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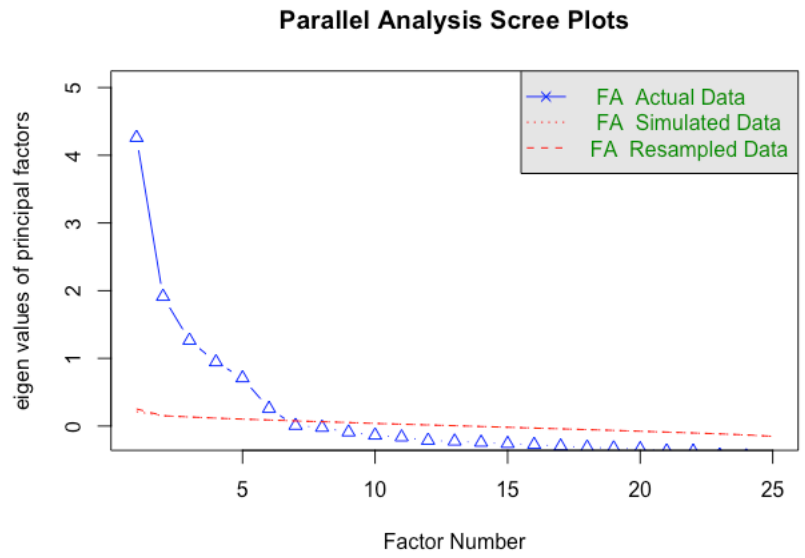
Educational and Psychological Measurement

EFA Project

The parallel analysis revealed that six factors surpassed the corresponding eigenvalues obtained from simulated random data. Consequently, based on the parallel analysis results, it is suggested that a six-factor solution may be appropriate for interpreting the underlying structure of the personality items.



3.

I ran exploratory factor analysis (EFA) for 4, 5, 6 and 7 factors using R studio (version 3). Here is the summary about the factor loadings, communalities, and interfactor correlations in order to determine the best model:

Communality - As we increase the number of factors, the communalities generally show an increasing trend, indicating that more factors are accounting for the variance in the variables.

Variables like x5_angry, x8_irritated, x9_approach, and x17_friends consistently show high communalities across models, suggesting their significance in multiple factors.

Most communalities are between .3 and .6 indicating that the factors are able to account for a good chunk of the variability in the item responses.

Factor Loading - The 6-factor model maintains a good balance between simplicity and interpretability. To determine the optimal structure, I considered the clarity of factor loadings and aimed to minimize cross-loading. I used a cutoff of 0.3 for factor loadings, considering loadings below this threshold as low. Items with loadings consistently above 0.3 on a single factor were considered well-defined.

Factor Correlation – Cumulative variance for 6-factor-model was the highest (41%). The correlation coefficients between factors range from -0.248 to 0.299, indicating moderate correlations. Notably, the correlations between Factor 2 (Social Engagement) and other factors are negative, suggesting a certain degree of orthogonality. Similarly, Factor 6 (Assertiveness) exhibits negative correlations with other factors. These findings imply that the factors in the 6-factor model are tapping into distinct yet correlated subconstructs.

Table 1 *Standardized factor loading estimates, communalities, and factor correlations of six-factor EFA (N = 2,800).*

Indicator	*Affective Instability*	*Social Engagement*	*Strategic Planning*	*Sociability*	*Intellectual Curiosity*	*Assertiveness*	h^2
item1					0.445	0.409	0.369
item2				0.559			0.338
item3			0.541				0.342
item4		0.594					0.391
item5	0.837						0.681
item6				0.682			0.496
item7					0.573		0.351
item8	0.833						0.662
item9		0.695					0.561
item10			0.673		0.397		0.494
item11		0.342					0.480
item12	0.673						0.540
item13	0.429	-0.417					0.487
item14				0.613			0.510
item15				0.391			0.275
item16					0.359		0.293
item17		0.535				0.359	0.551
item18			0.554				0.310
item19				0.451			0.475
item20			0.643			0.303	0.567
item21			0.543				0.427
item22		0.399					0.397
item23	0.438						0.348
item24					0.653		0.480
item25		-0.350			0.375		0.253

Interfactor Correlation						
Affective Instability	1.00					
Social Engagement	-0.248	1.00				
Strategic Planning	-0.184	0.212	1.00			
Sociability	-0.101	0.299	0.187	1.00		
Intellectual Curiosity	0.017	0.196	0.189	0.246	1.00	
Assertiveness	-0.156	-0.078	0.020	-0.144	-0.019	1.00

Shown loadings are > cutoff value of 0.3. The total variance explained by the six factors was 41.0%.

R code and output

Code:

```
## 2. locating the data

HSdata <- assign5


## 3. Running the Parallel analysis

fa.parallel(HSdata, fa = "fa", n.iter = 50)


## EFA four factors

efa_fourf <- fa(HSdata, nfactors = 4, fm = "minres", rotate = "oblimin")
print(efa_fourf)
```

Output:

```
Factor Analysis using method =  minres
Call: fa(r = HSdata, nfactors = 4, rotate = "oblimin", fm = "minres")
Standardized loadings (pattern matrix) based upon correlation matrix
```

	MR1	MR2	MR3	MR4	h2	u2	com
x1_probe	-0.10	-0.09	0.04	0.54	0.291	0.71	1.1
x2_feel	0.20	-0.09	-0.02	0.02	0.056	0.94	1.4
x3_exact	-0.03	0.05	0.54	0.15	0.328	0.67	1.2
x4_talk	0.51	-0.03	-0.14	0.10	0.276	0.72	1.2
x5_angry	0.01	0.74	-0.01	-0.03	0.551	0.45	1.0
x6_wellbeing	0.52	0.08	0.12	-0.01	0.299	0.70	1.2
x7_ideas	0.12	0.02	0.07	0.50	0.315	0.69	1.2
x8_irritated	-0.02	0.73	0.01	0.02	0.542	0.46	1.0
x9_approach	0.56	-0.22	-0.04	0.07	0.418	0.58	1.3
x10_perfect	0.01	0.15	0.67	0.03	0.454	0.55	1.1
x11_captivate	0.57	0.06	-0.02	0.27	0.441	0.56	1.5
x12_moodswing	0.02	0.75	-0.01	0.01	0.563	0.44	1.0
x13_sad	-0.21	0.58	-0.08	0.06	0.443	0.56	1.3
x14_comfort	0.63	0.06	0.06	-0.01	0.406	0.59	1.0
x15_younger	0.41	-0.01	0.21	-0.17	0.243	0.76	1.9
x16_reading	-0.18	-0.20	0.07	0.47	0.264	0.74	1.7
x17_friends	0.72	-0.06	-0.01	-0.09	0.505	0.49	1.0
x18_plan	0.03	0.03	0.57	-0.07	0.319	0.68	1.0
x19_ease	0.63	-0.06	0.02	0.01	0.429	0.57	1.0
x20_halfway	-0.04	-0.21	0.60	0.06	0.453	0.55	1.3
x21_timewaste	0.09	-0.25	0.52	-0.08	0.410	0.59	1.6
x22_charge	0.39	0.07	0.23	0.21	0.340	0.66	2.3
x23_panic	0.03	0.56	0.03	-0.17	0.335	0.66	1.2
x24_convo	0.22	0.05	0.01	0.60	0.471	0.53	1.3
x25_reflect	-0.08	0.24	0.03	0.32	0.154	0.85	2.0

	MR1	MR2	MR3	MR4
SS loadings	3.14	2.68	1.96	1.53
Proportion Var	0.13	0.11	0.08	0.06
Cumulative Var	0.13	0.23	0.31	0.37
Proportion Explained	0.34	0.29	0.21	0.16

Cumulative Proportion 0.34 0.62 0.84 1.00

With factor correlations of

	MR1	MR2	MR3	MR4
MR1	1.00	-0.19	0.27	0.22
MR2	-0.19	1.00	-0.18	-0.05
MR3	0.27	-0.18	1.00	0.18
MR4	0.22	-0.05	0.18	1.00

Mean item complexity = 1.3
Test of the hypothesis that 4 factors are sufficient.

df null model = 300 with the objective function = 7.23 with Chi Square = 20163.79
df of the model are 206 and the objective function was 1.23

The root mean square of the residuals (RMSR) is 0.05
The df corrected root mean square of the residuals is 0.06

The harmonic n.obs is 2762 with the empirical chi square 3555.08 with prob < 0
The total n.obs was 2800 with Likelihood Chi Square = 3421.61 with prob < 0

Tucker Lewis Index of factoring reliability = 0.764
RMSEA index = 0.075 and the 90 % confidence intervals are 0.072 0.077
BIC = 1786.51
Fit based upon off diagonal values = 0.95
Measures of factor score adequacy

	MR1	MR2	MR3	MR4
Correlation of (regression) scores with factors	0.92	0.92	0.87	0.84
Multiple R square of scores with factors	0.84	0.84	0.76	0.70
Minimum correlation of possible factor scores	0.68	0.68	0.52	0.40

Input:

```
round(efa_fourf$communalities, digits = 3)
print(efa_fourf$loadings, cutoff = .3)
round(efa_fourf$Phi, digits = 3)
```

Output:

```
round(efa_fourf$communalities, digits = 3)
    x1_probe      x2_feel     x3_exact      x4_talk     x5_angry  x6_wellbeing      x7_ideas
       0.291        0.056        0.328        0.276        0.551        0.299        0.315
 x8_irritated   x9_approach   x10_perfect x11_captivate x12_moodswing      x13_sad   x14_comfort
       0.542        0.418        0.454        0.441        0.563        0.443        0.406
  x15_younger   x16_reading   x17_friends      x18_plan     x19_ease   x20_halfway x21_timewaste
       0.243        0.264        0.505        0.319        0.429        0.453        0.410
   x22_charge     x23_panic     x24_convo   x25_reflect
       0.340        0.335        0.471        0.154
```

```
print(efa_fourf$loadings, cutoff = .3)

Loadings:
            MR1    MR2    MR3    MR4
x1_probe                    0.535
x2_feel
x3_exact                0.542
x4_talk       0.511
x5_angry            0.741
x6_wellbeing  0.517
x7_ideas                    0.504
x8_irritated        0.734
```

```
x9_approach    0.560
x10_perfect                0.674
x11_captivate  0.566
x12_moodswing         0.753
x13_sad              0.575
x14_comfort    0.631
x15_younger    0.410
x16_reading                      0.468
x17_friends    0.716
x18_plan                  0.570
x19_ease       0.635
x20_halfway                0.602
x21_timewaste              0.520
x22_charge     0.394
x23_panic            0.559
x24_convo                        0.602
x25_reflect                      0.320

                MR1   MR2   MR3   MR4
SS loadings    3.007 2.623 1.860 1.464
Proportion Var 0.120 0.105 0.074 0.059
Cumulative Var 0.120 0.225 0.300 0.358
> round(efa_fourf$Phi, digits = 3)
       MR1    MR2    MR3    MR4
MR1  1.000 -0.189  0.275  0.224
MR2 -0.189  1.000 -0.178 -0.048
MR3  0.275 -0.178  1.000  0.184
MR4  0.224 -0.048  0.184  1.000
```

Input:

EFA five factors

```
efa_fivef <- fa(HSdata, nfactors = 5, fm = "minres", rotate = "oblimin")
print(efa_fivef)
```

Output:

```
Factor Analysis using method =  minres
Call: fa(r = HSdata, nfactors = 5, rotate = "oblimin", fm = "minres")
Standardized loadings (pattern matrix) based upon correlation matrix
                MR2   MR1   MR3   MR5   MR4   h2   u2 com
x1_probe      -0.13 -0.10  0.03 -0.04  0.54 0.30 0.70 1.2
x2_feel       -0.21 -0.17 -0.07  0.41  0.06 0.19 0.81 2.0
x3_exact       0.07 -0.03  0.55 -0.02  0.15 0.33 0.67 1.2
x4_talk        0.06  0.56 -0.11  0.08  0.10 0.35 0.65 1.2
x5_angry       0.81  0.10  0.00 -0.11 -0.05 0.65 0.35 1.1
x6_wellbeing  -0.02  0.00  0.08  0.64  0.03 0.45 0.55 1.0
x7_ideas       0.02  0.10  0.07  0.02  0.51 0.31 0.69 1.1
x8_irritated   0.78  0.04  0.01 -0.09  0.01 0.60 0.40 1.0
x9_approach   -0.10  0.68  0.02  0.05  0.06 0.54 0.46 1.1
x10_perfect    0.15 -0.09  0.67  0.08  0.04 0.45 0.55 1.2
x11_captivate  0.08  0.42  0.00  0.25  0.28 0.44 0.56 2.6
x12_moodswing  0.71 -0.10 -0.04  0.08  0.02 0.55 0.45 1.1
x13_sad        0.47 -0.39 -0.14  0.09  0.08 0.49 0.51 2.3
x14_comfort   -0.03  0.12  0.02  0.66  0.03 0.52 0.48 1.1
x15_younger   -0.06  0.06  0.19  0.43 -0.15 0.28 0.72 1.7
x16_reading   -0.19 -0.06  0.08 -0.16  0.46 0.26 0.74 1.7
x17_friends    0.01  0.59  0.02  0.29 -0.08 0.53 0.47 1.5
x18_plan       0.03 -0.06  0.57  0.09 -0.07 0.32 0.68 1.1
x19_ease      -0.11  0.23  0.01  0.53  0.04 0.46 0.54 1.5
```

```
x20_halfway   -0.17  0.00  0.61 -0.04  0.05 0.45 0.55 1.2
x21_timewaste -0.19  0.14  0.55 -0.02 -0.09 0.43 0.57 1.4
x22_charge     0.15  0.42  0.27  0.05  0.21 0.40 0.60 2.6
x23_panic      0.49 -0.20  0.00  0.21 -0.15 0.35 0.65 2.0
x24_convo      0.03  0.15  0.02  0.08  0.61 0.46 0.54 1.2
x25_reflect    0.13 -0.32 -0.02  0.17  0.37 0.25 0.75 2.7

                       MR2  MR1  MR3  MR5  MR4
SS loadings           2.57 2.20 2.03 1.99 1.59
Proportion Var        0.10 0.09 0.08 0.08 0.06
Cumulative Var        0.10 0.19 0.27 0.35 0.41
Proportion Explained  0.25 0.21 0.20 0.19 0.15
Cumulative Proportion 0.25 0.46 0.66 0.85 1.00

 With factor correlations of
     MR2   MR1   MR3   MR5   MR4
MR2  1.00 -0.21 -0.19 -0.04 -0.01
MR1 -0.21  1.00  0.23  0.33  0.17
MR3 -0.19  0.23  1.00  0.20  0.19
MR5 -0.04  0.33  0.20  1.00  0.19
MR4 -0.01  0.17  0.19  0.19  1.00

Mean item complexity =  1.5
Test of the hypothesis that 5 factors are sufficient.

df null model =  300  with the objective function =  7.23 with Chi Square =  20163.79
df of  the model are 185  and the objective function was  0.65

The root mean square of the residuals (RMSR) is  0.03
The df corrected root mean square of the residuals is  0.04

The harmonic n.obs is  2762 with the empirical chi square  1392.16  with prob <  5.6e-184
```

The total n.obs was 2800 with Likelihood Chi Square = 1808.94 with prob < 4.3e-264

Tucker Lewis Index of factoring reliability = 0.867
RMSEA index = 0.056 and the 90 % confidence intervals are 0.054 0.058
BIC = 340.53
Fit based upon off diagonal values = 0.98
Measures of factor score adequacy

	MR2	MR1	MR3	MR5	MR4
Correlation of (regression) scores with factors	0.92	0.89	0.88	0.88	0.84
Multiple R square of scores with factors	0.85	0.79	0.77	0.77	0.71
Minimum correlation of possible factor scores	0.70	0.59	0.54	0.54	0.42

Input:

```
round(efa_fivef$communalities, digits = 3)
print(efa_fivef$loadings, cutoff = .3)
round(efa_fivef$Phi, digits = 3)
```

Output:

```
round(efa_fivef$communalities, digits = 3)
    x1_probe      x2_feel     x3_exact      x4_talk     x5_angry  x6_wellbeing      x7_ideas
       0.300        0.192        0.330        0.348        0.652        0.447        0.313
 x8_irritated   x9_approach   x10_perfect x11_captivate x12_moodswing      x13_sad   x14_comfort
       0.600        0.544        0.450        0.439        0.547        0.488        0.523
  x15_younger   x16_reading   x17_friends      x18_plan      x19_ease   x20_halfway x21_timewaste
       0.280        0.257        0.531        0.318        0.464        0.451        0.427
   x22_charge     x23_panic     x24_convo   x25_reflect
       0.403        0.350        0.464        0.251
> print(efa_fivef$loadings, cutoff = .3)
```

Loadings:

	MR2	MR1	MR3	MR5	MR4
x1_probe				0.542	
x2_feel			0.414		
x3_exact			0.546		
x4_talk		0.557			
x5_angry		0.815			
x6_wellbeing				0.640	
x7_ideas				0.508	
x8_irritated		0.777			
x9_approach		0.676			
x10_perfect			0.666		
x11_captivate		0.418			
x12_moodswing		0.706			
x13_sad		0.474	-0.386		
x14_comfort				0.660	
x15_younger				0.433	
x16_reading					0.456
x17_friends		0.591			
x18_plan			0.567		
x19_ease				0.532	
x20_halfway			0.614		
x21_timewaste			0.553		
x22_charge		0.421			
x23_panic		0.486			
x24_convo					0.609
x25_reflect		-0.323			0.371

	MR2	MR1	MR3	MR5	MR4
SS loadings	2.499	1.964	1.913	1.805	1.511
Proportion Var	0.100	0.079	0.077	0.072	0.060
Cumulative Var	0.100	0.179	0.255	0.327	0.388

```
> round(efa_fivef$Phi, digits = 3)
      MR2    MR1    MR3    MR5    MR4
MR2  1.000 -0.213 -0.187 -0.038 -0.011
MR1 -0.213  1.000  0.230  0.329  0.167
MR3 -0.187  0.230  1.000  0.203  0.195
MR5 -0.038  0.329  0.203  1.000  0.193
MR4 -0.011  0.167  0.195  0.193  1.000
```

Input:

```
## EFA six factors

efa_sixf <- fa(HSdata, nfactors = 6, fm = "minres", rotate = "oblimin")
print(efa_sixf)
```

Output:

```
Factor Analysis using method =  minres
Call: fa(r = HSdata, nfactors = 6, rotate = "oblimin", fm = "minres")
Standardized loadings (pattern matrix) based upon correlation matrix
              MR2   MR1   MR3   MR5   MR4   MR6   h2   u2 com
x1_probe      -0.03 -0.04  0.02  0.04  0.45  0.41 0.37 0.63 2.0
x2_feel       -0.09 -0.09 -0.08  0.56 -0.06  0.30 0.34 0.66 1.7
x3_exact       0.01 -0.06  0.54 -0.06  0.19 -0.07 0.34 0.66 1.3
x4_talk        0.13  0.59 -0.11  0.12  0.08  0.09 0.39 0.61 1.3
x5_angry       0.84  0.10  0.01 -0.07 -0.05  0.00 0.68 0.32 1.0
x6_wellbeing   0.04  0.04  0.08  0.68  0.00  0.05 0.50 0.50 1.1
x7_ideas      -0.05  0.04  0.07 -0.05  0.57 -0.03 0.35 0.65 1.1
x8_irritated   0.83  0.06  0.02 -0.04 -0.01  0.07 0.66 0.34 1.0
```

```
x9_approach   -0.05  0.70  0.02  0.07  0.06  0.03 0.56 0.44 1.0
x10_perfect    0.07 -0.14  0.67  0.02  0.11 -0.17 0.49 0.51 1.3
x11_captivate  0.00  0.34  0.00  0.15  0.40 -0.21 0.48 0.52 2.9
x12_moodswing  0.67 -0.13 -0.03  0.07  0.05 -0.08 0.54 0.46 1.1
x13_sad        0.43 -0.42 -0.13  0.08  0.10 -0.05 0.49 0.51 2.4
x14_comfort   -0.02  0.12  0.03  0.61  0.07 -0.11 0.51 0.49 1.2
x15_younger   -0.07  0.06  0.19  0.39 -0.10 -0.15 0.28 0.72 2.1
x16_reading   -0.11  0.00  0.07 -0.09  0.36  0.36 0.29 0.71 2.4
x17_friends   -0.05  0.53  0.03  0.20  0.04 -0.29 0.55 0.45 1.9
x18_plan       0.01 -0.06  0.55  0.08 -0.04 -0.06 0.31 0.69 1.1
x19_ease      -0.16  0.19  0.01  0.45  0.13 -0.21 0.47 0.53 2.3
x20_halfway   -0.06  0.09  0.64  0.06 -0.07  0.30 0.57 0.43 1.5
x21_timewaste -0.15  0.18  0.54  0.01 -0.11  0.05 0.43 0.57 1.5
x22_charge     0.15  0.40  0.27  0.05  0.23 -0.01 0.40 0.60 2.8
x23_panic      0.44 -0.23  0.00  0.18 -0.10 -0.16 0.35 0.65 2.4
x24_convo     -0.02  0.09  0.02  0.03  0.65  0.02 0.48 0.52 1.1
x25_reflect    0.09 -0.35 -0.02  0.15  0.37  0.04 0.25 0.75 2.5

                       MR2  MR1  MR3  MR5  MR4  MR6
SS loadings           2.48 2.17 2.05 1.88 1.68 0.82
Proportion Var        0.10 0.09 0.08 0.08 0.07 0.03
Cumulative Var        0.10 0.19 0.27 0.34 0.41 0.44
Proportion Explained  0.22 0.20 0.18 0.17 0.15 0.07
Cumulative Proportion 0.22 0.42 0.60 0.77 0.93 1.00

 With factor correlations of
     MR2   MR1   MR3   MR5   MR4   MR6
MR2  1.00 -0.25 -0.18 -0.10  0.02 -0.16
MR1 -0.25  1.00  0.21  0.30  0.20 -0.08
MR3 -0.18  0.21  1.00  0.19  0.19  0.02
MR5 -0.10  0.30  0.19  1.00  0.25 -0.14
MR4  0.02  0.20  0.19  0.25  1.00 -0.02
```

MR6 -0.16 -0.08 0.02 -0.14 -0.02 1.00

Mean item complexity = 1.7
Test of the hypothesis that 6 factors are sufficient.

df null model = 300 with the objective function = 7.23 with Chi Square = 20163.79
df of the model are 165 and the objective function was 0.37

The root mean square of the residuals (RMSR) is 0.02
The df corrected root mean square of the residuals is 0.03

The harmonic n.obs is 2762 with the empirical chi square 639.91 with prob < 4.1e-57
The total n.obs was 2800 with Likelihood Chi Square = 1032.48 with prob < 1.8e-125

Tucker Lewis Index of factoring reliability = 0.92
RMSEA index = 0.043 and the 90 % confidence intervals are 0.041 0.046
BIC = -277.19
Fit based upon off diagonal values = 0.99
Measures of factor score adequacy

	MR2	MR1	MR3	MR5	MR4	MR6
Correlation of (regression) scores with factors	0.93	0.89	0.89	0.87	0.86	0.77
Multiple R square of scores with factors	0.86	0.79	0.78	0.76	0.73	0.59
Minimum correlation of possible factor scores	0.72	0.59	0.57	0.53	0.46	0.17

Input:

```
round(efa_sixf$communalities, digits = 3)
print(efa_sixf$loadings, cutoff = .3)
round(efa_sixf$Phi, digits = 3)
```

Output:

```
> round(efa_sixf$communalities, digits = 3)
    x1_probe       x2_feel      x3_exact       x4_talk      x5_angry  x6_wellbeing      x7_ideas
       0.369         0.338         0.342         0.391         0.681         0.496         0.351
 x8_irritated   x9_approach   x10_perfect x11_captivate x12_moodswing       x13_sad   x14_comfort
       0.662         0.561         0.494         0.480         0.540         0.487         0.510
  x15_younger   x16_reading   x17_friends      x18_plan      x19_ease   x20_halfway x21_timewaste
       0.275         0.293         0.551         0.310         0.475         0.567         0.427
   x22_charge     x23_panic     x24_convo   x25_reflect
       0.397         0.348         0.480         0.253
> print(efa_sixf$loadings, cutoff = .3)

Loadings:
            MR2    MR1    MR3    MR5    MR4    MR6
x1_probe                          0.445  0.409
x2_feel                    0.559
x3_exact                0.541
x4_talk             0.594
x5_angry       0.837
x6_wellbeing                    0.682
x7_ideas                          0.573
x8_irritated   0.833
x9_approach          0.695
x10_perfect             0.673
x11_captivate        0.342              0.397
x12_moodswing  0.673
x13_sad        0.429 -0.417
x14_comfort                     0.613
x15_younger                     0.391
x16_reading                           0.359  0.359
```

```
x17_friends          0.535
x18_plan                  0.554
x19_ease                        0.451
x20_halfway               0.643              0.303
x21_timewaste             0.543
x22_charge          0.399
x23_panic      0.438
x24_convo                            0.653
x25_reflect         -0.350             0.375

                MR2   MR1   MR3   MR5   MR4   MR6
SS loadings    2.365 1.923 1.929 1.695 1.575 0.775
Proportion Var 0.095 0.077 0.077 0.068 0.063 0.031
Cumulative Var 0.095 0.172 0.249 0.316 0.379 0.410
> round(efa_sixf$Phi, digits = 3)
      MR2    MR1    MR3    MR5    MR4    MR6
MR2  1.000 -0.248 -0.184 -0.101  0.017 -0.156
MR1 -0.248  1.000  0.212  0.299  0.196 -0.078
MR3 -0.184  0.212  1.000  0.187  0.189  0.020
MR5 -0.101  0.299  0.187  1.000  0.246 -0.144
MR4  0.017  0.196  0.189  0.246  1.000 -0.019
MR6 -0.156 -0.078  0.020 -0.144 -0.019  1.000
```

Input:

```
## EFA seven factors

efa_sevenf <- fa(HSdata, nfactors = 7, fm = "minres", rotate = "oblimin")
print(efa_sevenf)
```

Output:

```
> print(efa_sevenf)
Factor Analysis using method =  minres
Call: fa(r = HSdata, nfactors = 7, rotate = "oblimin", fm = "minres")
Standardized loadings (pattern matrix) based upon correlation matrix
                MR2   MR1   MR3   MR5   MR4   MR7   MR6   h2   u2 com
x1_probe      -0.04 -0.02  0.04  0.01  0.42  0.00  0.42 0.37 0.63 2.0
x2_feel       -0.12 -0.04 -0.06  0.50 -0.08  0.08  0.33 0.33 0.67 2.1
x3_exact      -0.01 -0.01  0.55 -0.07  0.18  0.07 -0.05 0.35 0.65 1.3
x4_talk        0.10  0.67 -0.07  0.02  0.04  0.01  0.16 0.44 0.56 1.2
x5_angry       0.84  0.01 -0.03 -0.02 -0.03 -0.02 -0.04 0.71 0.29 1.0
x6_wellbeing   0.07 -0.04  0.03  0.74  0.00 -0.05  0.05 0.53 0.47 1.0
x7_ideas       0.00 -0.04  0.04  0.03  0.60 -0.11 -0.07 0.38 0.62 1.1
x8_irritated   0.82 -0.02 -0.01  0.00  0.00  0.00  0.04 0.68 0.32 1.0
x9_approach   -0.03  0.68  0.03  0.01  0.03 -0.14  0.06 0.57 0.43 1.1
x10_perfect    0.02 -0.07  0.68  0.01  0.11  0.13 -0.15 0.50 0.50 1.3
x11_captivate  0.01  0.34 -0.01  0.16  0.38 -0.01 -0.17 0.48 0.52 2.8
x12_moodswing  0.53  0.05  0.01 -0.03  0.02  0.39  0.01 0.57 0.43 1.9
x13_sad        0.28 -0.22 -0.09 -0.01  0.08  0.42  0.03 0.51 0.49 2.6
x14_comfort   -0.02  0.09  0.00  0.64  0.07  0.01 -0.09 0.52 0.48 1.1
x15_younger   -0.08  0.07  0.18  0.39 -0.10  0.03 -0.13 0.27 0.73 2.0
x16_reading   -0.10 -0.01  0.09 -0.10  0.34 -0.06  0.35 0.29 0.71 2.6
x17_friends   -0.10  0.65  0.06  0.11  0.00  0.10 -0.21 0.60 0.40 1.4
x18_plan       0.03 -0.10  0.53  0.12 -0.03 -0.05 -0.09 0.31 0.69 1.3
x19_ease      -0.17  0.23  0.00  0.44  0.12  0.05 -0.16 0.47 0.53 2.4
x20_halfway   -0.05  0.08  0.66  0.02 -0.09 -0.08  0.29 0.58 0.42 1.5
x21_timewaste -0.11  0.11  0.53  0.03 -0.10 -0.17  0.01 0.42 0.58 1.5
x22_charge     0.26  0.21  0.21  0.16  0.26 -0.31 -0.09 0.45 0.55 5.4
x23_panic      0.29 -0.02  0.04  0.07 -0.14  0.43 -0.07 0.39 0.61 2.1
x24_convo     -0.04  0.14  0.02  0.02  0.63  0.06  0.06 0.48 0.52 1.1
```

x25_reflect 0.03 -0.26 -0.02 0.14 0.36 0.20 0.07 0.25 0.75 2.9

	MR2	MR1	MR3	MR5	MR4	MR7	MR6
SS loadings	2.18	2.01	2.00	1.88	1.63	1.02	0.74
Proportion Var	0.09	0.08	0.08	0.08	0.07	0.04	0.03
Cumulative Var	0.09	0.17	0.25	0.32	0.39	0.43	0.46
Proportion Explained	0.19	0.18	0.17	0.16	0.14	0.09	0.06
Cumulative Proportion	0.19	0.37	0.54	0.70	0.85	0.94	1.00

With factor correlations of

	MR2	MR1	MR3	MR5	MR4	MR7	MR6
MR2	1.00	-0.15	-0.14	-0.13	0.01	0.38	-0.10
MR1	-0.15	1.00	0.18	0.43	0.24	-0.30	-0.14
MR3	-0.14	0.18	1.00	0.24	0.20	-0.20	-0.01
MR5	-0.13	0.43	0.24	1.00	0.22	0.01	-0.08
MR4	0.01	0.24	0.20	0.22	1.00	-0.01	0.02
MR7	0.38	-0.30	-0.20	0.01	-0.01	1.00	-0.12
MR6	-0.10	-0.14	-0.01	-0.08	0.02	-0.12	1.00

Mean item complexity = 1.8
Test of the hypothesis that 7 factors are sufficient.

df null model = 300 with the objective function = 7.23 with Chi Square = 20163.79
df of the model are 146 and the objective function was 0.25

The root mean square of the residuals (RMSR) is 0.02
The df corrected root mean square of the residuals is 0.02

The harmonic n.obs is 2762 with the empirical chi square 428.84 with prob < 1.3e-29
The total n.obs was 2800 with Likelihood Chi Square = 708.03 with prob < 1.2e-74

Tucker Lewis Index of factoring reliability = 0.942

RMSEA index = 0.037 and the 90 % confidence intervals are 0.034 0.04
BIC = -450.82
Fit based upon off diagonal values = 0.99
Measures of factor score adequacy

	MR2	MR1	MR3	MR5	MR4	MR7	MR6
Correlation of (regression) scores with factors	0.93	0.90	0.89	0.88	0.85	0.81	0.75
Multiple R square of scores with factors	0.86	0.80	0.78	0.78	0.73	0.65	0.56
Minimum correlation of possible factor scores	0.71	0.61	0.57	0.56	0.46	0.30	0.13

Input:

```
round(efa_sevenf$communalities, digits = 3)
print(efa_sevenf$loadings, cutoff = .3)
round(efa_sevenf$Phi, digits = 3)
```

Output:

```
> round(efa_sevenf$communalities, digits = 3)
    x1_probe      x2_feel     x3_exact      x4_talk     x5_angry  x6_wellbeing      x7_ideas
       0.374        0.334        0.348        0.437        0.712        0.533        0.376
 x8_irritated   x9_approach   x10_perfect x11_captivate x12_moodswing      x13_sad   x14_comfort
       0.679        0.568        0.499        0.476        0.574        0.510        0.518
  x15_younger   x16_reading   x17_friends      x18_plan      x19_ease   x20_halfway x21_timewaste
       0.274        0.293        0.597        0.311        0.471        0.585        0.423
   x22_charge     x23_panic     x24_convo   x25_reflect
       0.451        0.390        0.478        0.249
> print(efa_sevenf$loadings, cutoff = .3)
```

Loadings:

	MR2	MR1	MR3	MR5	MR4	MR7	MR6
x1_probe				0.423		0.417	
x2_feel			0.500			0.327	
x3_exact			0.550				
x4_talk		0.669					
x5_angry		0.841					
x6_wellbeing				0.744			
x7_ideas				0.597			
x8_irritated		0.822					
x9_approach			0.676				
x10_perfect			0.678				
x11_captivate			0.341			0.385	
x12_moodswing		0.529					0.394
x13_sad						0.423	
x14_comfort				0.639			
x15_younger				0.391			
x16_reading					0.344		0.348
x17_friends			0.653				
x18_plan			0.529				
x19_ease				0.437			
x20_halfway			0.663				
x21_timewaste			0.528				
x22_charge					-0.312		
x23_panic					0.431		
x24_convo				0.631			
x25_reflect				0.364			

	MR2	MR1	MR3	MR5	MR4	MR7	MR6
SS loadings	2.00	1.733	1.876	1.677	1.527	0.783	0.706
Proportion Var	0.08	0.069	0.075	0.067	0.061	0.031	0.028

Cumulative Var 0.08 0.149 0.224 0.291 0.353 0.384 0.412

```
> round(efa_sevenf$Phi, digits = 3)
      MR2    MR1    MR3    MR5    MR4    MR7    MR6
MR2  1.000 -0.152 -0.143 -0.129  0.014  0.376 -0.098
MR1 -0.152  1.000  0.182  0.431  0.244 -0.301 -0.142
MR3 -0.143  0.182  1.000  0.237  0.204 -0.201 -0.010
MR5 -0.129  0.431  0.237  1.000  0.222  0.009 -0.080
MR4  0.014  0.244  0.204  0.222  1.000 -0.014  0.018
MR7  0.376 -0.301 -0.201  0.009 -0.014  1.000 -0.116
MR6 -0.098 -0.142 -0.010 -0.080  0.018 -0.116  1.000
>
```

Appendix 1

x1. I will probe deeply into a subject.
x2. I am attentive to the feelings of others.
x3. I am exacting in my work.
x4. I talk a lot.
x5. I get angry easily.
x6. I inquire about others' well-being.
x7. I am full of ideas.
x8. I get irritated easily.
x9. I find it easy to approach others.

x10. I continue until everything is perfect.
x11. I know how to captivate people.
x12. I have frequent mood swings.
x13. I often feel sad.
x14. I know how to comfort others.
x15. I enjoy being around younger people.
x16. I prefer difficult reading material.
x17. I make friends easily.
x18. I do things according to a plan.
x19. I make people feel at ease.
x20. I never do things in a half-way manner.
x21. I waste my time.
x22. I take charge.
x23. I panic easily.
x24. I carry the conversation to a higher level.
x25. I spend time reflecting on things.