SOME NEW ELEMENTS OF GRAPHICAL PLOTTING

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The sciencies dealing with research into the tendencies and regularities of socio-economic phenomena frequently employ the possibilities offered by graphical plotting. Of these sciences, the ones making most frequent use of the rich possibilities of graphical plotting are economic geography and regional statistics.

The plotting methods of use in regional research are systematized by numerous handbooks, textbooks and various other publications. Their possible incorrect application is criticized, and they are enriched with new aspects.

These publications arouse interest in specialist circles primarily for the reason that, as the spate of information influencing mankind increases, there is a parallel increase in the role and importance of graphical plotting, not only in communication, but also in scientific research.

In the application of graphical plotting, however, it must never be forgotten that the procedure employed is not an end, but merely a means, with the aid of which understanding can be promoted.

Graphical plotting may further research-analytical work; it facilitates orientation in the sphere of phenomena that can be grasped only with difficulty or not at all by direct observation; it is one of the means of transmitting ideas; and with its application it is possible to emphasize the rate and regional differentiation of development, as well as the nature (direction) and extent of the correlation between the phenomena.

With regard to all this, it is by no means irrelevant which, or which combination, of the broad range of graphical plotting methods is employed.

As the subjects of the sciences dealing with regional questions change, and as their research methods develop, there is a corresponding rise in the demand for new, up-to-date plotting methods. In the age of the scientific-technical revolution, when the use of computers is extremely widespread, the modernization of the plotting methods is not simply a question of demand: as a consequence of interaction, the possibility for development is also given.

Below we wish to enrich the plotting methods (that have been developing so rapidly in recent years) whit some new elements.

Above all we shall touch upon the question of the plotting of stochastic connections (probability connections), of which there are a large number even in the sphere of the system of connections of socio-economic phenomena.

For the plotting of the correlation connection it is possible to use a characteristic (not too well known) means of plotting. The essence of this is that a scale correspond-

ing to the number of the correlation coefficient is given on the horizontal axis, while the perpendicular axis shows a scale ranging from +1 to −1, upwards and downwards from the horizontal axis. Following this, the "r" value is measured as the perpendicular amplitude on the horizontal axis, and conneeted with a wawe line. From the 26-element sample in Table 1 the following correlation matrix was obtained:

$$R = \begin{bmatrix} 1 & 0{,}6563 & 0{,}2776 \\ 0{,}6563 & 1 & -0{,}3730 \\ 0{,}2776 & -0{,}3730 & 1 \end{bmatrix}$$

On the basis of the above description, the curved line correlation to be seen in Fig. 1 can be used for illustration of this.

Table 1.

Floodwave peaking at Budapest		Rainfall (mm)	Water level at Budapest at beginning of rainfall (cm)
Date	Water level (cm)		
14.8.1896	590	58	405
20.8.1896	660	52	450
8.8.1897	780	133	350
22.9.1899	770	179	285
15.7.1903	710	98	330
20.7.1906	640	72	400
2.5.1907	670	72	550
29.6.1907	520	43	480
21.7.1907	660	62	450
31.5.1912	690	67	610
27.7.1912	500	64	380
4.8.1912	460	33	460
16.9.1912	610	57	425
21.9.1912	710	62	560
14.7.1914	620	54	420
24.7.1914	660	48	620
1.7.1918	620	86	390
15.8.1918	590	74	350
26.6.1926	740	95	570
1.7.1926	730	44	710
17.7.1926	720	53	700
6.8.1926	720	77	580
14.8.1926	640	46	700
18.7.1954	805	123	560
26.6.1955	510	26	370
16.7.1955	673	62	430

In recent time there has been a rapid spreading of one of the very widely applicable methods of multivariant statistical analysis, factor analysis. It has found application in the sciences dealing with regional questions since 1960. The most widespread area of application of the factor model is the determination of the level of development, and the construction of development sequences and groups. It is a charac-

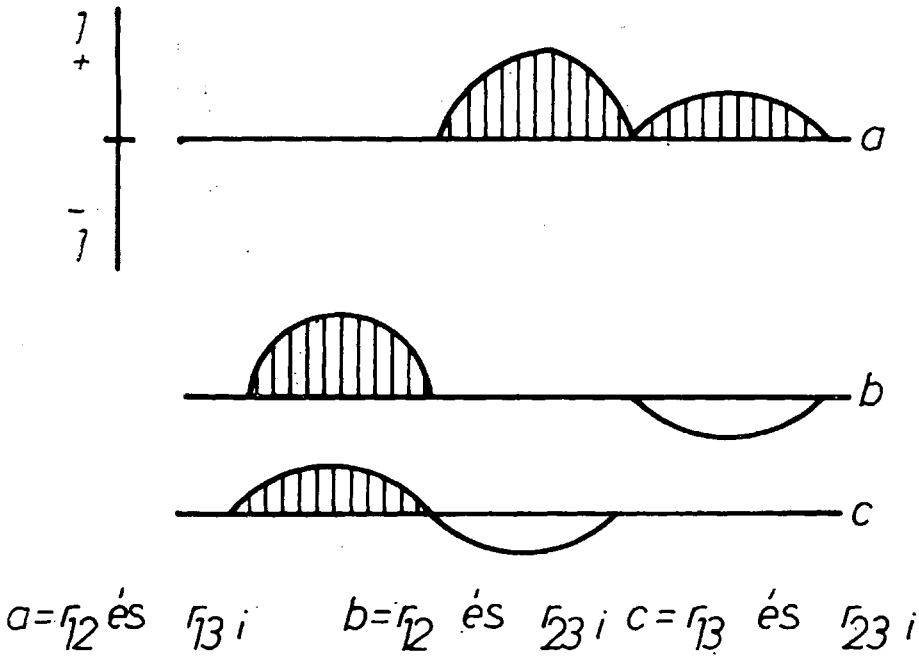

Fig. 1. Curved line correlation

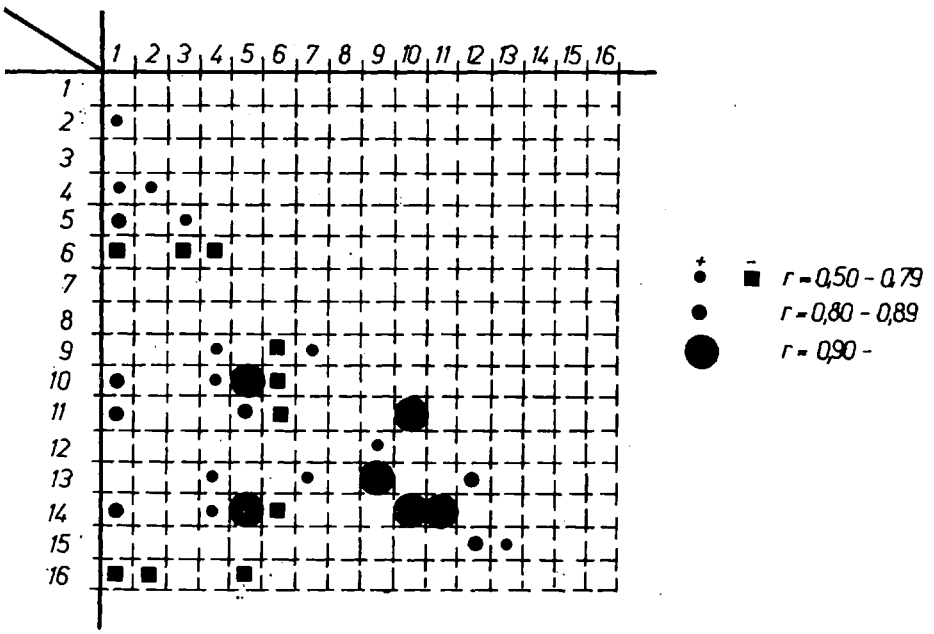

Fig. 2. Correlation matrix of indices expressing the level of development of the food industry

Table 2.

index / index	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	1.000															
2.	0.609	1.000														
3.	0.196	−0.070	1.000													
4.	0.754	0.606	0.421	1.000												
5.	0.831	0.478	0.560	0.280	1.000											
6.	−0.722	−0.396	−0.111	−0.524	−0.780	1.000										
7.	0.172	0.273	−0.176	0.402	0.266	−0.122	1.000									
8.	−0.218	−0.037	−0.006	−0.117	−0.261	−0.023	−0.299	1.000								
9.	0.467	0.438	−0.065	0.703	0.448	−0.526	0.639	−0.215	1.000							
10.	0.861	0.465	0.078	0.519	0.930	−0.781	0.069	−0.133	0.431	1.000						
11.	0.840	0.415	0.014	0.496	0.869	−0.725	0.052	−0.188	0.432	0.972	1.000					
12.	−0.042	−0.038	−0.299	0.202	0.098	−0.109	0.407	−0.349	0.634	0.064	0.125	1.000				
13.	0.430	0.332	−0.202	0.627	0.397	−0.422	0.581	−0.266	0.952	0.423	0.469	0.760	1.000			
14.	0.886	0.452	0.049	0.516	0.901	−0.772	0.059	−0.170	0.393	0.984	0.971	0.028	0.395	1.000		
15.	−0.106	−0.040	−0.037	0.070	0.132	−0.188	0.156	−0.306	0.464	0.125	0.175	0.776	0.502	0.111	1.000	
16.	−0.610	−0.554	−0.225	−0.473	−0.512	0.421	−0.303	−0.090	−0.135	−0.417	−0.353	0.392	0.018	−0.422	0.422	1.000

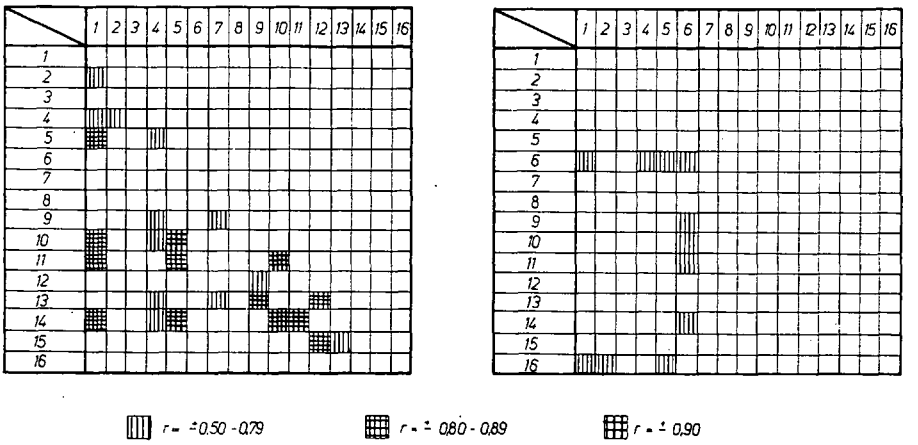

Fig. 3. Correlation coefficients in the + and − directions of the indices expressing the level of development of the food industry

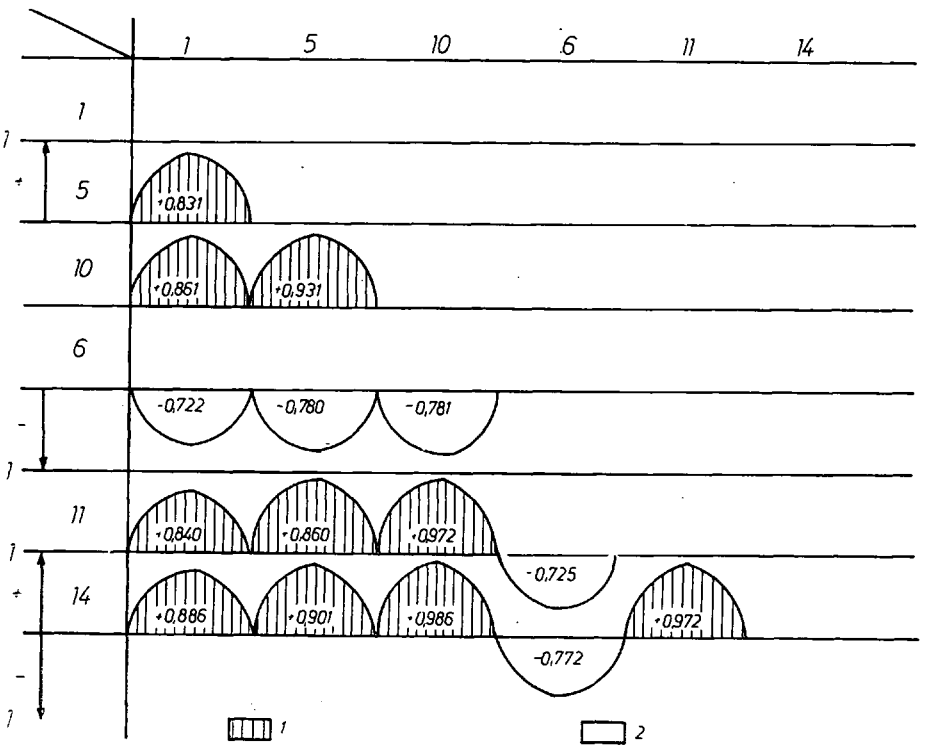

Fig. 4. Curved line correlations of the variables combined in factor K_1
1 = +correlation coefficient
2 = −correlation coefficient

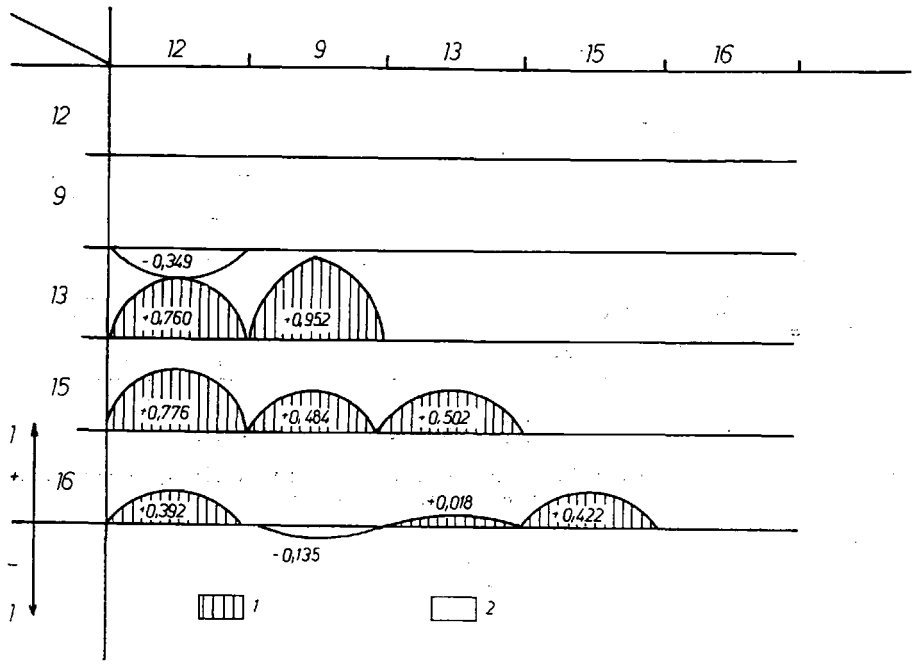

Fig. 5. Curved line correlations of the variables combined in factor K_2
1 = + correlation coefficient
2 = − correlation coefficient

teristic of the method that it also provides a possibility for the revelation of causal correlations. Calculations of such a nature are based on more or fewer natural (or result) indices. In the course of the calculations we form the correlation matrix of the variables (indices) included in the examination. In Fig. 2 we have attempted to illustrate the paired correlation connection of every index with every other index.* (The Figure can be evaluated with ease of the correlation coefficients are characterized on the basis of the closeness of the connection.) The areas of the circles express the closeness of the connection, and their colours or shading the direction of the connection. (Table 2.) In a coloured Figure the positive "r" values may be shown in red and the negative ones in blue, for instance, to facilitate differentiation. Since the Table summarizing the correlation matrix plays a determining role in the subsequent examinations, its plotting is justified among others because of the confirmation of the correctness of the index system, in addition to the greater ease of survey and evaluation.

The above correlation matrix also be plotted in such a way that the correlation coefficients in the + and − directions are separated from one another, and in each

* The Figure illustrates the correlation matrix obtained on the basis of a 16-index system, necessary for determination of the level of development of the food industry in the different counties.

lattice the differences are denoted by shading merely on the basis of the closeness of the connection (Fig. 3).

A very important step in the course of the factor-analytical examination is the investigation of the correlations between the original variables and the factors. In the factor structure this is performed by forming the factor weights. Since the factors are characterised primarily by those variables which are connected to the factors with large factor weights, this means that the factor in question explains the majority of the scatter of the original variable. The curve line correlations of the variables combined in the first factor (named the first factor and denoted by K_1) are shown in Fig. 4, and the corresponding ones relating to factor K_2 in Fig. 5.

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