possible level of the mortality has the intervals 20.1-31.9% and 23.6-36.0%: while the group no. 2 – included the age categories 35-44 and 55-65, for which the probable level of mortality is 8.2-17.3%. The group of age between 45-54 years didn't fit in any of the groups. Its veridicity interval cuts the one of the up mentioned groups. Even if it has certain properties specific to both groups and the probable mortality level is situated between 13.6-24.2%. in fact this level could be between 7.8% and 36%.

[30] Romanova 1986, 195-203.

	Age	Number N	%	ΔP±	Trusting intervals
1	0. -14	55	26.066	5.923	20.143-31.989
2	15-19	10			
	20-24	11			
	25-29	11			
	30-34	6			
	15-34	25			
		63	29.857	6.174	23.683-36.031
3	35-39	9			
	40-44	13			
	35-44	5			
		27	12.796	4.507	8.289-17.303
4	45-49	6			
	50-54	1			
	45-54	23			
		40	18.957	5.288	13.669-24.245
5	55-60	9			
	60-64	5			
	55-64	12			
		26	12.322	4.435	7.887-12.322
	Total	**211**	**100**		

Fig. 25. Trusting intervals for different ages.

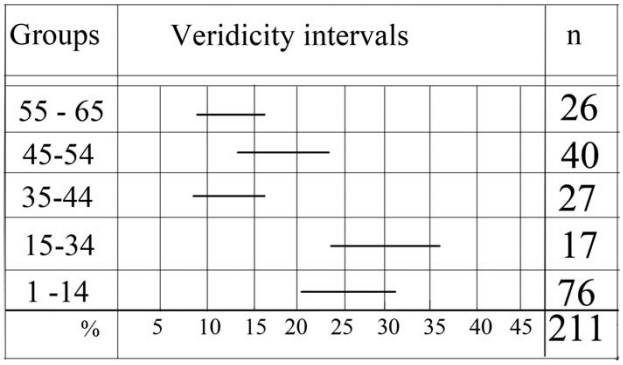

Fig. 26. Veridicity intervals for different age categories.

From the analysis of our table, by considering the trusting intervals we could see that there are just two groups of mortality, on different levels: 1- the highest one for the groups no. 1 and no. 2 with ages from 0-14 (20.143-31.989%) and 15-34 (23.683-36.031%) years; 2 – the lowest level for groups no. 3 and no. 5 with ages of 35-44 (8.289-17.303%), 55-64 (7.887-12.322%) years. Regarding the mortality level (8.289-17.303%) for group no. 3 with the age of 35-44 years, we could see that it has an intermediate position between the level of the group no. 5 on one hand and the level of group no. 4 for the age 45-54 years on the other hand. Therefore, the highest level of mortality (20%-36%) belongs to the age categories of 0-14 and 15-34 years, while the lowest mortality level (7.8%-17%) belongs to the old individuals in the age categories of 35-44 and 55-64 years.

Group	Age	Number N	%	ΔP±	Trusting intervals
1	0. -1	15	16.304	7.548	8.756-23.852
2	1-2.9	25	27.173	9.09	18.083-36.263
3	3-5.9	16	17.391	7.745	9.646-25.136
4	6-8.9	14	15.217	7.339	7.878-22.556
5	9-11.9	10	10.869	6.36	4.509-17.229
6	12-14.9	12	13.043	6.881	6.162-19.924
	Total	**92**	**100**		

Fig. 27. Trusting intervals for different ages.

Now we could draw another kind of conclusion:

- statistically it is proven that: 1) there is a maximal level of the death probability in that population at the age category 1-34 years; 2) the minimal level is for the age categories of 35-44 years and 55-65 years; 3) regarding the age category of 45-54 years, it has an intermediate position between the previous two.

Therefore, the opinion of the researcher, who relied just on the calculation of the empirical percentages without considering the margin of error was not correct.

the children of 6-9 years (Group 4). The lowest level of the children mortality had been notices for the children with the age between 9-12 ani (Group 5 with 10.8%) that increased up to 14.1% (in fact -13.043%) for the children at the age between 12-15 years (Group 6).

The researcher goes even further, by saying that the distribution of the children by the age categories shows several peaks of mortality: the first – at the age category of 1-3 years (Groups 1 and 2) and the second at the age category between 12-15 years (Group 6).

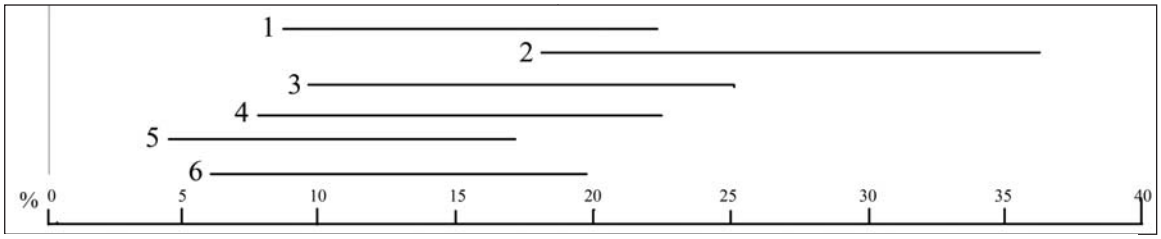

Fig. 28. Veridicity intervals for certain age categories.

Example no. 16

In an article the level of the children mortality in the Scythian period has been studied[31]. Based just upon empirical percentages, the author has drawn the conclusion that the largest number of children had died between the age of 1 year and up to 3 years (Group 2 with 27%). Afterwards the mortality level decreased up to 16% (in fact -17.391%) for the children of 3-6 years (Group 3) and 15% for

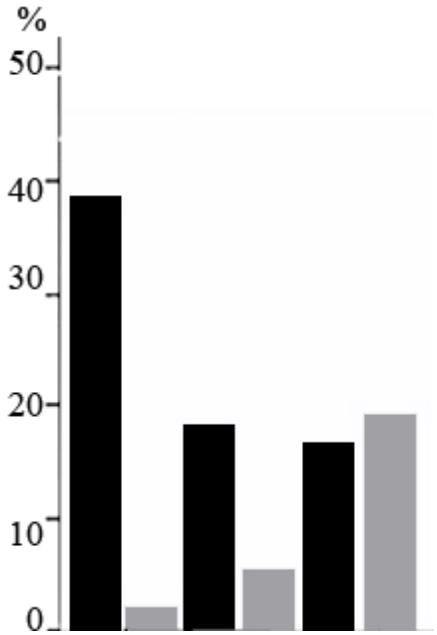

Fig. 29. The inhumation burials of different types (*apud* the data of V. Sîrbu). I – complete skeleton; II – skeleton without the skull; III – part of the skeleton; IV - skull; V – isolated bones; VI – unknown.

[31] Litvinova 2004, 144-181.

Unfortunately, these considerations must be established. From the analysis of the trusting intervals (Fig. 27) we could observe that we could discuss just about the age categories between 1-3 years (group 2) and 9-12 years (group 5), whose intervals are not cross-cut (18.083-36.263% and 4.509 - 17.229%), while other categories could not be distinguished as their intervals cross-cut the up mentioned categories (Fig. 28) and this is why we could say that the conclusion of the author is not statistically supported.

Example no. 17

In an article, Valeriu Sîrbu presented a graph (Fig. 29) with representations of a sample of inhumation burials of different types, by using the bar representation of the percentages[32].

This graph rendered empirical percentages (P), but it doesn't reflect the real rank of each type, due to the lack of calculation for the margin of errors and trusting intervals. We had processed the data of the graph presented by the author[33] and we calculated the margin of error and the trusting intervals (Fig. 30).

After the mentioned procedure we had the results which showed that the sample (N=196) is not too big, so that the margin of error (ΔP) varied between ±1.979% and ±6.837%. Still, we can discuss about the existence of the following groups (Fig. 31).

[32] Sîrbu 1997, 193-221.

[33] Sîrbu 1997, 207, fig. 3.

Group 1 – type I (32.448 - 46.122%).

Group 2 – type III (12.946-23.788%), type V (12.045-22.647%) and type VI (13.408-24.366%) .

Group 3 – type II (0.061- 4.019%) and type IV (1.312-6.85%).

Concerning the typology forwarded by the author, we should mention that this is a vicious one. All studied graves are generally part of just three big categories:

I – graves with complete skeletons and

II – graves with incomplete skeletons, with subtypes or variants:

1) – skeletons without the skull; 2) part of the skeleton; (In this subtype could be included at the same time the graves which contained just the skull and those with single bones).

III – unknown graves are part of the sample, but they are not a specific type. Therefore, this sample could be re-grouped in the following manner (Fig. 32).

At first glance, it seems that the graves with incomplete skeletons (41.8%) are predominant in the funerary rituals of the Thracians, compared with those containing complete skeletons (39.28%). But, the margin of error and the veridicity intervals show us that they do not differ from each other. This thing is obvious if we look at the graph (Fig. 33).

Example no. 18

In this case we will take the analysis of the burials containing animal bones. The researchers Ekaterina Buneatean and Vitalii Otroščenko from the Institute of Archaeology of the National Academy of Sciences of the Ukraine, when studying the property forms upon domestic animals in the Bronze Age populations of the Eurasian steppe, have advanced some percentages about the different animal species, yet without giving also the quantity of the osteological materials that they used for this investigation[34]. Based upon these data they had reached some certain conclusions. Afterwards they divided the burials containing animal bones in three main areas (Fig. 34). According to their calculation it results that is the same picture all over the place, namely the burials with animal bones reach 12.3% -13.4% in each region. We should stress here the fact that the data selection and their clustering had been done by the author in a hazardous manner. Therefore, in the

[34] Buneatean, Otroščenko 1993, 93-131.

	Inhumations	N	P %	ΔP±	Trusting intervals
1	I -complete	77	39.285	6.837	32.448 - 46.122
2	II-skeleton without the skull	4	2.040	1.979	0.061- 4.020
3	III-part of the skeleton	36	18.367	5.421	12.946-23.788
4	IV-skull	8	4.081	2.77	1.311-6.851
5	V-isolated bones	34	17.346	5.301	12.045 -22.647
6	VI-unknown	37	18.887	5.478	13.398 - 24.356
	Total	196	100		

Fig. 30. Trusting intervals for the different grave types (*apud* the data of V. Sîrbu).

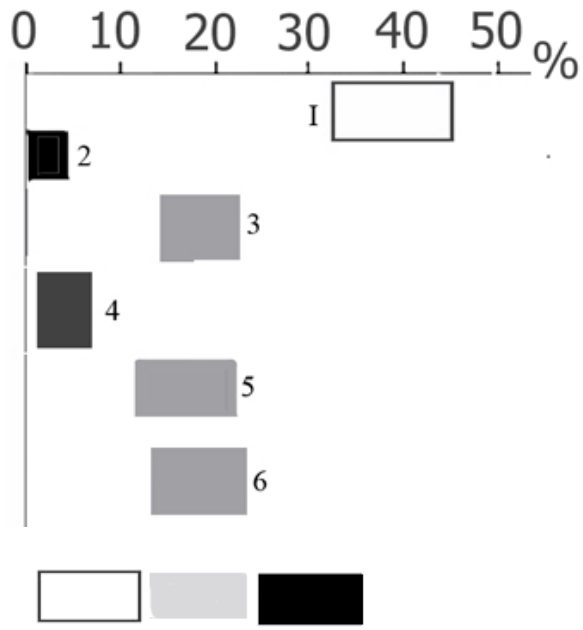

Fig. 31. Veridicity intervals for the different grave types.

	Inhumations	N	P %	ΔP±	Trusting intervals
1	I – complete skeletons	77	39.285	6.837	32.448 - 46.122
2	II – incomplete skeletons	82	41.836	6.906	34.930 - 48.742
3	III – unknown	37	18.877	5.478	13.398 - 24.356
	Total	196	100		

Fig. 32. Veridicity intervals for different grave types (*apud* the data of V. Sîrbu).

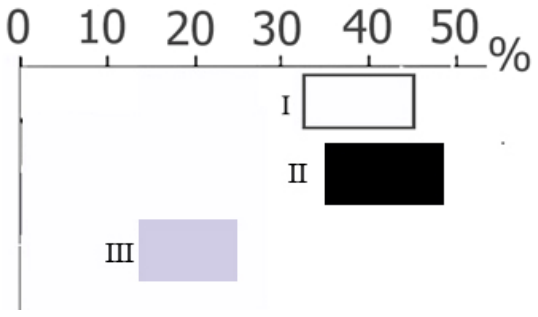

Fig. 33. The graph of veridicity intervals for different grave types (*apud* the data of V. Sîrbu).

Geographic regions	Regions	Number of graves N	Number of graves with animal bones *n*	**P** or **%**	**ΔP or margin of error**	Veridicity intervals
Volga and Ural	Baškorstan	238	18	7.56	±3.36	4.2-10.92
	Samara	548	58	10.58	±2.57	8.01-13.15
	Saratov	149	38	25.5	±6.99	18.51-32.49
	Volgograd	517	60	11.6	±2.76	8.84-14.36
	Astrahani	47	11	23.4	±12.1	11.3-35.5
	total	*1499*	*185*	*12.34*	*±1.66*	*10.68-14*
Don and Donbas	Voronezh	248	38	15.32	±4.48	10.84-19.8
	Lugansk	79	5	6.33	±5.37	0.96-11.7
	Donetsk	168	21	12.5	±5.0	7.5-17.5
	total	*495*	*64*	*12.93*	*±2.95*	*9.98-15.88*
Lower Dniepr	Dnepropetrovsk	669	101	15.1	±2.71	12.39-17.81
	Zaporozh'e	489	55	11.24	±2.79	8.45-14.03
	total	*1158*	*156*	*13.47*	*±1.96*	*11.51-15.43*
	Total	***3152***	***405***	***12.84***	***±1.16***	***11.68-14***

Fig. 34. Veridicity intervals for different geographical regions.

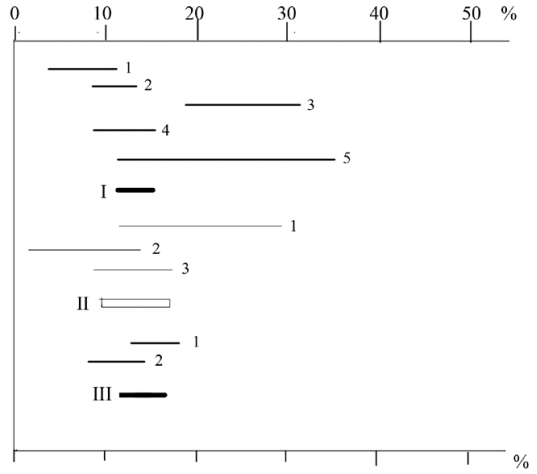

Fig. 35. Trusting intervals for different geographical regions.
Geographical regions: I – Volga and Ural, regions: 1 – Baškorstan. 2 – Samara. 3 – Saratov. 4 – Volgograd. 5 – Astrahani; II – Don and Donbas, regions: 1 – Voronezh. 2 – Lugansk. 3 – Donetsk; III – Lower Dniepr, regions: 1 – Dnepropetrovsk. 2 – Zaporozh'e.

Ural and Volga region have encompassed territories from distinct flora and climatic zones: steppe (Saratov and Volgograd), steppe-semi desert (Astrahan), silvo-steppe (Samara) and even forest (Baškorstan). The zone of the Don and Donbas render just the Upper Don basin and partly the Middle course of the Don with silvo-steppe, while the Lower Don (steppe) was not included at all. In this zone, the same like in the previous one had been put together the silvo-steppe (Voronež) and steppe regions (Lugansk, Donetsk). Just the zone of the Dniepr, in our opinion is presented almost correctly, as the Dnepropetrovsk region was rendered with the silvo-steppe and steppe. There are not known the reasons why the authors did not include in this zone the Kherson region (steppe) at the mouth of the Dniepr. But we should follow the data of the authors to which we have added the margin of error and the veridicity intervals (Fig. 34).

Based upon these data we can make the graph of the trusting intervals (Fig. 35).

When analysing the graph, we could observe the following facts: – in the Ural zone the number of burials containing animal bones in the region of the forests from Baškorstan (4.2-10.92%) and the neighbouring silvo-steppe one from Samara (8.01-13.15%) do not differ from each other but they are very distinct compared to the steppe zone of Saratov (18.51-32.49%); - the number of burials with animal bones in the steppe region of the Volgograd (8.84-14.36%) is clearly different from the steppe one of Saratov and resembles those of Baškorstan and Samara; - regarding the steppe-semi desert zone of Astrahani (11.3-35.5%) we should take into consideration the very small sample, which has a big margin of error and brings closer this region to those of Saratov and Volgograd.

After this analysis, it is clear that in the zone of Volga and Ural there are two other subzones: 1- the one of the forests and silvo-steppe from Ural (Baškorstan and Samara), represented by 76 burials containing animal bones in a sample of 786 graves, which means 9.669%±2.066% or 7.603%-11.735%; 2 – the one of the steppes in the Volga basin (Saratov, Volgograd and Astrahani) represented by 109 burials with animal bones in the sample of 713 graves, which means 15.287%±2.641% or 12.646%-17.929% (Fig. 36). The veridicity intervals are not cross-cut and are different. The number of burials with animal bones in the steppe zone of the Volga basin is larger and could be explained by the fact that animal breeding was more developed in the steppe zones than in the one of the forest and silvo-steppe. This is how

	Geographical regions	Regions		Number of graves N	Number of graves with animal bones *n*	**P** or **%** **n/N**	**P** or margin of error	Veridicity intervals
I	Ural	Baškorstan	1	N1=238	18	2.29	±1.04	1.24-3.33
		Samara	2	N2=548	58	7.37	±1.82	5.55-9.20
		total		***N=786***	***76***	***9.66***	±2.06	***7.60-11.73***
II	Volga	Saratov	3	N1=149	38	5.0	±1.54	3.45-6.54
		Volgograd	4	N2=517	60	7.89	±1.91	5.97-9.81
		Astrahani	5	N3=47	11	1.44	±0.84	0.59-2.29
		total		***N=713***	***109***	***10.65***	±2.26	***8.39-12.92***
III	Don	Voronež	6	N=248	38	15.32	±4.48	10.84-19.8
		total		***N=248***	***38***	***15.32***	±4.48	***10.84-19.8***
IV	Donbas	Lugansk	7	N1=79	5	2.02	±1.75	0.26-3.78
		Donetsk	8	N2=168	21	8.50	±3.47	5.02-11.98
		total		**N=247**	**26**	**10.52**	±3.82	**6.69-14.35**
V	Lower Dniepr	Dnepropetrovsk	9	N1=669	101	8.72	±1.62	7.09-10.34
		Zaporozh'e	10	N2=489	55	4.74	±1.22	3.52-5.97
		total		***N=1158***	***156***	***13.47***	±1.96	***11.51-15.43***
		Total		***3152***	***405***	***12.84***	±1.16	***11.68-14***

Fig. 36. Veridicity intervals for different geographical regions.

we could emphasize a certain trend – the increase of the burial number with animal bones in the regions where animal breeding is more developed.

In the region of Don and Donbas, according to the veridicity intervals all regions are cross-cut and the presence of animal bones in the burials reaches the average value of 12.93%±2.95% or 9.98%-15.88% (Fig. 37). This hint resembles the data of the Samara and Volgograd regions. But, we should stress that in the mentioned area the authors had included also the silvo-steppe region of Voronež, in which can be found 50% of the entire sample of the respective area, reaching 15.322%±4.483% or 10.839%-19.805% burials with animal bones. Other 50% of the samples are represented by the steppe regions of Donetsk and Lugansk that reach 10.526%±3.827% or 6.699%-14.353% burials with animal bones. If the authors calculate percentages reports from the sample of the zone with 495 units, in this case we should find that the smallest numbers of burials with animal bones are situated in the region of Lugansk 1.010%±0.880% or 0.129%-1.891%. The second ranks the Donetsk region with 4.242%±1.775% or 2.466%-6.018% together with the Voronež region with 7.676%±2.345% or 5.331%-10.022%.

If we consider the average figures for each region we could find that in each zone the region differ significantly from each other: – in the Ural zone the Baškorstan region has just 2.29%±1.04% or 1.24%-3.33% and Samara 7.37%±1.82% or 5.55%-9.20%.

Therefore, due to the unification of the diverse data we could find that in the Don area, Voronež region, in the Volga zone, Baškorstan region

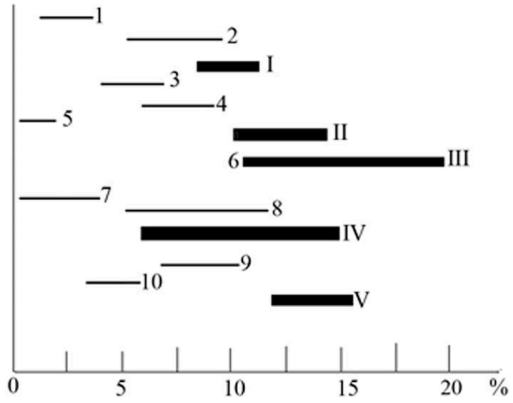

Fig. 37. Trusting intervals for different geographical regions.

Geographical regions: I – Ural regions: 1 – Baškorstan. 2 – Samara; II – Volga regions: 3 – Saratov. 4 – Volgograd. 5 – Astrahani; III – Don regions: 6 – Voronež; IV-Donbas regions: 7 – Lugansk. 8 – Donetsk; V – Lower Dniepr regions: 9 – Dnepropetrovsk. 10 – Zaporozh'e.

where existed burials with animal bones rendered as 15, 32±4.48% and 7.56±3.36% two main trends had existed. Burials with animal bones in a relatively great number in the basin of the Upper Don and with a small amount of them in Baškorstan. The silvo-steppe region of Volga has an intermediate place among them. The veridicity intervals of Volga, Baškorstan and of the Don region are cross-cut. By the way, the Volga zone is located on the territory between Baškorstan and the Don region.

In the of the semi-desert and steppe zone of Volga we could notice two distinct trends: 1 – the presence of a large number of burials with animal bones in the Saratov region 25.5±6.99%; 2 – the small number of this kind of monuments in the Volgograd region – 11.6±2.76%. Trusting intervals of

the Lower Volga are represented by the Astrahan region that cross-cuts the up mentioned zones.

Now we will analyse the territory of the Ukraine, which is represented by four regions. The Lugansk region, which indeed is the zone of the distinct silvo-steppe zone, which entered into the steppe ones and has a small number of burials with animal bones – 6.33±5.37%. Another zone is the Dnepropetrovsk region encompassed from the north and east by the silvo-steppe that reaches 15.1±2.71% burials with animal bones. The Zaporozh'e and Donetsk regions which are situated in the steppe of the Azov Sea, southward from the Lugansk and Dnepropetrovsk regions also by territory and trusting intervals ranks and intermediate position – 11.24±2.79% (Zaporozh'e) and 12.5±5.0% (Donetsk).

However, the image that we could observe and the one given by the authors are very different from each other. It is necessary a more precise grouping of the data and then looking the explanation for the noticed trends.

Example no. 19

In this example we will focus our attention upon a researcher from the Ukraine who drew incorrect conclusions about the paleodemographic situation, by using percentage reports. As he had mentioned "*given the difficult situation determined by the anthropological data regarding the age and sex determination*" he was "constrained" to look for other ways for enhancing the information by "*establishing the age and sex of the deceased by other methods*"[35]. According to this researcher, we are about to make a significant find when the anthropology could be replaced by using other methods. We will see how the respective researcher had solved this situation.

By analysing the distinction by sex and age in the funerary ritual of the Delacău-Babino culture of the interfluves region of Dniepr and Don, R. Litvinenko had advanced some numerical and percentage indices. According to his data in that region 591 burials could be found.

For only 94 burials of 591 had been done the anthropological study, which resulted in 15.9%±2.94% or 12.95%-18.85%[36]. Considering that the percentage determined by the anthropologists in the uncertain category of burials is situated between 4.49%-13.46%, we are astonished to see how the researcher had managed to apply the easiest method – "*by analogy*"[37] – to determine as sure the sex of the deceased interred in other 497 burials and to begin the statistical calculations. Taking into account the percentage of the burials established as being uncertain by anthropologists, in this sample at least 44-45 burials should be considered in this category.

All burials with an eastern orientation and the skeleton laid on the right side in the opinion of the researcher had belonged to women (N=100). while those with a western orientation with the skeletons laid on their back and slightly bent to the left had belonged to the men (N=397). At last we could see that in the society constructed by the researcher the demographic picture looks as it follows: the male population (79.87% ±3.52% or 76.35%-83.40%.) is bigger compared to the one of the women (20.12%±3.52% or 16.59%-23.64%) of 3-3.5 times.

If we analysed the available anthropological material we could find that the percentage of the burials containing male individuals would be of 75.53%±8.69% or 66.84%-84.22%, while the women have accordingly 24.46%±8.69% or 15.77%-33.15%, meaning that the men were in larger number than women of 2-2.5 times.

R. Litvinenko considers that 468 burials would belong to the men, 123 to the women, among which he makes the distinction between those of the adults, adolescents and children. Characterising these groups, constructed by sex and age, he makes the separate calculation for the burials of men and women. Comparing the burials by the feature of "*existence of a mound mantle or filling of the grave*", R. Litvinenko mentioned that this is present for 89% (or N=320) of men graves (N=360) and for 66% (or N=81) of women graves (N=106). At the same time, the adolescent group of the male sex and those of the female sex have very similar percentages: 68.6% (or N=74) for boys (N=108) and 67% (or N=11) for girls (N= 17). The statistic average of the men graves in the Dniepr-

[35] Litvinenko 2007.

[36] In another place, R. Litvinenko writes that from the sample of 1149 skeletons the anthropologist have determined a number of 282 (25.4%), but from 100 male skeletons and 56 female ones, 8, respectively 6 were uncertainly assigned. Therefore, the percentage of the uncertain burials is of 8.97±4.48% or 4.489%-13.459%.

[37] Based upon the so-called discovery in the field or the Babino society organization, when the age and sex are being considered the ideas of Dubovskaya advanced in the 8th decade of the 20th century. She had assumed that in the early period besides the skeletons with western orientation, laid on their back and with a turn to the left side, must be included and the graves with the skeletons with east orientation, lying on their right side. Otroščenko has further developed this idea and assumed that they could be the women burials that represented a kind of antithesis to the male ones which had a western orientation and the skeletons were placed ont heir left side.

Don region reaches 78% (N=320), while for women is 64% (N=79), but this figure is established based on the sample of the entire series of male individual graves (N=360) and female ones (N=123). Here it seems that the researcher had done a mistake. If the boys (n=108) are part of the entire group of the men (N=468) and the category of features "*existence of a mound mantle or filling of the grave*" have 74 graves, then, how could appear the figure of 329 for the adult men? It should have been 286, with the percentage of 79.44%±4.17% of the girls represented by 11 burials out of the 17 that belonged to all women, then how could appear figure 81 for the burials of the adult women? In fact, it had to be figure 68 with the corresponding percentage of 79.44%, 64.15% ±9.129%. or 55.02%-73.28%.

		Apud the data of R. Litvinenko			Authors' calculations		
		Quantity of graves		Empirical percentage	Margin of error	Trusting intervals	
		N	**n**	**P %**	**ΔP±**	**min**	**max**
1	Men	468	360	77.99145	3.753638	74.23782	81.74509
2	Boys	108	74	68.51852	8.759428	59.75909	77.27795
3	Adult men	360	**286** 320	**79.4444** 88.88889	**4.174469** 3.246439	**75.26998** 85.64245	**83.61891** 92.13533
6	Adult women	106	**68** 81	**64.15094** 76.41509	**9.129427** 8.081831	**55.02152** 68.33326	**73.28037** 84.49693
4	Women	123	79	64.22764	8.47107	55.75657	72.69871
5	Girls	17	11	64.70588	22.71719	41.98869	87.42307
		123	90	73.17	7.830268	65.34046	81.001
	Total	591	439	74.28088	3.523943	70.75694	77.80482

Fig. 38. Distribution of the burials belonging to the Babino culture in the region of Dniepr-Donets Severskyi considering "*the existence of a mound mantle or the filling of the burial*".

The compared samples are very unequal in quantity, fact which should raise suspicion about the percentages that do not reflect the real situation, as the calculated empirical percentages are not accompanied by the margin of error and the veridicity intervals (Fig. 38).

Out of table no. 38 constructed upon the data of R. Litvinenko we could see that the feature regarding "*the existence of a mound mantle or filling of the grave*" is not in 89% for men but in 77.97%±3.75% or 74.237%-81.74%. while the percentage of the female graves represent not 66% but 64.227% ±8.47% or 55.75%-72.698%.

Analysing the funerary settings, among which we could find the wooden frames and stone cists, the researcher doesn't bring the numerical data, saying that the grave with wooden frame represent 26% (N=122), being 22% (N=130) for the entire region, while for the adult individuals it reaches a percentage of 35% (N=126). The presence of the wooden fragments in women graves is a rare occurrence and represents 12.6% (cca N=15). The stone cists are not in large number (N=25) and reach 3.8%.

We will further try to examine the data of the "*mathematic calculation*" done by the author. As we already mentioned, he didn't gave us the number of the wooden frame graves, but when he discussed about the stone cists he mentioned their number and the percentage established for them. If 25 graves reached 3.8%, this means that the samples from where it started the calculation had numbered not 591 graves, but (25: 3.8) x100) =658.

If the culture of the mentioned region has the sample of 591 graves, out of which just 22%, or 130 burials have been done in wooden frame, for the adult male skeletons buried there (N=360), 35% or 126 burials had wooden frames. In this case, we have to settle one thing. How comes that from 130 burials with wooden frame 126 belong to male individuals, while the author insisted that instead of four burials with wooden frame (3.25%), there were 15 burials, or 12.6% from the women burials (N=123); in this case the percentage is different, as 15/123=12.19% not 12.6.

In the paper of R. Litvinenko the percentages are often incorrectly used. Thus, in tab. 3.20 the researcher has rendered the percentage reports for the Babino culture in the Dniepr and Pruth region in the absence of the numerical data, but those percentages are mistaken. Knowing some information about the samples based upon which the percentages had been established, we have tried to choose and examine some data, which are not

	P	±	min	max	n	Sample	Materials from the grave
Dniepr-Pruth	6.1	1.208	4.89	7.3	92	1508	Animal bones
Don-Dniepr	18.1	2.77	15.33	20.88	134	740	Animal bones
Dniepr-Pruth	26.4						Ceramic vessels
Don-Dniepr	19.0	2.42	16.57	21.43	191	1005	Ceramic vessels

Fig. 39. Comparison of the percentages reports for some indexes of the Babino culture in the Dniepr-Pruth and the Don-Dniepr regions.

N=11	Orientation	n	P	±	min	max
	NW	1	9.09	16.98	0	26.07
	W	1	9.09	16.98	0	26.07
	SW	2	18.18	22.79	0	40.97
	N	0	0	0	0	0
	NE	2	18.18	22.79	0	40.97
	E	3	27.27	26.31	0.95	53.59
	SE	2	18.18	22.79	0	40.97
	S	0	0	0	0	0
	NW.W.SW	4	36.36	28.42	7.93	64.79
	NE.E.SE	7	63.63	28.42	35.20	92.06

Fig. 40. Orientation of the individual burials in the necropolis from Brăeşti (*apud* Dascălu, 2007).

rendered in the tables. The feature about "*the presence of animal bones in the graves*" for the Babino culture between the Dniepr and Pruth according to the author it reaches 6.1% with 92 units, fact which means that the researcher had used a sample of 1,508 units; 18.1% represent 134 units calculated on the sample of 740 units. The feature about "the presence of ceramic vessels in the graves" for the Babino culture in the region between the Don and Dniepr rivers reaches 19% that represent 191 units and had been established by using the sample of 1,005 units. We have created a table by using the data of the researcher, adding the margin of error and veridicity intervals for a better visual comparison of the data (Fig. 39).

Example no. 20

Now we will analyse few aspects from the paper of a Romanian archaeologist referring to the Bronze Age in the Moldova Plain[38]. The percentages had been widely used in this article. Sometimes they had been used for very small samples, where the percentage calculation without the margin of error is unjustified. Thus, in tab. 3f (p. 145) "*Orientation of the individual burials*" from Brăeşti[39] it is analysed a sample comprising just 11 units, parted into 8 groups and then in other 4. At first sight it could seem that the eastern orientation (63.63%) is predominant in this necropolis, compared with others (the western one – 36.36%), but, after calculating the margin of error this difference became obvious (Fig. 40):

We could point out the same thing for tab. 3e where the sample comprised 13 units in tab. 3d with a sample of 26 units, in tab. 3b with a sample of 29 units, the same as in tab. 3c with a sample of 47 units.

In tab. 1 "Burials of the Noua culture" we have observed that percentage reports had not been accompanied by the unit number and also by the general sample upon which the empirical percentages had been calculated. We have tried to estab-

TRANSYLVANIA				MOLDOVA			
Orientation	**n**	**P**	**N=P/nx100**	**Orientation**	**n**	**P**	**N=P/nx100**
NW	7	5.93	85	NW	7	5.93	85
W	0	0		W			
SW	18	15.25	85	SW			
N	3	3.39	113	N			
NE				NE	30	26.27	88
E	2	1.70	85	E			
SE	9	7.63	85	SE	2	1.78	89
S	11	10.17	92	S			
	50				39		

Fig. 41. Distribution of the burials belonging to the Noua culture from Transylvania and Moldova (*apud* Dascălu).

TRANSYLVANIA				MOLDOVA			
Orientation	**n**	**P**	**N=P/nx100**	**Orientation**	**n**	**P**	**N=P/nx100**
NW	7	5.93	85	NW	7	5.93	85
W	0	0		W			
SW	18	15.25	85	SW			
N	3	3.39	113	N			
NE				NE	30	26.27	88
E	2	1.70	85	E			
SE	9	7.63	85	SE	2	1.78	89
S	11	10.17	92	S			
	50				39		

Fig. 42. Distribution of the burials belonging to the Noua culture from Transylvania and Moldova (*apud* Dascălu).

[38] Dascălu 2007.

[39] Dascălu 2007, 143-145.

lish the sample of the burials from Transylvania[40]. In four cases it comprised 85 units, while in other two cases it comprised 113 and 92 units and for the burials from Moldova there were 85, 88 and 89 units (Fig. 41), even if the total sum of all burials equals 89 units.

From the study of figure 40 we could observe that in Transylvania prevailed the southern orientation (S, SV, SE)- 42. 69% ±10.27% or 32. 42%-52. 97%, while in Moldova the northern one (N, NV, NE) – 41. 57% ±10. 23% or 31. 33%-51. 81% (Fig. 42).

Regarding the typical orientation of the Noua culture burials the author had written in the conclusion that for Truşeşti this is NW, while for Crasnoleuca it is NE and SE. The data about the necropolis from Truşeşti rendered in tab. 3a (p. 143) we could find that 57 burials of 76 had a NW orientation 75, 0%±9.73% or 65. 26%-84.73%. But, as concerns the Crasnoleuca necropolis presented in tab. 3b (p. 143) none of 29 burials had a NE orientation, while to SE just eight burials had existed – 27.58%±16, 26% or 11.31%-43.85%. From the same table we could find that seven burials had been orientated to NV and the same number to S -24.13%±15.57% or 8.56%-39.71%.

***

The examples we have given above could be even more numerous, without any problem, but the main conclusion, which has to be perceived is the fact that the method of the percentage reports is a good instrument for the researchers. This method, with veridicity intervals had been successfully applied by us in the study of the burials belonging to the Bronze Age in the North-Pontic steppe of the Eastern Ukraine. This is how we could point out two cultural – chronological groups among the known archaeological materials, one of the groups being interpreted as part of the Delacău-Babino culture (the Mnogovalikovaya culture or Babino culture). Then, by using the same method, we have determined specific cultural and chronological groups of the Middle and Late Bronze Age[41].

The same method had been also used by Liubov Geraskova in the study of the monumental sculptures of the medieval nomadic populations of the European and Asian steppe[42].

The method of percentage reports with veridicity intervals need its correct use, namely the calculation of the empirical percentages (P) that should be accompanied by the establishing of the margin of error (ΔP) or by veridicity intervals. Such a percentage registrations looks similar to the ^{14}C dating, where the figures at the beginning mean the empirical percentage (P) followed by the signs ± and another figure which mean ΔP or the veridicity interval.

By the way, all the researchers mentioned in our article, when using the ^{14}C dating for the burial types, have used the data with the possible mistake (Examples: 3,890±150 BC or 3,830±120 BC etc.).

Paleoanthropologists, when describing the dimensions of the investigated skeletal materials, added to the average value the minimal and maximal ones[43]. For instance, the skull of men had an average longitudinal diameter of 196 mm (min-max: 187-205 mm). In a similar manner things were presented by the researchers in paleozoology. When studying animal species and comparing different indices of bone dimensions, they also brought the possible variations. For example, the alveolary length R2-R4 of the maxillary is 139.00 ±3.67 mm; the entire length of the atlant is 9.38±2.26 cm etc.). Still, when they analyze the structure of the heard by species or burials, the researchers do not use this procedure anymore.

This is the reason why we consider that in the publication of the osteological or paleozoological studies should be kept the following rules:

The empirical percentages (P) established by the researchers should be accompanied by all means by the total number (n) of the bones (NR) and of the individuals (NMI) upon which the percentages were calculated.

For establishing the percentages (P) they should also calculate ΔP (the possible mistake, or margin of error. Examples: 20.12%±3.52% or 16.59%-23. 64%; 24. 13%±15.57% or 8.56%-39.71%, etc.).

Just after the comparative analysis of the percentage reports with the margin of error and veridicity intervals we could draw the conclusions about the studies of the given osteological materials.

The archaeologists, in their studies, when using the percentages reports, should follow the same procedure: 1 – any established percentage should be accompanied by the information about the quantity of the materials used for the rendered cal-

[40] Dascălu 2007, 141.

[41] Pislaryi, Pozhidaev 1982, 178-187.

[42] Geraskova 1990, 19-28.

[43] Zinevič 1967.

culations. 2 – If the researchers drew any conclusions based upon the percentages and percentage reports, they should bring argument for it, adding the margin of error and veridicity intervals. Thus, the scientists cold avoid drawing mistaken conclusions, and their opinions would become more true and documented.

BIBLIOGRAPHY

Abdulganeev, Vladimirov 1991 — М. Т Абдулганеев, В. Н. Владимиров, *Статистическая обработка керамики и периодизация поселений лесостепиного и предгорного Алтая второй половины 1 тысю до н.э.,* Проблемы хронологии в археологии и истории, Барнаул, 1991, 93-107.

Abdulganeev, Vladimirov 1994 — М. Т Абдулганеев. В. Н Владимиров, *Программа FUZZICLASS новые возможности археологического исследования (Типология поселений Алтая раннего делезного века)*, Круг идей: Новое в исторической информатике, Москва 1994. 121-128.

Abdulganeev, Vladimirov 1997 — М. Т Абдулганеев. В. Н Владимиров, *Статистическая обработка керамики и периодизация поселений лесостепиного и предгорного Алтая второй половины 1 тысю до н.э.,* Информационный бюллетень Ассоциации «История и компьютер» Москва 1997.

Abdulganeev. Vladimirov 1997 — М. Т. Абдулганеев. В. Н. Владимиров, *Статистическая обработка керамики и периодизация поселений лесостепиного и предгорного Алтая второй половины 1 тыс. до н.э.,* Материалы научных чтений памяти акад. И. Д. Ковальченко. Москва, 1997.

Archaeometry... 1990 — *Archaeometry in Romania*, v. 2, Bucharest, 1990, 45-46, 57, 374, tab. 3. 4.

Bălăşescu 2000 — A. Bălăşescu. *La faune découverte dans le tumulus I de Ciulnitza (dep. Ialomitza)*, in *Pratiques funéraires dans l'Europe des XIII-IV siècles av. J.-C.*, Tulcea, 2000, 169-176.

Bejenaru 2003 — Luminiţa Bejenaru, *Arheozoologia spaţiului românesc medieval*, Iaşi, t. XLVIII, 2003.

Berezanskaya 1974 — С. С. Березанская, *Пустынка. Поселение эпохи бронзы на Днепре,* Киев, 1974.

Borziac, Leviţki 2003 — I. Borziac, O. Leviţki*, Nivelul de locuire din paleoliticul superior de la aşezarea pluristratigrafică Trinca-Izvorul lui Luca, jud. Edineţ, Republica Moldova,* in*: Interferenţe cultural-cronologice în spaţiul nord-pontic,* Chişinău, 2003, 28-52.

Britiuc *et alii* 2005 — О. О. Бритюк, М. І. Удовіченко, О. М. Удовіченко, *Неолітична пам'ятка біля міста Ізюм*, Матеріали та дослідження з археології Східної України, №4, Луганськ, 2005, 42-53.

Buneatean, Otroščenko 1993 — Е. П. Бунятян, В. В. Отрощенко, *Формы собственности на скот и способы изучения их по археологическим данным,* Хозяйство древнего населения Украины, Киев, 1993, 93-131.

Cavaleriu, Bejenaru, 2007 — R. Cavaleriu, Luminiţa Bejenaru, *Studiu preliminar al materialelor faunistice descoperite în situl de la Feteşti (com. Adâncata, jud.Suceava),* in *CCA campania 2006, A XLI-a Sesiunea Naţională de rapoarte arheologice, Tulcea, 29 mai-1 iunie,* Bucureşti, 2007, 155-157, 499-500.

Dascălu 2007 — Lidia Dascălu*, Bronzul mijlociu şi târziu în Câmpia Moldovei*, Iaşi, 2007.

Derevianko, Felinger, Holyushkin 1989 — А. П. Деревянко, А. Ф. Фелингер, Ю. П. Холюшкин, *Опыт статистического группирования позднепалеолитических комплексов Евразии,* Новосибирск, 1989.

Geraskova 1990 — Liubovi S. Geraskova, *The Analysis of Medieval Sculptures from the steppes of Eastern Europe: an application of the Kolmogorov-Smirnov test,* New Tools from mathematical Archaelogy, Warsaw / Krakow, 1990, 19-28.

Geraskova 1991 — Л. С. Гераськова, *Скульптура середньовічних кочовиків степів Східної Європи,* Київ, 1991.

Ivanov, Kriger 1988 — В. А. Иванов, В. А. Кригер, *Курганы кыпчакского времени на Южном Урале (XII-XIVвв.),* Москва, 1988, 52.

Kamenetskyi 1965 — И. С. Каменецкий, *Датировка слоёв по процентному соотношению типов керамики,* Археология и естественные науки, МИА, №129, Москва, 1965, 302-307.

Kovaleva 1984 — И. Ф. Ковалёва, *Нео-энеолитический могильник «Госпитальный холм»,* Проблемы археологии Поднепровья, №1, Днепропетровск, 1984, 25-44.

Lazarovici et *alii* 1996 — Gh. Lazarovici, L. Tarcea, Cristina Sângerean, *Zeus: sistem pentru gestionarea şi prelucrarea datelor arheologice*, ActaMN, 33, I, 1996, 683-689.

Litvinenko 2008 — Р. О. Литвиненко, *Культурне коло Бабине (за матеріалами поховальних пам'яток)*, дис. д-ра іст. наук. 2008.

Litvinova 2004 — Л. В. Литвинова, *Палеоантропологический материал из могильника Мамай-Гора (исследования 1992-1999 гг.),* С. И. Андрух, Г. Н. Тощев, *Могильник Мамай-Гора*, книга III, Запорожье, 2004, 144-181.

New Tools... 1990 — *New Tools from Mathematical Archaelogy,* Warsaw / Krakow, 1990.

Pannett 2005 — Amelia Pannett, *The lithic assemblages from Teleor 003,* in *Cronica Cercetărilor Arheologice din România, Campania 2004,* Bucureşti, 2005, 231-234.

Pislary et *alii* 1989a — I. A. Pislary, A. P. Gegerun, T. G. Popova, *Archaeological classification and expert systems,* New Tools from Mathematical Archaeology, Krakow, 1989, 123-126.

Pâslaru, Colesniuc 2007 — I. Pâslaru, S. M. Colesniuc, *Câteva note asupra necropolelor neolitice şi eneolitice din Sud-Estul Europei,* Pontica, LX, 2007, 523-532.

Pislaryi 1982 — И. А. Писларий, *О методе проверки однородности массивов археологических памятников. Новые методы археологических исследований.- Киев. изд. «Наукова Думка», 1982, 169-193.*

Pislaryi 1989b — И. А. Писларий*, Об автоматизации исследований памятников археологии, Духовная культура древнего населения Украины. Тезисы докладов на конференции,* Киев, 1989, 60-61.

Pislaryi, Požidaev 1982 — И. А. Писларий, В. Ф. Пожидаев, *О применении процентных соотношений, Методологические и методические вопросы археологии*, Киев,1982, 178-187.

Popovici *et alii* 2005 — D. Popovici, F. Vlad, Al. Nălbiţoiu, Monica Mărgărit*, Borduşani, com. Borduşani, jud. Ialomiţa. Punct: Popina,* in *Cronica Cercetărilor Arheologice din România Campania 2004,* Bucureşti, 2005, 69-72, 477-478.

Prihodniuk 1993 — О. М. Приходнюк*, Об уровне хозяйственной жизни восточных славян предгосударственного периода. Хозяйство древнего населения Украины,* Киев, 1993, 165-179.

Ryčkov 1982 — Н. Рычков, *Опыт статистической характеристики коллективных погребений степных племён эпохи бронзы. Методологические и методические вопросы археологии,* Киев, 1982, 85-103.

Ryčkov 1982 — Н. Рычков, *Оценка представительности и характера распределения признаков погребальных памятников. Методологические и методические вопросы археологии,* Киев, 1982, 16-178.

Romanova 1986 — Г. Романова, *О демографическом анализе палеоантропологических материалов могильника Лебеди-3.* Археологические открытия на новостройках, вып. 1, Москва, 1986, 195-203.

Sîrbu 1997 — *V. Sîrbu, Sacrifices humains et pratiqués funéraire insolites dans l'areal thrace du Hallstatt du La Tène,* in *Premier Âge du Fer aux bouches du Danube et dans les régions autour de la Mer Noire, Tulcea,* 1997, 193-221.

Savcenco 1986 — Е. И. Савченко, *Крымский могильник.* Археологические открытия на новостройках, вып. 1, Москва, 1986, 70-101.

Shestakov, Vybornyi 2005 — И. А. Шестаков, В. Ю. Выборный, *Местонахождение Зеленополье – новый памятник неолита в Сев. Приазовье*, Матеріали та дослідження з археології Східної України, №4, Луганськ, 2005, 54-60.

Shaposhnikova, Bočkarev, Sharafutdinova 1977	О. Г. Шапошникова, В. С. Бочкарёв, И. Н. Шарафутдинова, *О памятниках эпохи меди-бронзы в бассейне р. Ингула,* Древности Поингулья, Киев, 1977, 7-36.
Stanc 2002	Simina Margareta Stanc, *Relaţiile omului cu lumea animală. Arheozoologia secolelor IV-X d. Hr. pentru zonele extracarpatice de est şi de sud ale României,* Iaşi, 2006.
Stanko, Grigorieva 1977	В. Н. Станко, Г. В. Григорьева, *Исследования памятников каменного века на р. Ингул.,* Древности Поингулья, Киев, 1977, 37-51.
Stokolos 1972	В. С. Стоколос, *Культура населения бронзового века Южного Зауралья,* Москва, 1972, 105-110.
Teodor 1996	E. Teodor, *Sistemul COMPAS. Studiu de morfologie analitică numerică, aplicat ceramicii uzuale din perioada de migraţie a slavilor,* Bucureşti, 1996.
Ungureanu 2001	A. Ungureanu, *Studiul materialului arheozoologic descoperit în staţiunea arheologică de la Todireşti (jud. Suceava) datată sec. V d. Chr.,* Anuarul muzeului naţional al Bucovinei XXVI-XXVII-XXVIII, Suceava, 2001, 209-217.
Voorrips 1990	A. Voorrips, *Expert Systems and Archaeologists. New Tools from Mathematical Archaelogy,* Warsaw / Krakow, 1990, 115-121.
Zinevič 1967	Г. П. Зиневич, *Очерки палеоантропологии,* Киев, 1967.