Manual Of The Program

FACTOR

v.8.10

Windows 95/98/2000/XP/Vista/W7

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Description

Factor is a program developed to fit the Exploratory Factor Analysis model. Below we describe the methods used.

Univariate and multivariate descriptives of variables:
- Univariate mean, variance, skewness, and kurtosis
- Multivariate skewness and kurtosis (Mardia, 1970)
- Var charts for ordinal variables

Dispersion matrices:
- User defined typo matrix
- Covariance matrix
- Pearson correlation matrix
- Polychoric correlation matrix (Polychoric algorithm: Olsson ,1979a, 1979b; Tetrachoric algorithm: Bonett & Price, 2005) with smoothing algorithm (Devlin, Gnanadesikan, & Kettenring, 1975; Devlin, Gnanadesikan, & Kettenring, 1981)

Procedures for determining the number of factors/components to be retained:
- MAP: Minimum Average Partial Test (Velicer, 1976)
- PA: Parallel Analysis (Horn, 1965)
- Optimal PA. It is an implementation of Parallel Analysis where it is computed based on the same type of correlation matrix (i.e., Pearson or polychoric correlation) and the same type of underlying dimensions (i.e., components of factor) as defined for the whole analysis (Timmerman & Lorenzo-Seva, 2011)
- Hull method for selecting the number of common factors: this method aims to find a model with an optimal balance between model fit and number of parameters (Lorenzo-Seva & Timmerman, 2011)

Factor and component analysis:
- PCA: Principal Component Analysis
- ULS: Unweighted Least Squares factor analysis (also MINRES and PAF)
- EML: Exploratory Maximum Likelihood factor analysis
- MRFA: Minimum Rank Factor Analysis (ten Berge, & Kiers, 1991)
- Schmid-Leiman second-order solution (1957)
- Factor scores (ten Berge, Krijnen, Wansbeek, & Shapiro, 1999)
- Person fit indices (Ferrando, 2009)

In ULS factor analysis, the Heywood case correction described in Mulaik (1972, page 153) is included: when an update has sum of squares larger than the observed variance of the variable, that row is updated by constrained regression using the procedure proposed by ten Berge and Nevels (1977).

Some of the rotation methods to obtain simplicity are:
- Quartimax (Neuhaus & Wrigley, 1954)
- Varimax (Kaiser, 1958)
- Weighted Varimax (Cureton & Mulaik, 1975)
- Orthomin (Bentler, 1977)

- Direct Oblimin (Clarkson & Jennrich, 1988)
- Weighted Oblimin (Lorenzo-Seva, 2000)
- Promax (Hendrickson & White, 1964)
- Promaj (Trendafilov, 1994)
- Promin (Lorenzo-Seva, 1999)
- Simplimax (Kiers, 1994)

Some of the indices used in the analysis are:

- Test on the dispersion matrix: Determinant, Bartlett's test and Kaiser-Meyer-Olkin (KMO)
- Goodness of fit statistics:
    - Chi-Square Non-Normed Fit Index (NNFI; Tucker & Lewis);
    - Comparative Fit Index (CFI);
    - Goodness of Fit Index (GFI);
    - Adjusted Goodness of Fit Index (AGFI);
    - Root Mean Square Error of Approximation (RMSEA);
    - Estimated Non-Centrality Parameter (NCP)
- Reliabilities of rotated components (ten Berge & Hofstee, 1999)
- Simplicity indices: Bentler’s Simplicity index (1977) and Loading Simplicity index (Lorenzo-Seva, 2003)
- Mean, variance and histogram of fitted and standardised residuals. Automatic detection of large standardised residuals
- The greatest lower bound (glb) to reliability (Woodhouse & Jackson, 1977). The greatest lower bound (glb) to reliability represents the smallest reliability possible given observed covariance matrix under the restriction that the sum of error variances is maximized for errors that correlate 0 with other variables (Ten Berge, Snijders, & Zegers, 1981)
- McDonald's Omega. Omega can be interpreted as the square of the correlation between the scale score and the latent common to all the indicators in the infinite universe of indicators of which the scale indicators are a subset (McDonald, 1999, page 89).

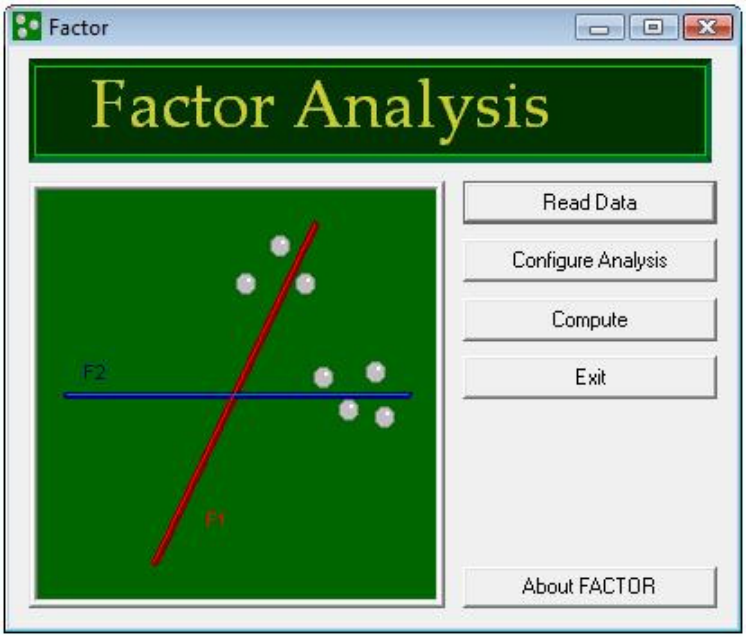
General information

We have developed Factor to be run in Microsoft Windows operating systems. We have tested the program in several computers with different chips (always pentiums) and Windows versions (95/98/NT/2000/XP/Vista/W7), and found that worked suitably.

The number of variables and subjects in the data set is not limited. However, when analysing large data sets, the amount of memory installed in the computer is important for the speed of the analysis.

Main menu

We now describe the main window of Factor. From here data is read from the disk, the analysis is configured and the computing begins. The program continuously informs the user about the process and announces the job is finished.



The steps for analysing the data are:

- The data is read by clicking on Read Data button. (See details)
- The analysis is configured by clicking on Configure Analysis button. (See details)
- Finally, the analysis is started by clicking on Compute button. (See details)

The above order must be followed. The program will not allow the analysis to start before the data are read and the analysis is configured. After the computation, the output of the program is stored in the file *output.txt* (see the output section of this manual for details).

The Exit button ends the program.

Read data

When using Factor to analyse data, you will need the participants' scores to some observed variables. For example, you may have the scores of 1,500 participants for a test of 10 items.

The data must be stored in a file in ASCII format. The scores of each participant correspond to the rows in the file, while participants' answers to each item correspond to the columns in the file.

Each column has to be spaced by at least one character: a space character, a tab, a coma, a : character, or a ; character.

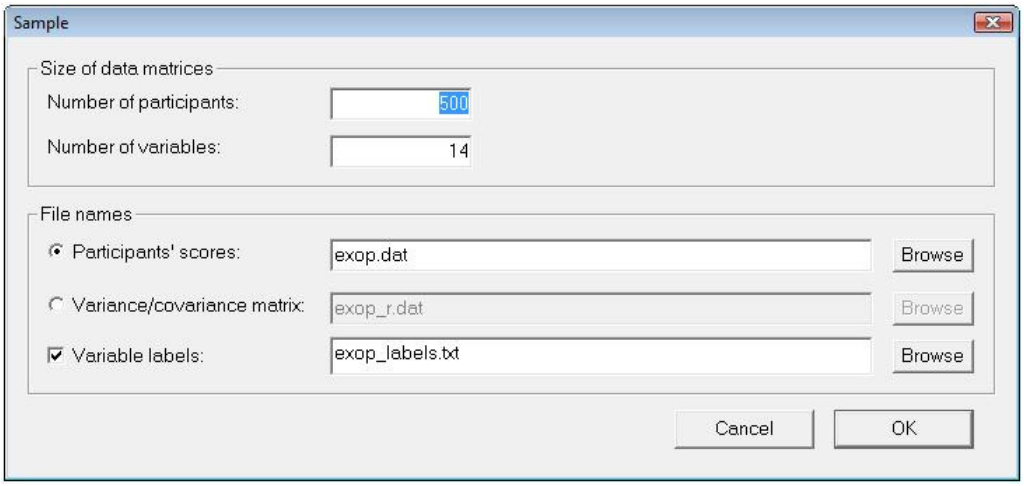
If you have your data in EXCEL, you may want to use this excel file (http://psico.fcep.urv.es/utilitats/factor/soft/data_preprocessing.xls at May 2012) to preprocess the data and save it in ASCII format (please, note that you must allow macros in order to preprocess the data).

The contents of the ASCII file for this example would be:

2	2	2	2	1	2	2	2	3	2
1	2	1	2	1	1	3	2	3	2
3	3	3	3	2	2	2	3	2	2
2	2	2	2	2	1	2	3	2	2
...	...	...	...	...	...	...	...	...	...
2	3	2	2	1	2	2	2	2	1

where the last row contains the answers reported by the last participant. Note that the presence of missing data is not allowed. If FACTOR finds missing, the whole row is dismissed from the analysis.

The data are read from the ASCII file by clicking on the Read Data button in the main menu (see details). This button opens the menu that helps to read the data.



The menu is now shown ready to read an ASCII file (y.dat) where the answers of 500 participants to 14 items were previously stored:

Please, note that a correlation matrix can also be read from disk. In this case, the matrix must be a square matrix. If this option is used, the program will not be able to compute all the indices available when raw data is used.

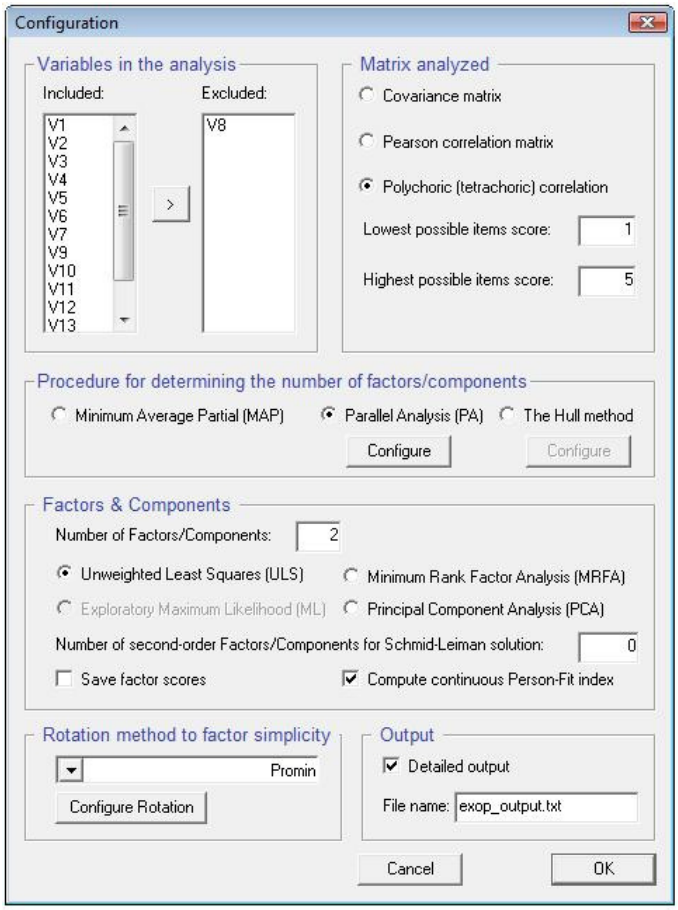
Finally, variable labels are allowed. It must be a text file, where each row corresponds to the labels of each variable. FACTORS expects to find as many rows, as variables. Labels with more than 40 characters are cut to be of 40 characters. The labels are used in the output report.

Configure analysis

The analysis is configured by clicking on Configure Analysis button in the main menu (see details). Note that before starting the computation the data must be read. This button opens the menu that helps to define the analysis.

The menu is now shown ready to (a) compute polychoric correlations (with categories from 1 to 5), (b) compute parallel analysis, (c) retain two factors computed by Unweighted Least Squares factor analysis, (d) rotate the solution by Promin, and (e) compute continuous person-fit indices. Note that variable 8 (i.e., the eighth column in the file) is excluded from the analysis.

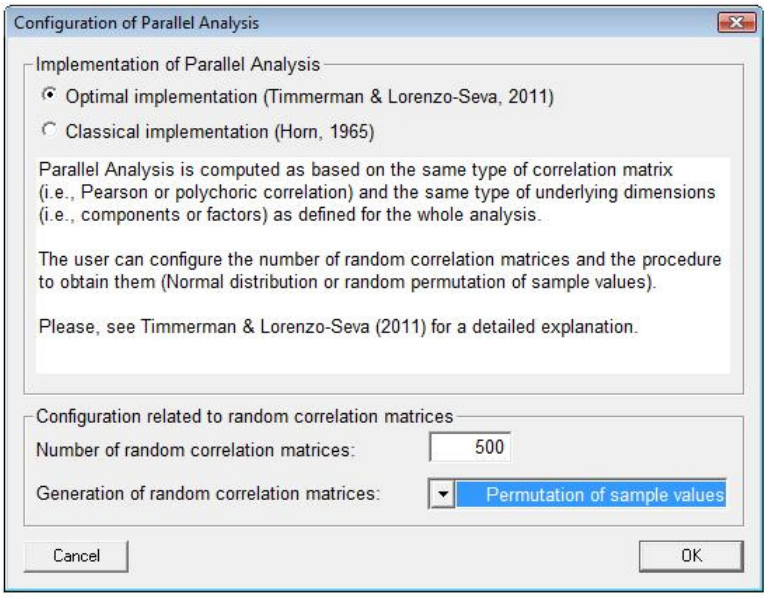
In addition, the output is stored in file *exop_output.txt*.



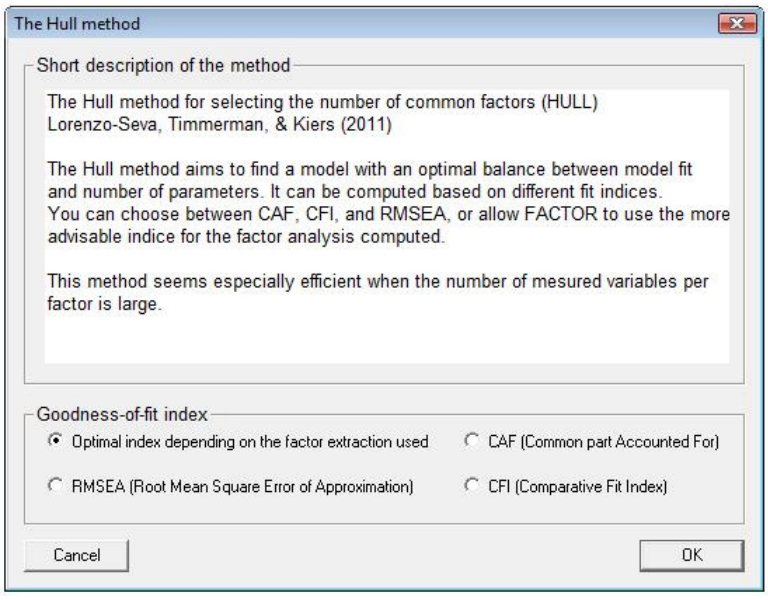
When computing the polychoric correlation, please note that:

- Factor computes the lowest and the highest answer in the data, and takes these values as default values.
- A value lower than the value observed in the data is not allowed.
- All the variables are expected to have the same number of categories of response.
- If the matrix is not positive-definite, a smooth algorithm is computed to solve it.
- If a polychoric correlation coefficient cannot be computed, the corresponding Pearson correlation is computed. If a large number of polychoric correlation coefficients cannot be computed, the analysis will be based only in Pearson correlation matrices.
- If the number of Factors/Components is set to the value of zero, the greatest lower bound (glb) to reliability is computed. The glb was defined by Woodhouse and Jackson (1977), and it is computed according to the algorithm suggested by Ten Berge, Snijders and Zegers (1981) as a modification of Bentler and Woodwards method (1980). This lower bound is better than coefficient alpha, but can only be trusted in large samples, preferably 1000 cases or more, due to a positive sampling bias.

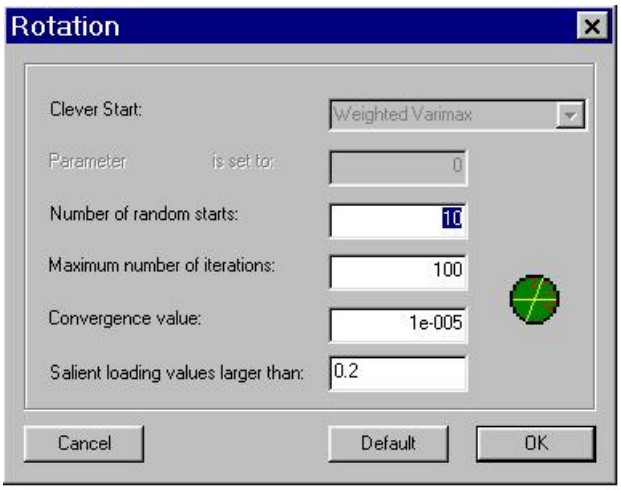
Different implementation of PA can be computed. This menu describes how PA can be configure:



Hull method is a procedure to assess the number of factors to retain. This menu describes how Hull method can be configure:



We implemented many methods to obtain simple structure. To configure the parameter values, the Configure rotation button opens the following menu:



This menu shows the default parameter values of Normalised Direct Oblimin. These values are:

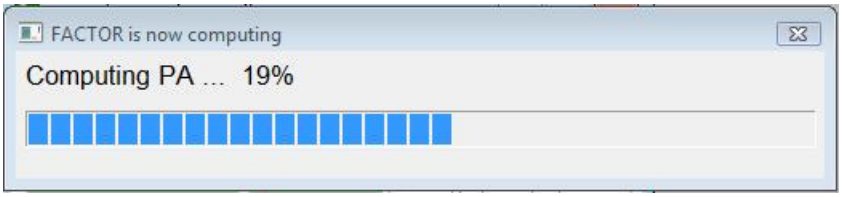
- **Clever start**: This is a pre-rotation method computed as a starting point for the Oblimin rotation.
- **Parameter gamma set to**: This defines a default value for the parameter gamma of Oblimin.
- **Number of random starts**: To avoid convergence to local maxima, each rotation is computed from a number of random starts, and the rotated solution that attains the highest criterion value is taken as the solution for the analysis.
- **Maximum number of iterations**: This defines the maximum number of iterations in the rotation method.
- **Convergence value**: This defines the convergence value to finish the rotation method.
- **Salient loading values larger than**: This defines the minimum value of the salient loadings to be printed in the cleaned loading matrix. If the value is set to zero, the cleaned loading matrix is not printed.

The default button sets the parameters of the rotation to the usual values in the literature. These values are the ones defined when the program starts.

When simplimax rotation is used, a range of salient loading values (and a final number) must be specified. This is done during the computation itself.

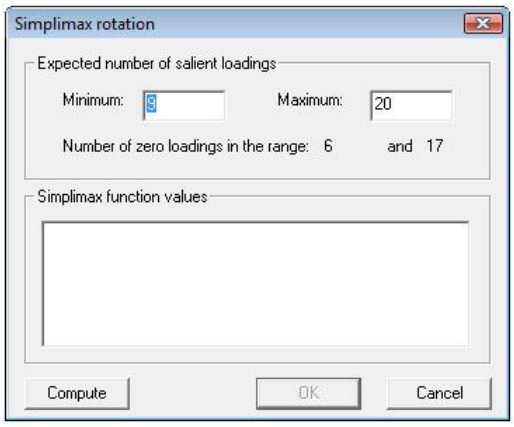
Compute

The computation is started by clicking on the Compute button in the main menu. Note that before the computation starts, the data must be read and the analysis must be configured. Once the computation begins, Factor continuously informs the user of the analysis been performed.



Please note that some analysis can take a long time, especially if you use the computer to run FACTOR and other applications simultaneously.

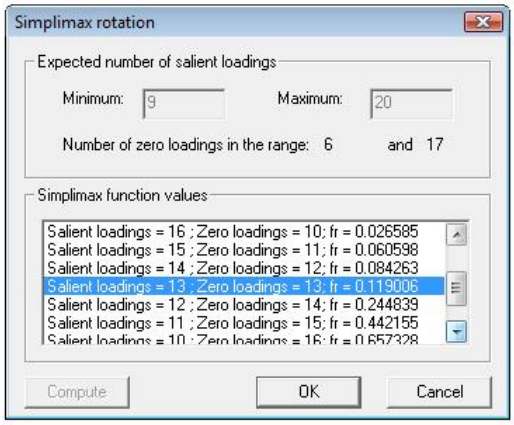
If the rotation used to obtain simplicity is Simplimax, the following menu appears,



The user must supply the range of salient loadings that could be expected in the loading matrix after rotating to simple structure. Factor suggests a maximum and a minimum for the number of salient loadings that could be expected in a perfectly simple structure (one salient loading per variable). In the example these values are 7 and 14. However, the user can define any other value.

To continue the analysis, the Compute button must be clicked.

After computing a rotated solution for each number of salient loadings in the range, one of the solutions must be selected as the final solution. To help the user, simplimax function values are shown, and a cut-off point is suggested: the rotated solution where after the function value shows a considerable relative increase.



Once the user selects the final rotated solution, the analysis is continued by clicking on the Ok button.

After the computation, the output of the program is stored in ASCII format in the file specified output file, for example, *exop_output.txt*.

Output

The output of the program is stored in ASCII format in specified output file (for example, *exop_output.txt*). When the analysis finishes, this file is automatically loaded (except in some versions of the operating system). It can then be edited, saved or printed like any other text file.

Follow we show the full output of an analysis.

```
                                F A C T O R

                          Unrestricted Factor Analysis

                               Release Version 8.1
                                   April, 2012
                           Rovira i Virgili University
                               Tarragona, SPAIN

                                  Programming:
                              Urbano Lorenzo-Seva

                           Mathematical Specification:
                              Urbano Lorenzo-Seva
                                Pere J. Ferrando

                           Date: Tuesday, April 17, 2012
                           Time: 16:11:17
--------------------------------------------------------------------------------

DETAILS OF ANALYSIS

Participants' scores data file                        : exop.dat
Variable labels file                                  : exop_labels.txt
Number of participants                                : 500
Number of variables                                   : 14
Variables included in the analysis                    : ALL
Variables excluded in the analysis                    : NONE
Number of factors                                     : 2
Number of second order factors                        : 0
Procedure for determining the number of dimensions    : Optimal implementation
                                                        of Parallel Analysis (PA)
                                                       (Timmerman, & Lorenzo-Seva, 2011)
Dispersion matrix                                     : Polychoric Correlations
Method for factor extraction                          : Minimum Rank Factor Analysis
                                                       (MRFA) (ten Berge and Kiers, 1991)
Rotation to achieve factor simplicity                 : Promin (Lorenzo-Seva, 1999)
Clever rotation start                                 : Weighted Varimax
Number of random starts                               : 10
Maximum mumber of iterations                          : 100
Convergence value                                     : 0.00001000

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UNIVARIATE DESCRIPTIVES

Variable              Mean       Confidence Interval  Variance   Skewness     Kurtosis
                                 (95%)                                      (Zero centered)

1. Extraversion +     2.986     (   2.88     3.09)       0.838     -0.113        0.004
2. Extraversion +     3.802     (   3.71     3.89)       0.639     -0.712        0.887
3. Extraversion -     2.324     (   2.20     2.45)       1.263      0.549       -0.492
4. Extraversion +     3.616     (   3.51     3.72)       0.837     -0.440       -0.087
5. Extraversion -     3.570     (   3.46     3.68)       0.957     -0.248       -0.314
6. Extraversion -     3.092     (   2.98     3.20)       0.912     -0.019       -0.376
7. Extraversion +     3.318     (   3.22     3.41)       0.701     -0.223        0.290
8. Openness -         2.154     (   2.03     2.28)       1.150      0.675       -0.278
9. Openness +         4.610     (   4.54     4.68)       0.326     -1.278        1.332
10. Openness -        2.588     (   2.45     2.72)       1.418      0.367       -0.761
11. Openness +        3.522     (   3.41     3.63)       0.950     -0.419       -0.151
12. Openness +        4.502     (   4.42     4.58)       0.478     -1.626        3.792
13. Openness +        4.428     (   4.35     4.50)       0.437     -0.983        1.113
```

14. Openness - 1.866 (1.75 1.98) 0.992 1.098 0.661

Polychoric correlation is advised when the univariate distributions of ordinal items are asymmetric or with excess of kurtosis. If both indices are lower than one in absolute value, then Pearson correlation is advised. You can read more about this subject in:

Muthén, B., & Kaplan D. (1985). A comparison of some methodologies for the factor analysis of non-normal Likert variables. British Journal of Mathematical and Statistical Psychology, 38, 171-189.

Muthén, B., & Kaplan D. (1992). A comparison of some methodologies for the factor analysis of non-normal Likert variables: A note on the size of the model. British Journal of Mathematical and Statistical Psychology, 45, 19-30.

BAR CHARTS FOR ORDINAL VARIABLES

Variable 1

Value	Freq	
1	31	*****
2	98	**********
3	240	*************************
4	109	**********
5	22	***

0 60.0 120.0 180.0 240.0

Variable 2

Value	Freq	
1	5	
2	26	***
3	111	**********
4	279	*************************
5	79	**********

0 69.8 139.5 209.3 279.0

Variable 3

Value	Freq	
1	139	**********
2	161	************
3	120	**********
4	59	**********
5	21	*****

0 40.3 80.5 120.8 161.0

Variable 4

Value	Freq	
1	8	*
2	49	********
3	147	**************
4	219	**********
5	77	**********

0 54.8 109.5 164.3 219.0

Variable 5

Value	Freq	
1	12	**
2	45	*********
3	186	**********
4	160	**********
5	97	**********

```
                0        46.5       93.0       139.5        186.0

Variable    6

 Value     Freq
                |
     1      21  |  ****
     2     111  |  **********
     3     202  |  ****************************************
     4     133  |  *************************
     5      33  |  ******
                +-----------+---------+---------+-----------+
                0        50.5       101.0       151.5        202.0

Variable    7

 Value     Freq
                |
     1      12  |  **
     2      52  |  ********
     3     234  |  ****************************************
     4     169  |  ****************************
     5      33  |  *****
                +-----------+---------+---------+-----------+
                0        58.5       117.0       175.5        234.0

Variable    8

 Value     Freq
                |
     1     168  |  ****************************************
     2     160  |  ************************************
     3     113  |  *************************
     4      45  |  **********
     5      14  |  ***
                +-----------+---------+---------+-----------+
                0        42.0       84.0       126.0        168.0

Variable    9

 Value     Freq
                |
     2       2  |
     3      16  |  *
     4     157  |  ******************
     5     325  |  ****************************************
                +-----------+---------+---------+-----------+
                0        81.3       162.5       243.8        325.0

Variable   10

 Value     Freq
                |
     1     103  |  *************************
     2     154  |  ************************************
     3     126  |  ******************************
     4      80  |  ********************
     5      37  |  *********
                +-----------+---------+---------+-----------+
                0        38.5       77.0       115.5        154.0

Variable   11

 Value     Freq
                |
     1      15  |  ***
     2      55  |  ***********
     3     159  |  *******************************
     4     196  |  ****************************************
     5      75  |  ***************
                +-----------+---------+---------+-----------+
                0        49.0       98.0       147.0        196.0

Variable   12
```

```
 Value     Freq
                |
     1       3  |
     2       4  |
     3      27  |  ***
     4     171  |  **********************
     5     295  |  ***************************************
                +-----------+---------+---------+-----------+
                 0        73.8       147.5       221.3        295.0

Variable   13

 Value     Freq
                |
     1       1  |
     2       2  |
     3      36  |  *****
     4     204  |  ****************************
     5     257  |  ***********************************
                +-----------+---------+---------+-----------+
                 0        64.3       128.5       192.8        257.0

Variable   14

 Value     Freq
                |
     1     228  |  ********************************
     2     159  |  **********************
     3      75  |  **********
     4      28  |  ****
     5      10  |  *
                +-----------+---------+---------+-----------+
                 0        57.0       114.0       171.0        228.0


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MULTIVARIATE DESCRIPTIVES

Analysis of the Mardia's (1970) multivariate asymmetry skewness and kurtosis.

                                          Coefficient        Statistic     df       P

Skewness                                       18.463         1538.595    560     1.0000
SKewness corrected for small sample            18.463         1549.064    560     1.0000
Kurtosis                                      257.844           17.877            0.0000**

** Significant at 0.05

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WARNING:   13 polychoric correlation coeficients did not converge. Pearson correlation coefficients
          were computed and inserted in the polychoric correlation matrix.

Pairs of variables with Pearson correlation coeffcients

Variable   1  -- Variable   9
Variable   2  -- Variable   9
Variable   3  -- Variable   9
Variable   4  -- Variable   9
Variable   5  -- Variable   9
Variable   6  -- Variable   9
Variable   7  -- Variable   9
Variable   8  -- Variable   9
Variable   9  -- Variable  10
Variable   9  -- Variable  11
Variable   9  -- Variable  12
Variable   9  -- Variable  13
Variable   9  -- Variable  14
```

STANDARIZED VARIANCE / COVARIANCE MATRIX (POLYCHORIC CORRELATION)
(Polychoric algorithm: Olsson ,1979a, 1979b; Tetrachoric algorithm: AS116)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
V 1	1.000													
V 2	0.405	1.000												
V 3	-0.409	-0.507	1.000											
V 4	0.437	0.644	-0.495	1.000										
V 5	-0.413	-0.306	0.394	-0.145	1.000									
V 6	-0.372	-0.438	0.443	-0.313	0.634	1.000								
V 7	0.398	0.451	-0.355	0.477	-0.279	-0.383	1.000							
V 8	0.024	-0.051	0.015	0.021	0.089	0.069	-0.108	1.000						
V 9	-0.022	0.098	0.004	0.100	0.029	-0.004	0.054	-0.193	1.000					
V 10	-0.025	-0.096	0.083	-0.043	0.187	0.172	-0.144	0.380	-0.142	1.000				
V 11	0.007	0.063	-0.035	0.064	-0.117	-0.076	0.123	-0.539	0.280	-0.254	1.000			
V 12	0.093	0.253	-0.131	0.213	-0.083	-0.076	0.065	-0.207	0.172	-0.174	0.277	1.000		
V 13	0.057	0.239	-0.115	0.204	-0.055	-0.073	0.148	-0.316	0.310	-0.302	0.349	0.532	1.000	
V 14	-0.087	-0.155	0.098	-0.058	0.006	0.024	-0.166	0.475	-0.226	0.303	-0.409	-0.342	-0.359	1.000

ADEQUACY OF THE CORRELATION MATRIX

Determinant of the matrix = 0.012175307187328
Bartlett's statistic = 2175.5 (df = 91; P = 0.000010)
Kaiser-Meyer-Olkin (KMO) test = 0.79636 (fair)

EXPLAINED VARIANCE BASED ON EIGENVALUES

Variable	Eigenvalue	Proportion of Variance	Cumulative Proportion of Variance
1	3.88700	0.27764	0.27764
2	2.57225	0.18373	0.46137
3	1.30056	0.09290	
4	0.91666	0.06548	
5	0.85323	0.06095	
6	0.76686	0.05478	
7	0.64571	0.04612	
8	0.61441	0.04389	
9	0.54185	0.03870	
10	0.47164	0.03369	
11	0.43563	0.03112	
12	0.38591	0.02756	
13	0.33442	0.02389	
14	0.27388	0.01956	

PARALLEL ANALYSIS (PA) BASED ON MINIMUM RANK FACTOR ANALYSIS
(Timmerman & Lorenzo-Seva, 2011)

Implementation details:

Correlation matrices analized: Polychoric correlation matrices
Number of random correlation matrices: 500
Method to obtain random correlation matrices: Permutation of the raw data (Buja & Eyuboglu, 1992)

Variable	Real-data % of variance	Mean of random % of variance	95 percentile of random % of variance
1	31.2*	14.5	16.7
2	20.4*	13.1	15.1
3	10.6	12.0	13.3
4	7.2	10.8	12.1
5	6.9	9.8	10.8
6	5.9	8.7	9.7

7	4.2	7.6	8.7
8	3.6	6.6	7.8
9	3.1	5.5	6.7
10	2.4	4.4	5.6
11	2.2	3.4	4.7
12	1.3	2.3	3.5
13	0.9	1.2	2.3
14	0.0	0.0	0.0

* Advised number of dimensions: 2

OVERALL FACTOR ANALYSIS STATISTICS

```
    Total observed variance =     14
      Total common variance =     8.624
  Explained common variance =     5.730 ( 66.44%)
Unexplained common variance =     2.895
```

EIGENVALUES OF THE REDUCED CORRELATION MATRIX

Variable	Eigenvalue	Proportion of Common Variance	Cumulative Proportion of Variance
1	3.53430	0.40980	0.40980
2	2.19538	0.25455	0.66435
3	1.00981	0.11709	
4	0.58176	0.06746	
5	0.33211	0.03851	
6	0.28867	0.03347	
7	0.21901	0.02539	
8	0.17627	0.02044	
9	0.13000	0.01507	
10	0.08323	0.00965	
11	0.06068	0.00704	
12	0.01314	0.00152	
13	0.00011	0.00001	
14	-0.00000	-0.00000	

UNROTATED LOADING MATRIX

Variable	F 1	F 2	Communality
1. Extraversion +	-0.534	0.341	0.535
2. Extraversion +	-0.701	0.241	0.658
3. Extraversion -	0.598	-0.312	0.542
4. Extraversion +	-0.668	0.302	0.859
5. Extraversion -	0.550	-0.286	0.801
6. Extraversion -	0.599	-0.318	0.632
7. Extraversion +	-0.588	0.190	0.569
8. Openness -	0.331	0.600	0.647
9. Openness +	-0.206	-0.333	0.332
10. Openness -	0.329	0.334	0.402
11. Openness +	-0.370	-0.580	0.684
12. Openness +	-0.423	-0.383	0.645
13. Openness +	-0.465	-0.497	0.679
14. Openness -	0.392	0.548	0.640

SEMI-SPECIFIED TARGET LOADING MATRIX
Obtained from prerotation of the loading matrix

Variable	F 1	F 2
1. Extraversion +	0.000	---
2. Extraversion +	0.000	---
3. Extraversion -	0.000	---
4. Extraversion +	0.000	---
5. Extraversion -	0.000	---

6. Extraversion -	0.000	---
7. Extraversion +	0.000	---
8. Openness -	---	0.000
9. Openness +	---	0.000
10. Openness -	---	0.000
11. Openness +	---	0.000
12. Openness +	---	0.000
13. Openness +	---	0.000
14. Openness -	---	0.000

ROTATED LOADING MATRIX

Variable	F 1	F 2
1. Extraversion +	-0.082	0.646
2. Extraversion +	0.083	0.720
3. Extraversion -	0.028	-0.679
4. Extraversion +	0.013	0.731
5. Extraversion -	0.025	-0.625
6. Extraversion -	0.033	-0.684
7. Extraversion +	0.081	0.597
8. Openness -	-0.699	0.098
9. Openness +	0.397	-0.036
10. Openness -	-0.452	-0.064
11. Openness +	0.697	-0.054
12. Openness +	0.538	0.110
13. Openness +	0.662	0.074
14. Openness -	-0.677	0.017

ROTATED LOADING MATRIX
(loadings lower than absolute 0.300 omitted)

Variable	F 1	F 2
1. Extraversion +		0.646
2. Extraversion +		0.720
3. Extraversion -		-0.679
4. Extraversion +		0.731
5. Extraversion -		-0.625
6. Extraversion -		-0.684
7. Extraversion +		0.597
8. Openness -	-0.699	
9. Openness +	0.397	
10. Openness -	-0.452	
11. Openness +	0.697	
12. Openness +	0.538	
13. Openness +	0.662	
14. Openness -	-0.677	

EXPLAINED VARIANCE AND RELIABILITY OF ROTATED FACTORS
Mislevy & Bock (1990)

Factor	Variance	Proportion of common variance	Reliability estimate
V 0	2.546	0.295	0.815
V 0	3.184	0.369	0.857

INDICES OF FACTOR SIMPLICITY
Bentler (1977) & Lorenzo-Seva (2003)

Bentler's simplicity index (S) : 0.99964 (Percentile 100)
Loading simplicity index (LS) : 0.78142 (Percentile 98)

INTER-FACTORS CORRELATION MATRIX

Factor	F 1	F 2

F   1   1.000
F   2   0.203   1.000

STRUCTURE MATRIX

Variable	F 1	F 2
1. Extraversion +	0.049	0.629
2. Extraversion +	0.229	0.737
3. Extraversion -	-0.110	-0.674
4. Extraversion +	0.161	0.733
5. Extraversion -	-0.102	-0.620
6. Extraversion -	-0.106	-0.677
7. Extraversion +	0.202	0.613
8. Openness -	-0.679	-0.043
9. Openness +	0.390	0.044
10. Openness -	-0.465	-0.155
11. Openness +	0.686	0.087
12. Openness +	0.560	0.219
13. Openness +	0.677	0.208
14. Openness -	-0.673	-0.121

GREATEST LOWER BOUND (GLB) TO RELIABILITY
Woodhouse & Jackson (1977)

WARNING: The GLB and Omega can only be trusted in large samples, preferably 1,000 cases or more,
         due to a positive sampling bias (ten Berge & Socan, 2004).

Greatest Lower Bound to Reliability =   0.898019
                  McDonald's Omega =   0.864656
      Standardized Cronbach's alpha =   0.790978
            Total observed variance = 14.000
              Total Common Variance =   8.623

ASSOCIATED COMMUNALITIES

Variable	Communality
1. Extraversion +	0.532423
2. Extraversion +	0.659889
3. Extraversion -	0.541198
4. Extraversion +	0.865715
5. Extraversion -	0.803234
6. Extraversion -	0.632892
7. Extraversion +	0.571555
8. Openness -	0.644244
9. Openness +	0.340801
10. Openness -	0.409079
11. Openness +	0.670183
12. Openness +	0.657306
13. Openness +	0.664591
14. Openness -	0.629803

The greatest lower bound (glb) to reliability represents the smallest reliability possible
given observed covariance matrix under the restriction that the sum of error variances
is maximized for errors that correlate 0 with other variables (Ten Berge, Snijders, & Zegers, 1981).

Omega can be interpreted as the square of the correlation between the scale score and the latent
variable common to all the indicators in the infinite universe of indicators of which the scale
indicators are a subset (McDonald, 1999, page 89).

DISTRIBUTION OF RESIDUALS

Number of Residuals = 91

Summary Statistics for Fitted Residuals

Smallest Fitted Residual = -0.1115
  Median Fitted Residual = 0.0247
 Largest Fitted Residual = 0.3088
    Mean Fitted Residual = 0.0280
Variance Fitted Residual = 0.0045

Root Mean Square of Residuals (RMSR) = 0.0725
Expected mean value of RMSR for an acceptable model = 0.0448 (Kelly's criterion)
(Kelly, 1935,page 146; see also Harman, 1962, page 21 of the 2nd edition)

Note: if the value of RMSR is much larger than Kelly's criterion value
the model cannot be considered as good

Histogram for fitted residuals

```
 Value        Freq
                  |
   -0.1115      3  |  ****
   -0.0694      6  |  *********
   -0.0274     19  |  ****************************
    0.0146     23  |  **********************************
    0.0566     26  |  ***************************************
    0.0987      7  |  **********
    0.1407      3  |  ****
    0.1827      2  |  ***
    0.2247      1  |  *
    0.2668      0  |
    0.3088      1  |  *
                   +-----------+---------+---------+-----------+
                     0        6.5       13.0       19.5        26.0
```

Summary Statistics for Standardized Residuals

Smallest Standardized Residual = -2.49
  Median Standardized Residual = 0.55
 Largest Standardized Residual = 6.90
    Mean Standardized Residual = 0.62

Stemleaf Plot for Standardized Residuals

```
  -2 | 553
  -1 | 8553220
  -0 | 998765555433332222111
   0 | 00112223444445677788888899
   1 | 0011112222333444467788
   2 | 11233
   3 | 0236
   4 | 18
   5 |
   6 | 9
```

Largest Positive Standardized Residuals

Residual for Var   5 and Var   2   3.32
Residual for Var   5 and Var   4   6.90
Residual for Var   6 and Var   4   4.10
Residual for Var   6 and Var   5   4.77
Residual for Var 12 and Var   8   3.65
Residual for Var 13 and Var   8   3.04
Residual for Var 13 and Var 12   3.23

PARTICIPANTS' SCORES ON FACTORS
Ten Berge, Krijnen, Wansbeeck, & Shapiro (1999)

Case	Factor	
	1	2

1	0.996	2.511
2	0.574	1.200
3	-0.103	0.021
4	-1.769	0.021
5	-1.282	-0.205
6	-0.105	-2.451
7	0.493	0.220
8	1.061	0.878
9	0.766	0.153
10	0.286	0.617
11	1.351	-2.161
12	0.421	0.864
13	1.365	2.492
14	0.019	0.335
15	0.619	1.644
16	-0.725	-0.348
17	-0.049	-0.080
18	-0.186	-0.937
19	0.649	-2.239
20	-0.468	-1.718
21	-2.802	-0.068
22	-0.531	-0.179
23	-0.147	-1.629
24	1.504	1.145
25	-0.431	-0.763
26	-0.706	-1.276
27	1.689	2.514
28	-1.770	-0.187
29	-0.361	1.003
30	0.979	0.507
31	-0.632	-0.713
32	-0.910	0.090
33	-2.148	-0.999
34	-0.966	-2.024
35	-1.226	-0.359
36	1.105	0.338
37	-0.397	-0.436
38	0.836	0.224
39	1.081	-1.280
40	1.388	0.289
41	-0.886	0.775
42	0.652	-1.164
43	0.115	0.267
44	1.598	0.702
45	-0.677	1.065
46	0.576	-0.771
47	-0.326	-1.170
48	0.980	-1.100
49	0.124	-0.556
50	0.181	-0.161
51	1.200	-0.671
52	-1.257	-0.629
53	-0.084	-0.968
54	-1.080	0.449
55	0.446	1.798
56	0.471	0.171
57	-1.611	1.039
58	-3.457	0.288
59	0.032	-0.368
60	0.824	-0.764
61	-2.552	-0.350
62	0.322	-2.238
63	0.366	1.077
64	0.701	1.999
65	0.407	-0.145
66	0.226	-0.389
67	1.042	0.127
68	0.701	-0.952
69	0.300	0.292
70	1.633	0.303
71	1.410	0.130
72	-1.704	-0.353
73	-1.422	0.205
74	-0.567	1.739

75	1.670	0.705
76	0.827	-0.741
77	-0.616	-1.017
78	0.661	-0.202
79	0.579	-0.706
80	1.219	0.763
81	-1.392	0.829
82	1.155	-1.130
83	-1.330	-3.069
84	0.637	0.649
85	-0.634	0.438
86	-0.149	-0.289
87	-0.544	0.874
88	0.415	-0.456
89	0.352	0.159
90	-1.335	0.422
91	0.635	1.206
92	1.349	-1.177
93	0.450	-0.732
94	0.326	0.349
95	1.651	0.680
96	-0.153	0.461
97	1.472	0.687
98	0.605	1.486
99	-0.951	-0.398
100	-1.541	-0.422
101	0.187	-0.618
102	0.891	0.327
103	0.505	0.280
104	1.158	-0.658
105	0.330	-0.144
106	0.031	-0.880
107	0.677	-0.793
108	0.222	1.891
109	-1.044	-0.181
110	-0.447	-0.871
111	0.159	0.038
112	1.461	0.304
113	-0.727	-0.146
114	0.081	-0.235
115	-1.433	-0.428
116	0.300	0.637
117	0.009	0.098
118	0.289	-0.075
119	0.809	1.627
120	-0.410	-0.365
121	0.323	-0.655
122	-1.771	-0.160
123	-0.845	0.431
124	0.737	0.980
125	-0.603	-1.782
126	0.570	-0.256
127	-2.040	0.153
128	-0.175	-0.234
129	0.410	0.550
130	-1.197	-0.628
131	-1.333	-0.372
132	0.042	-0.374
133	-0.891	-0.813
134	0.794	0.187
135	1.049	0.986
136	-1.434	0.637
137	-0.521	0.348
138	-0.430	-0.527
139	-0.610	0.929
140	0.651	-1.209
141	-0.383	1.434
142	-0.082	-1.149
143	-0.461	-1.378
144	0.011	0.887
145	-1.116	-0.647
146	0.667	1.057
147	-1.079	0.692
148	0.102	0.196

149	0.164	0.885
150	-1.443	-0.448
151	1.470	-0.017
152	-0.467	1.176
153	0.234	1.418
154	0.655	1.376
155	0.930	0.236
156	0.460	0.591
157	1.087	1.173
158	-0.287	-0.172
159	0.520	0.714
160	0.906	1.077
161	0.545	0.986
162	0.147	0.203
163	-1.257	-0.459
164	-0.106	-0.166
165	1.074	0.710
166	-0.403	-0.329
167	0.461	-0.067
168	-0.965	0.455
169	-0.641	0.133
170	0.815	-0.173
171	1.303	0.051
172	-2.855	0.909
173	1.661	-0.185
174	-1.860	0.373
175	-0.283	-0.781
176	-0.003	1.475
177	0.939	-1.083
178	-0.080	1.130
179	-0.988	0.701
180	0.323	-0.717
181	-0.383	-1.370
182	0.981	1.135
183	-0.145	0.107
184	-0.387	0.008
185	-0.303	-0.459
186	-0.710	-0.358
187	0.287	-0.482
188	-1.619	-0.696
189	0.582	0.912
190	-1.473	1.022
191	-0.211	0.833
192	0.816	-0.339
193	0.420	-2.561
194	1.177	-0.301
195	0.581	0.950
196	-0.851	0.106
197	-0.407	0.079
198	-0.756	-0.872
199	0.546	-0.265
200	-0.183	-0.912
201	0.729	-0.767
202	0.912	0.281
203	0.197	-0.539
204	0.424	2.340
205	0.387	-0.460
206	0.302	0.224
207	0.604	-0.204
208	1.312	0.768
209	1.293	0.825
210	0.205	1.659
211	1.233	0.116
212	-0.184	0.925
213	0.058	0.335
214	-1.485	-0.858
215	-0.042	0.057
216	-0.929	-0.781
217	-1.235	-0.966
218	-0.558	0.012
219	1.121	0.725
220	-1.837	-1.978
221	0.702	0.535
222	-1.075	1.124

223	0.508	1.178
224	0.467	0.330
225	-0.910	0.229
226	-0.366	1.112
227	0.193	-0.289
228	-0.695	0.426
229	-0.225	0.273
230	-1.024	-0.526
231	-1.391	2.322
232	-0.196	-1.344
233	0.151	0.737
234	1.011	-0.687
235	-0.091	-0.364
236	1.229	-0.344
237	-1.704	-1.179
238	1.452	-0.878
239	-0.635	-0.563
240	-2.121	0.762
241	0.322	0.107
242	1.059	0.300
243	-0.503	-0.055
244	0.629	-0.686
245	-0.472	-1.332
246	1.207	1.263
247	-0.721	0.040
248	-0.313	-0.646
249	-0.627	0.141
250	0.686	0.538
251	-0.317	-1.436
252	-0.021	-1.317
253	0.751	1.805
254	-0.695	-0.197
255	-0.125	1.120
256	-0.420	0.248
257	-0.589	-1.137
258	0.271	0.275
259	0.507	0.358
260	0.252	1.404
261	-1.701	-1.072
262	-0.462	0.301
263	0.046	-0.751
264	1.415	-0.807
265	-0.280	0.772
266	0.817	0.917
267	-0.155	-0.440
268	1.098	0.067
269	-0.140	-0.841
270	-0.284	-1.271
271	1.311	-0.028
272	-0.274	1.071
273	0.706	0.603
274	-0.973	-0.199
275	-0.730	-2.195
276	1.348	0.533
277	0.984	-1.115
278	-2.253	-0.978
279	-0.132	0.504
280	-1.118	-0.623
281	0.955	0.029
282	0.097	-0.146
283	0.045	-0.120
284	-0.595	-0.401
285	-0.617	-1.719
286	-1.008	1.119
287	1.374	-2.003
288	-0.872	0.894
289	1.369	-0.571
290	1.369	1.139
291	0.153	0.454
292	-0.744	-0.697
293	1.469	-1.664
294	-1.093	-1.154
295	-0.998	1.607
296	0.997	2.691

297	0.022	-0.005
298	0.666	0.754
299	0.338	0.151
300	1.417	-0.541
301	1.584	0.976
302	-0.697	1.488
303	-0.181	0.164
304	0.939	1.146
305	0.292	0.436
306	-1.139	-1.228
307	-2.613	1.178
308	0.437	-0.288
309	0.721	-0.047
310	1.645	0.725
311	1.494	0.055
312	0.283	-1.000
313	1.005	0.824
314	0.236	0.673
315	0.133	0.014
316	-0.902	-0.062
317	0.512	0.606
318	0.751	0.806
319	1.654	-0.951
320	-1.582	-0.876
321	0.698	0.476
322	-1.263	-1.200
323	1.415	0.572
324	-2.178	-1.251
325	-0.106	0.324
326	-1.950	-0.731
327	1.027	0.676
328	-0.497	0.931
329	0.994	-1.177
330	1.630	-0.395
331	-0.332	2.030
332	-0.334	0.019
333	-0.098	-0.188
334	0.691	0.343
335	0.675	0.525
336	1.125	1.314
337	0.675	-1.104
338	1.493	1.676
339	1.339	-1.215
340	0.867	0.309
341	-2.210	0.078
342	-1.582	-0.586
343	-0.493	0.106
344	0.798	0.434
345	-0.163	1.158
346	0.326	0.225
347	0.424	-0.015
348	0.918	0.921
349	-0.415	1.266
350	-1.451	-1.056
351	-0.773	-0.499
352	0.223	0.660
353	0.607	-0.412
354	0.295	0.971
355	-0.941	0.034
356	0.190	-0.309
357	-1.409	0.763
358	-0.913	-2.216
359	0.649	-2.575
360	1.119	-0.343
361	0.179	-0.524
362	0.744	-0.484
363	1.374	1.608
364	1.439	0.773
365	0.954	0.676
366	-0.276	-2.011
367	-0.066	-0.098
368	-1.438	-0.137
369	0.608	-0.277
370	0.661	0.671

371	-2.326	-0.831
372	-0.540	0.095
373	-1.116	0.735
374	0.753	-1.041
375	-1.200	0.708
376	1.374	1.608
377	-0.051	2.320
378	-2.367	-1.143
379	1.056	1.307
380	0.694	0.476
381	-0.221	-0.293
382	1.055	-0.763
383	1.632	-0.181
384	-0.669	-0.222
385	1.548	1.454
386	0.085	-0.252
387	0.737	0.538
388	1.485	1.130
389	0.963	0.245
390	-1.014	-0.078
391	-1.014	-0.078
392	0.830	0.761
393	0.937	1.040
394	-0.936	0.753
395	-1.916	0.651
396	-1.389	-0.537
397	1.258	-0.346
398	1.354	-0.309
399	0.893	-1.308
400	-0.799	0.826
401	0.891	1.268
402	0.699	1.005
403	-0.348	-0.149
404	1.266	-0.734
405	-0.998	-0.714
406	-0.695	-1.089
407	-0.491	-0.246
408	1.368	-0.807
409	0.746	1.608
410	-0.402	1.636
411	1.446	-0.822
412	0.924	0.759
413	1.764	-0.884
414	0.599	-1.165
415	-0.452	1.258
416	1.698	0.421
417	-1.695	1.370
418	-0.385	-0.479
419	-0.682	-0.996
420	0.808	-0.036
421	0.968	0.274
422	0.305	-1.583
423	-0.489	0.193
424	0.116	-2.509
425	-1.439	-0.125
426	1.240	-1.629
427	0.435	1.632
428	0.356	-0.689
429	-1.968	-3.321
430	0.835	-0.451
431	-0.228	-2.301
432	0.835	0.967
433	1.355	2.224
434	1.004	0.507
435	-0.622	-2.621
436	-0.518	-0.971
437	1.338	0.350
438	-0.290	-1.408
439	-1.411	-2.211
440	1.693	0.919
441	-1.698	0.597
442	-0.522	0.293
443	0.772	0.502
444	1.087	0.534

445	-1.430	0.526
446	-2.164	0.344
447	-0.816	-0.402
448	-0.350	-0.079
449	-0.319	-0.301
450	-0.226	0.470
451	1.203	1.326
452	0.292	-0.214
453	-1.149	-2.177
454	0.203	0.760
455	-1.854	-1.266
456	-1.634	-0.631
457	-0.223	-0.422
458	-0.705	-1.007
459	-0.631	0.329
460	-0.997	-0.415
461	-0.362	0.274
462	0.431	1.165
463	-0.802	0.137
464	-0.374	-1.232
465	1.752	0.433
466	-0.954	-0.550
467	0.290	-0.429
468	-1.196	1.822
469	-0.541	0.826
470	-0.264	0.334
471	-0.017	1.044
472	0.229	-0.108
473	0.264	-0.739
474	0.759	1.456
475	-1.751	-0.628
476	-0.536	-1.205
477	-0.702	-1.008
478	-0.066	-0.444
479	0.150	-0.652
480	1.749	2.074
481	-2.396	-2.128
482	-1.256	1.243
483	1.360	2.029
484	-0.981	-2.049
485	0.491	-0.243
486	-0.354	-1.595
487	-0.555	1.253
488	0.650	-2.722
489	-1.610	-2.051
490	1.214	0.503
491	-0.059	1.735
492	-1.080	-0.783
493	0.560	-0.638
494	-0.003	-0.241
495	1.206	-0.634
496	-2.873	0.491
497	0.694	-1.536
498	-0.256	1.640
499	-0.682	0.149
500	-0.654	0.659

PERSON-FIT INDICES
Ferrando (2009)

Please note that Ferrando's Person-Fit Indices can be only safely interpreted
for continuous variables

Summary Statistics for Person Fit Indices

Smallest = -2.1821
 Largest = 11.3196

Cases with large Person-Fit Indices (Absolute value larger than 2.99)

Case	Lc
2	3.086
16	3.179
18	4.107
19	4.974
20	6.772
21	4.615
34	3.409
49	3.852
57	4.818
61	4.802
62	3.712
64	4.036
79	4.532
83	4.947
88	3.185
90	4.536
93	4.722
99	3.418
101	4.398
106	3.985
110	4.116
114	5.430
115	4.005
125	6.084
132	3.323
134	4.060
136	3.395
138	3.021
141	5.246
150	8.192
152	4.754
153	3.031
167	3.473
184	5.431
190	4.264
191	3.045
193	3.795
195	11.320
196	5.820
198	3.102
199	6.012
211	3.211
217	3.726
220	3.121
227	4.182
230	3.454
231	7.802
240	6.549
257	4.403
259	3.279
270	3.025
271	3.967
277	4.911
292	3.798
298	4.294
300	6.209
307	3.327
312	3.194
316	3.089
320	6.210
321	4.376
322	8.144
326	3.176
330	5.162
336	3.667
337	4.642
339	5.422
342	3.504
347	3.128
351	3.619
357	4.162
364	3.013

367	5.326
371	6.386
378	4.377
384	4.799
386	4.509
389	4.082
395	4.380
399	4.866
402	5.581
403	4.070
412	3.805
416	4.787
417	6.269
418	8.198
423	4.045
424	4.647
425	3.179
429	3.054
434	5.211
435	5.691
436	5.287
437	3.261
438	4.719
439	3.240
440	4.807
441	6.353
444	3.793
445	3.941
448	4.308
449	6.211
454	3.913
455	3.411
456	3.521
459	7.876
460	7.816
465	3.339
469	5.772
470	5.807
471	3.156
473	3.084
476	3.289
479	3.413
481	3.571
484	4.496
486	3.392
494	3.151
496	4.192
498	3.622
499	4.793

Person-Fit Indices for individuals

Case	Lc
1	-0.809
2**	3.086
3	0.842
4	2.334
5	0.472
6	-0.789
7	0.476
8	-0.185
9	-0.233
10	0.472
11	1.670
12	2.015
13	0.228
14	-0.643
15	0.722
16**	3.179
17	2.317
18**	4.107
19**	4.974

20**	6.772
21**	4.615
22	-1.110
23	1.835
24	-0.845
25	2.843
26	2.026
27	0.878
28	-0.026
29	-0.230
30	1.875
31	2.701
32	0.059
33	2.975
34**	3.409
35	0.873
36	-1.797
37	-0.985
38	1.321
39	1.067
40	-0.701
41	0.599
42	0.078
43	-0.098
44	-1.029
45	0.641
46	-0.375
47	1.402
48	1.498
49**	3.852
50	1.369
51	0.179
52	0.138
53	1.147
54	0.911
55	1.199
56	-0.532
57**	4.818
58	2.318
59	1.830
60	0.703
61**	4.802
62**	3.712
63	1.159
64**	4.036
65	0.852
66	0.233
67	1.700
68	0.359
69	-0.611
70	-2.055
71	1.691
72	0.434
73	1.023
74	-0.032
75	-1.917
76	0.288
77	1.591
78	1.130
79**	4.532
80	-1.212
81	1.719
82	0.367
83**	4.947
84	1.265
85	-0.621
86	0.726
87	0.133
88**	3.185
89	1.172
90**	4.536
91	2.625
92	-0.721
93**	4.722

94	-0.777
95	0.480
96	2.185
97	-1.159
98	0.652
99**	3.418
100	1.606
101**	4.398
102	2.814
103	-0.038
104	0.244
105	1.336
106**	3.985
107	-1.448
108	1.820
109	1.578
110**	4.116
111	0.448
112	-1.217
113	2.017
114**	5.430
115**	4.005
116	1.943
117	1.313
118	1.131
119	0.913
120	0.466
121	2.602
122	0.957
123	-0.880
124	-0.215
125**	6.084
126	1.016
127	2.381
128	0.299
129	-0.804
130	-0.184
131	0.956
132**	3.323
133	-0.474
134**	4.060
135	0.051
136**	3.395
137	0.900
138**	3.021
139	-0.942
140	0.353
141**	5.246
142	2.816
143	2.277
144	0.662
145	0.099
146	0.771
147	-0.490
148	0.288
149	0.570
150**	8.192
151	-0.113
152**	4.754
153**	3.031
154	0.979
155	0.034
156	-0.319
157	0.603
158	1.167
159	-0.307
160	-0.374
161	0.052
162	0.866
163	-1.928
164	1.870
165	-1.809
166	1.527
167**	3.473

168	-1.610
169	2.367
170	0.033
171	0.179
172	2.295
173	2.297
174	2.515
175	0.354
176	1.358
177	0.831
178	1.445
179	2.794
180	-0.299
181	2.431
182	-0.456
183	2.968
184**	5.431
185	0.030
186	2.861
187	1.249
188	0.685
189	2.861
190**	4.264
191**	3.045
192	0.999
193**	3.795
194	-0.379
195**	11.320
196**	5.820
197	2.177
198**	3.102
199**	6.012
200	-1.658
201	2.046
202	-0.062
203	2.348
204	1.570
205	1.001
206	-0.041
207	2.522
208	0.140
209	2.978
210	-0.353
211**	3.211
212	2.784
213	1.483
214	-0.802
215	2.257
216	-0.381
217**	3.726
218	0.436
219	-1.123
220**	3.121
221	0.761
222	1.076
223	0.317
224	1.966
225	-0.643
226	1.526
227**	4.182
228	0.193
229	1.494
230**	3.454
231**	7.802
232	-1.342
233	2.440
234	0.712
235	0.363
236	1.040
237	0.301
238	1.351
239	1.548
240**	6.549
241	-0.151

242	-0.884
243	0.586
244	0.430
245	-1.651
246	0.225
247	0.731
248	-0.672
249	1.150
250	-1.384
251	2.777
252	1.823
253	1.175
254	-0.708
255	-0.192
256	-0.370
257**	4.403
258	1.052
259**	3.279
260	0.205
261	2.535
262	0.086
263	2.479
264	0.225
265	2.737
266	-1.497
267	-0.341
268	-0.514
269	1.865
270**	3.025
271**	3.967
272	-0.979
273	0.784
274	0.696
275	1.128
276	-1.479
277**	4.911
278	2.735
279	-0.112
280	1.480
281	0.122
282	1.092
283	0.833
284	0.661
285	1.426
286	2.795
287	1.916
288	2.171
289	1.760
290	-0.551
291	0.519
292**	3.798
293	-0.893
294	2.175
295	2.123
296	0.147
297	0.527
298**	4.294
299	0.779
300**	6.209
301	0.964
302	2.114
303	2.814
304	-0.913
305	1.043
306	0.899
307**	3.327
308	2.187
309	1.590
310	-0.739
311	-0.567
312**	3.194
313	0.061
314	0.239
315	0.824

316** 3.089
317 1.655
318 1.433
319 0.130
320** 6.210
321** 4.376
322** 8.144
323 2.704
324 2.973
325 1.767
326** 3.176
327 -1.014
328 -0.146
329 1.469
330** 5.162
331 0.847
332 2.390
333 2.131
334 -0.825
335 1.886
336** 3.667
337** 4.642
338 -0.075
339** 5.422
340 2.348
341 2.401
342** 3.504
343 2.222
344 2.112
345 1.335
346 1.032
347** 3.128
348 0.658
349 0.217
350 1.882
351** 3.619
352 2.400
353 0.108
354 1.337
355 2.580
356 2.035
357** 4.162
358 2.731
359 1.100
360 0.022
361 1.468
362 0.820
363 2.494
364** 3.013
365 0.254
366 0.702
367** 5.326
368 2.967
369 0.576
370 1.028
371** 6.386
372 1.590
373 -0.213
374 2.551
375 0.479
376 2.494
377 1.291
378** 4.377
379 -0.267
380 -0.743
381 -0.029
382 2.788
383 2.833
384** 4.799
385 -1.705
386** 4.509
387 -2.182
388 -0.343
389** 4.082

390	1.159
391	1.159
392	0.875
393	-0.094
394	1.233
395**	4.380
396	2.489
397	-1.024
398	0.553
399**	4.866
400	-0.117
401	1.759
402**	5.581
403**	4.070
404	0.468
405	2.747
406	1.802
407	2.927
408	-0.423
409	1.447
410	0.404
411	-0.102
412**	3.805
413	2.109
414	0.707
415	1.497
416**	4.787
417**	6.269
418**	8.198
419	2.435
420	1.439
421	-0.423
422	1.272
423**	4.045
424**	4.647
425**	3.179
426	-1.134
427	-0.437
428	1.441
429**	3.054
430	2.006
431	2.579
432	-0.484
433	0.756
434**	5.211
435**	5.691
436**	5.287
437**	3.261
438**	4.719
439**	3.240
440**	4.807
441**	6.353
442	1.030
443	2.719
444**	3.793
445**	3.941
446	0.627
447	2.439
448**	4.308
449**	6.211
450	2.297
451	-0.593
452	2.238
453	1.092
454**	3.913
455**	3.411
456**	3.521
457	2.525
458	1.577
459**	7.876
460**	7.816
461	-0.222
462	0.695
463	2.523

464	-0.433
465**	3.339
466	2.559
467	-0.232
468	1.583
469**	5.772
470**	5.807
471**	3.156
472	2.239
473**	3.084
474	-1.248
475	1.489
476**	3.289
477	1.320
478	0.629
479**	3.413
480	-0.636
481**	3.571
482	2.409
483	-0.886
484**	4.496
485	2.858
486**	3.392
487	1.218
488	0.039
489	2.078
490	-0.720
491	0.910
492	0.282
493	1.847
494**	3.151
495	1.757
496**	4.192
497	0.591
498**	3.622
499**	4.793
500	1.644

**: Individual with a large Person-Fit Index value

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Anderson, E., Bai, Z., Bischof, C., Blackford, S., Demmel, J., Dongarra, J., Du Croz, J., Greenbaum, A., Hammarling, S., McKenney, A., & Sorensen, D. (1999). LAPACK Users' Guide. Society for Industrial and Applied Mathematics. Philadelphia, PA

FACTOR can be refered as:
Lorenzo-Seva, U., & Ferrando, P.J. (2006). FACTOR: A computer program to fit the exploratory factor analysis model.Behavioral Research Methods, Instruments and Computers, 38(1), 88-91.

FACTOR completed

Computing time   : 5.35 minutes.
Matrices generated : 7074871

Free download

Factor is a freeware program developed at the Rovira i Virgili University. Users are invited to download a DEMO and the program:

- Download the demo
- Download the program
- Manual of Factor 8.10 by Dr. G. Visco (Chemistry Department, Rome University, Italy)
- Manual del programa Factor 8.02 elaborado en español por Sergio Dominguez, Graciela Villegas y Noemi Sotelo (Facultad de Psicología y Trabajo Social, Universidad Inca Garcilaso de la Vega, Perú).

If you work with Excel, the following file can be used to preprocess the data file. Please note that that you must allow macros when opening the preprocessing.xls file:

- Download the preprocessing Excel file

We would greatly appreciate any suggestions for future improvements. Detailed reports of failures are also welcome.

Version of the program: 8.10 (April, 2012)
This version implements:
- Greatest lower bound (glb) to reliability, and McDonald's Omega reliability index.
- GFI and AGFI are computed excluding the diagonal values of the variance/covariance matrix.
- Algorithm 462: Bivariate Normal Distribution by Donnelly (1973) is used to compute polychoric correlation matrix. In addition, polychoric correlation matrix is computed with more demanding convergence values.
- Tetrachoric correlation matrix is computed based on AS116 algorithm. This algorithm is more accurate accurate than the algorithm provided in previous versions of the program.
- Technical revisions to solve different errors that halted the analysis and that were reported by users.

Version of the program: 8.02 (March, 2011)
This version implements:
- A more friendly user reading data implementation. ASCII format data files can be separated using different characters, and missing values are eliminated from the data.
- Variable labels are allowed.
- The ouput data file can be specified.
- New analysis are implemented: Optimal Parallel Analysis, Hull method, and Person fit indices.
- Some analysis have been improved. For example, the polychoric correlations matrix is checked to be positive definite and smoothed (if necessary), and the non-convergent coefficients are changed by the corresponding Pearson coefficient.
- Technical revisions to solve different errors that halted the analysis and that were reported by users.

Version of the program: 7.00 (January, 2007)
This version implements:
- Univariate mean, variance, skewness, and kurtosis.
- Multivariate skewness and kurtosis (Mardia, 1970).

- Var charts for ordinal variables.
- Polychoric correlation matrix with optional Ridge estimates.
- Structure matrix in oblique factor solutions.
- Schmid-Leiman second-order solution (1957).
- Mean, variance and histogram of fitted and standardised residuals. Automatic detection of large standardised residuals.

In addition, a bug that halted the program during the execution has been detected and corrected.

Version of the program: 6.02 (June, 2006)
This version implements PA - MBS. It is an extension of Parallel Analysis that generates random correlation matrices using marginally bootstrapped samples (Lattin, Carroll, & Green, 2003).

In addition, indices of asymmetry and kurtosis related to the variables are computed. The inspection of these indices helps to decide if polychoric correlation is to be computed when ordinal variables are analysed.

Version of the program: 6.01 (March, 2005)
This version implements the selection of variables to be included and excluded in the analysis.

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