CHAPTER 7

The Overall Strength of the GFP

GFP ACROSS 21 DATASETS

Previous chapters have been dedicated to the concept and the role of the general factor of personality (GFP) in the personality structure. Since the times of Hippocrates, the structure of personality has been a leading theme in psychological research. In scientific psychology, several theoretical models of personality structure have been developed including the models of Cattell (Cattell, 1950, 1957), Eysenck (Eysenck, 1970, 1986, 1991), and the five-factor model (FFM) describing five very general dimensions, labeled the Big Five: extraversion, agreeableness, conscientiousness, neuroticism, and openness (Digman, 1990; Goldberg, 1981, 1990; John, 1990; McCrae & Costa, 1987, 1998).

The discovery that the Big Five are correlated (Becker, 1999, 2002; Block, 1995; Costa & McCrae, 1992; Digman, 1997; Eysenck, 1991; John & Srivastava, 1999; Ostendorf & Angleitner, 1994; Wiggins & Trapnell, 1996) opened the door to the search for higher-order dimensions of personality. First, Digman (1997) extracted two higher dimensions based on the Big Five intercorrelations, the so-called Alpha and Beta factors (Big Two). The Big Two were confirmed by other authors (DeYoung, Peterson & Higgins, 2001), who proposed somewhat different labels and interpretation of them (Stability and Plasticity). Some years later, Musek (2007) hypothesized and confirmed the existence of the general factor of personality (GFP) and proposed a new theoretical model of the structural hierarchy of personality, a pyramidal model with the GFP at the apex of the hierarchical structure (see Chapters 1 and 2 for more details).

The existence of GFP was further replicated in a series of studies using different samples of participants and different measures (Hirschi, 2008; Musek, 2007, 2010; Rushton, Bons, & Hur, 2008, Rushton et al., 2009; Rushton & Irwing, 2009a, 2009b, 2009c, 2009d; Van der Linden, Nijenhuis, Cremers, & van de Ven, 2011; Veselka, Schermer, Petrides, & Vernon, 2009). Several hundred scientific articles throughout the world addressed the issues concerning the GFP. Different important problems have been discussed in the literature focusing on GFP, including the cross-cultural consistency of GFP (Musek, 2010; see Chapter 3 for more details), the nature and possible

The General Factor of Personality
ISBN 978-0-12-811209-0
http://dx.doi.org/10.1016/B978-0-12-811209-0.00007-8

interpretations of the GFP (Musek, 2007, 2010; Rushton et al., 2008, 2009; Rushton & Irwing, 2008; Van der Linden, Scholte, Cillessen, Nijenhuis, & Segers, 2010; see Chapter 4 for more details), the connections of GFP to other prominent psychological and demographic variables (Erdle & Rushton, 2010; Musek, 2007, 2010; Schermer & Vernon, 2010; Vecchione, Alessandri, Barbaranelli, & Caprara, 2011; see Chapter 5 for more details), the heritability and bioevolutionary aspects of GFP (Loehlin, 2011; Loehlin & Martin, 2011; Rushton et al., 2008, 2009; Rushton, Irwing, & Booth, 2010; Veselka et al., 2009; see Chapter 6 for more details), the generality of GFP and possible extensions beyond the realm of the FFM (Erdle & Rushton, 2010; Erdle, Rushton, Irwing, & Park, 2010; Musek, 2010; Rushton & Irwing, 2009b, 2009d, 2011; see Chapter 8 for more details), not to mention others.

The Study of 21 Datasets

One of the most intriguing and controversial questions related to the GFP concerns its relative strength. On the one hand, many authors claimed that GFP is strong enough to be interpreted as a general factor in the field of personality traits (Erdle et al., 2010; Erdle & Rushton, 2010; Hirschi, 2008; Musek, 2007, 2010; Rushton et al., 2008, 2009; Rushton & Irwing, 2008, 2009a, 2009b, 2009c, 2009d; Rushton et al., 2010; Schermer & Vernon, 2010; Van der Linden et al., 2011; Veselka et al., 2009), while others insisted that GFP is not so important, general, or consistent (Ashton et al., 2009; Backstrom, Bjorklund, & Larsson, 2009; De Vries, 2011) and that it is substantially weaker or "muddier" than, for example, Spearman's g-factor, its counterpart in the field of cognitive abilities (Revelle & Wilt, 2010).

In order to clarify the issues concerning the importance of the GFP, a special investigation was designed in order to test the strength of the first factor extracted from the Big Five dimensions in a number of studies, which vary in the size of the sample (number of participants), the measures being applied, and the national or cultural background. In the investigation, we included some data from the meta-analytic and cross-national aggregation studies with very large samples of participants and subsamples.

METHOD

Source Studies, Participants and Measures

In our investigation, the available data from 19 different studies was examined. This included 21 dataset collections published or otherwise accessible from 1993 to 2011. The list of the investigated datasets comprised the data that was analyzed in the cross-cultural study reported in Chapter 3 and included several data collections from other studies. The data analyzed in this study involved very large samples in meta-analytic research (Digman, 1997; Mount, Barrick, Scullen, & Rounds, 2005; Rushton & Irwing, 2008; Van der Linden, te Nijenhuis, et al., 2010), a national representative project (National Survey of Midlife Development in the US, MIDUS II: Ryff et al., 2007; a Chinese national sample: Lanyon & Goodstein, 2007), a multinational selection (Synthetic Aperture Personality Assessment; Revelle & Laun, 2004; Revelle, Wilt, & Rosenthal, 2009), and aggregated results from 56 national samples (Schmitt et al., 2007).

In all cases, the analyzed personality data comprised the correlation matrix of the Big Five factors. The Big Five factors were measured by different instruments on samples representing different national and cultural environments. The data from the following sources was analyzed in this study:

1–10. The first 10 sources are the same as listed in Chapter 3, section "GFP across cultures," subsection "Method," paragraph "Source studies, participants and measures."

11. The data of 14 sets of the Big Five correlation matrices from Digman (1997) rearranged and prepared in the Rushton and Irwing study (Rushton & Irwing, 2008). The data (Digman data) was drawn from 14 different samples with 4496 participants and collected by means of revised NEO Personality Inventory (NEO-PI-R; two samples), self-ratings by adults (four samples), teachers' ratings of students (five samples), peer ratings (two samples), and alternative self-report measure (one sample). See details in Digman (1997) and Rushton and Irwing (2008).

12. The Big Five interscale correlations derived from the meta-analytic study of Mount et al. (2005) as reported by Rushton and Irwing (2008) (Mount data). The data was collected from four samples using, respectively, the NEO-PI-R questionnaire (Costa & McCrae, 1992), the Hogan Personality Inventory (HPI; Hogan & Hogan, 1995), the Personal Characteristics Inventory (PCI; Mount, Barrick, & Callans, 1999), and the International Personality Item Pool (IPIP; Goldberg, 1999). Each inventory was considered as having the equivalent of 1000 participants by the sample (4000 participants in the whole). See more details in Mount et al. (2005) and Rushton and Irwing (2008).

13. The Big Five intercorrelation matrix from the meta-analytic study of Van der Linden, te Nijenhuis, et al. (2010) obtained on the total number of 212 samples with 114,117 participants (van der Linden data). The Big Five data was collected by means of numerous instruments including NEO Five Factor Inventory (NEO-FFI), the NEO-PI, the NEO-PI-R, the Big Five Inventory (BFI), and IPIP. The mentioned measures were applied in 67% of the studies, the rest including the Big Five Observer, the PCI, the Hamburg Personality Inventory, the Five-Dimensional Temperament Inventory, the Trait Descriptive Adjective Scale, the 10 Item Personality Inventory, and the Personality Style Inventory. For more details see Van der Linden, te Nijenhuis, et al. (2010).

14. The Big Five correlation matrices from the studies of Cook (2005) on the two largest samples (N = 250 and 325) (Cook 250 data and Cook 325 data). The Big Five scales were from the personality inventory developed by Lounsbury, Gibson, and Hamrick (2004).
15. The Big Five correlation matrix from the study of Hartman (2006) on the sample with 301 (finally 292) participants (Hartman data). The Big Five data was collected by NEO-FFI.
16. The Big Five correlation matrix from the study of Biesanz and West (2004) on the sample with 339 participants (Biesanz data). The Big Five scales were measures of 97 unipolar trait adjectives (Goldberg, 1992).
17. The Big Five correlation matrix obtained by conversion of the HPI scales (Hogan & Hogan, 1995) to the Big Five scales (Barrett & Rolland, 2007; using the formula developed by Smith & Ellingson, 2002) (Hogan data). HPI data was collected on the sample with 156,614 participants.
18. The Big Five correlation matrix from the study of Buchanan, Johnson, and Goldberg (2005) on a sample with 2448 participants (Buchanan data). The Big Five scales were measures of 50 items selected from the IPIP list of items.

All reported sources of studies involved in our analysis are found in Table 7.1. The table displays the codes for the source data with respective references, number of participants, and personality measures.

Data Analyses

Two general approaches were performed in our data analyses. First, the factor analyses of the respective Big Five correlations were performed using the *fa* algorithm from *psyche* package of R program (Revelle, 2015). Also, the Schmid–Leiman transformation using the *omega* algorithm from the same package was performed. Then, some of the most recommended direct measures for determining the strength of tentative or possible general factor were calculated (recommended by Reise, 2012): McDonald omegaH

Table 7.1 The codes for the sources of data, references of respective studies, number of participants, and personality measures used in the studies

Source of data	References	N	Measures
Schmitt data	Schmitt et al. (2007)	17,837 (56)	BFI
MIDUS data	Ryff et al. (2007)	4032	MIDI
Musek data	Musek (2010)	916	BFI
SAPA data	Revelle and Laun (2004), Revelle et al. (2009)	51,410	IPIP
EapAS data	Eap et al. (2008)	320	BFI
EapEU data	Eap et al. (2008)	242	BFI
Yik data	Yik and Bond (1993)	656	Adjective descriptors
CLUES data	Lanyon and Goodstein (2007)	1419	Clues
Aziz data	Aziz and Jackson (2001)	135	BFI
Mi Kyoung Jin data	Mi Kyoung Jin (2005)	212	NEO-PI
BoUS data	Boudreau, Boswell, and Judge (1999)	1885	NEO-FFI
BoEU data	Boudreau, Boswell, and Judge (1999)	1871	NEO-FFI
Mount data	Mount et al. (2005), Rushton and Irwing (2008)	4000 (100)	NEO-PI-R, HPI, PCI, IPIP
Cook250 data	Cook (2005)	250	Lounsbury Gibson Personality Inventory
Cook325 data	Cook (2005)	325	Lounsbury Gibson Personality Inventory
Hartman data	Hartman (2006)	292	NEOFFI
Digman data	Digman (1997), Rushton and Irwing (2008)	4496	Other ratings, self-ratings, peer ratings, NEO-PI-R
Biesanz data	Biesanz and West (2004)	339	97 unipolar trait adjectives
Hogan data	Barrett and Rolland (2007), Hogan and Hogan (1995)	156,614	HPI
van der Linden data	Van der Linden, te Nijenhuis, et al. (2010)	144,117 (212 samples)	Numerous measures, see text
Buchanan data	Buchanan et al. (2005)	2448	50 items IPIP

coefficient (McDonald, 1999; Zinbarg, Revelle, Yovel, & Li, 2005; Zinbarg, Yovel, Revelle, & McDonald, 2006), and explained common variance coefficient (ECV; see Reise, 2012; Ten Berge & Socan, 2004). Additionally, some other relevant although less direct measures were also considered including the Kaiser–Meyer–Olkin index of sampling adequacy (KMO; Kaiser, 1970), suggested number of extracted factors (NFE) according to four extraction criteria (optimal coordinates–op, acceleration factor–ac, parallel analysis test–pa, and Kaiser criterion–ka) and the ratio of the percent of total variance explained by the first factor to the sum of the variance explained by the first and the second factor (Percent of Variance Ratio - PVR).

In the second part of the analyses, different models describing the structure of the Big Five and higher-order factors including GFP were tested by means of confirmatory structural equation model (SEM) analyses. As the measures of model fit, the following fit indices were calculated: the root-mean-square error of approximation (RMSEA; Browne & Cudeck, 1993), the standardized root-mean-square-residual (SRMR; Bentler, 2006; Hu & Bentler, 1999), the comparative fit index (CFI; Hu & Bentler, 1999), the Tucker–Lewis non-normed-fit-index (TLI or NNFI; Tucker & Lewis, 1973), and the AIC (Akaike, 1987).

All correlation sets were analyzed using the statistical program packages SPSS 23.0 (IBM Corp. Released 2015, 2015) and R program language (R Core Team, 2015).

RESULTS

In the first part of our analyses, exploratory factor analyses and other multivariate analyses were done in order to obtain relevant information about the strength of the GFP.

Thus, the criteria of the strength of the general factor were specially analyzed. Table 7.2 displays several coefficients and other criteria relevant for determining the strength of the tentative general factor along a list of the data sources included into our research. In the second and third column, they include McDonald's hierarchical omega coefficient (omegaH) and the ECV, applied both for two- and three-primary-factors solution. Additionally, the next three columns show the KMO measure of sampling adequacy, the NFE, and the PVR, all with included relevant subcolumns.

The coefficients omegaH and ECV were calculated separately for three- and two-primary-factor solutions. As expected, the values of the coefficients were consistently higher for three-factor solutions, ranging

Table 7.2 Indicators of the strength of the first factor extracted from the Big Five dimensions

	OmegaH		ECV		KMO	NFE				PVR	
Source	**3**	**2**	**3**	**2**		**oc**	**af**	**pa**	**ka**	**PC**	**MR**
Schmitt data	.61	.40	.45	.35	.655	1	1	1	1	.71	.76
MIDUS data	.63	.50	.62	.54	.714	1	1	1	1	.70	.81
Musek data	.61	.51	.68	.56	.691	1	1	1	1	.70	.64
SAPA data	.61	.36	.58	.35	.689	1	1	1	1	.71	.84
EapAS data	.48	.37	.49	.35	.677	1	1	1	1	.69	.75
EapEU data	.55	.37	.48	.36	.668	1	1	1	1	.69	.76
Yik data	.55	.49	.45	.42	.689	2	1	2	2	.73	.77
CLUES data	.73	.65	.75	.70	.804	1	1	1	1	.77	.88
Aziz data	.64	.32	.67	.30	.723	1	1	1	1	.71	.85
Mi Kyoung Jin data	.51	.25	.51	.24	.577	2	2	2	2	.61	.71
BoUS data	.57	.31	.65	.39	.690	2	1	2	2	.66	.79
BoEU data	.50	.26	.47	.25	.673	1	1	1	1	.64	.80
Mount data	.59	.40	.63	.38	.675	2	2	2	2	.65	.66
Cook250 data	.71	.66	.67	.65	.812	1	1	1	1	.82	.92
Cook325 data	.76	.67	.75	.65	.791	1	1	1	1	.79	.78
Hartman data	.60	.48	.60	.54	.678	1	1	1	1	.69	.78
Digman data	.33	.23	.28	.23	.655	2	2	2	2	.63	.68
Biesanz data	.51	.46	.52	.48	.695	1	1	1	1	.70	.81
Hogan data	.52	.28	.48	.23	.623	2	1	2	2	.71	.75
van der Linden data	.52	.47	.54	.46	.714	1	1	1	1	.69	.75
Buchanan data	.40	.07	.39	.06	.604	1	1	2	2	.64	.72

ECV, Explained Common Variance coefficient, 3 (first subcolumn: value for three primary factors), 2 (second subcolumn: value for two primary factors); *KMO*, Kaiser–Meyer–Olkin measure of sampling adequacy; *NFE*, suggested number of factors to be extracted according to the following criteria: optimal coordinates (*oc*; first subcolumn), acceleration factor (*af*; second subcolumn), parallel analysis test (*pa*; third subcolumn), Kaiser criterion (*ka*; fourth subcolumn); *OmegaH*, McDonald's omega hierarchical coefficient, 3 (first subcolumn: value for three primary factors), 2 (second subcolumn: value for two primary factors); *PVR*, ratio of the % of variance explained by the first factor to the sum of the % of variance explained by the first and second factors (values for the PC/*PC*/solution in the first subcolumn and for the MINRES/*MR*/solution in the second subcolumn).

from .76 to .33 for omegaH and from .75 to .28 for ECV (the range for two-factor solutions was from .67 to .07 for omegaH and from .70 to .06 for ECV). Regarding the three-factor solutions (the default in the algorithm for Schmid–Leiman transformation used in this study), both coefficients in the majority of cases exceeded the value .50, confirming thus the substantiality of the general factor. Kaiser–Meyer–Olkin coefficients of sampling adequacy ranged from .812 to .577 indicating a considerable amount of common factors behind the manifest correlations in the analyzed matrices. In the majority of cases, the criteria for the NFE suggested the single-factor solutions, corroborating thus further the hypothesis of a strong first factor. Finally, PVR values (ranging from .82 to .61 for PC algorithm and from .88 to .64 for MR algorithm) indicate that in almost all cases the first extracted factor explained far more of the variance in the Big Five than the second.

GFP AS A PART OF THE BEST STRUCTURAL SOLUTIONS

Provided the considerable strength of the GFP, we may further investigate its role in the structural modeling of the personality dimensions. The higher-order structure of the Big Five can be modeled in different ways, and the respective models can be tested by means of the appropriate SEM analyses. Thus, in the next part of our study, the confirmatory factor analyses of structural models were performed for all data sources. The following structural models were prepared for 21 different correlation matrices:

11. Unmodified model with the Big Five and general factor;
12. Modified model with the Big Five and general factor;
13. Model with the Big Five and two uncorrelated primary factors;
14. Model with the Big Five and two correlated primary factors;
15. Classical hierarchical model with the Big Five, two primary factors and general factor;
16. Bifactor model with the Big Five, two primary factors and general factor.

In all models, all Big Five personality dimensions were treated as correlated, not independent or orthogonal. As you can see from Fig. 7.1 and Table 7.3, the simplest model containing only the uncorrelated Big Five was not even considered in the display of the results. In all cases, this model fit the data so catastrophically badly (CFI and TLI about 0) that it is obviously unrealistic. The Big Five are also definitely correlated.

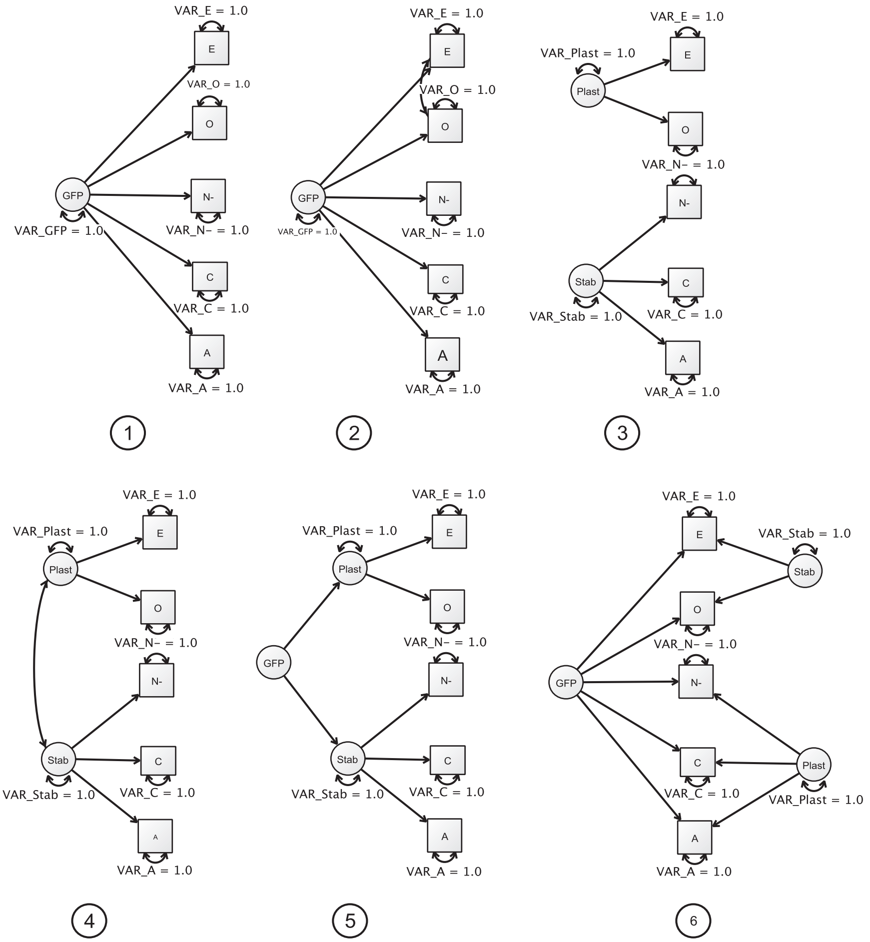

Figure 7.1 Schematic presentations of six structural models: unmodified model with the Big Five and general factor (1); modified model with the Big Five and general factor (2); model with the Big Five and two uncorrelated primary factors (3); model with the Big Five and two correlated primary factors (4); classical hierarchical model with the Big Five, two primary factors, and general factor (5); and bifactor model with the Big Five, two primary factors, and general factor (6).

COMPARISON OF SIX STRUCTURAL MODELS

The difference between the models is displayed in Fig. 7.1. The most interesting difference is between two full hierarchical models, namely the classical hierarchical model and the bifactor model. Regarding the fact that

Table 7.3 Fit indices for the six models of the confirmative analyses of 21 source data

Source	Model (df)	Chi df	p > .05	RMSEA	SRMR	CFI	TLI	AIC
Schmitt data	1 (5)	2.870		.184	.083	.862	.724	34.3
	2 (3)	.455	.713	.000	.030	1.000	1.008	25.4
	3 (7)	2.938		.188	.185	.799	.713	36.6
	4, 5 (4)	3.058		.193	.072	.878	.696	34.2
	6 (2)	1.689	.167	.112	.080	.969	.898	29.1
MIDUS data	1 (5)	39.962		.098	.039	.942	.885	219.8
	2 (3)	9.246		.045	.017	.993	.976	51.8
	3 (7)	115.222		.200	.176	.668	.525	1146.7
	4, 5 (4)	40.559		.099	.033	.953	.883	184.2
	6 (2)	14.124		.057	.021	.992	.961	54.2
Musek data	1 (5)	19.930		.144	.059	.877	.754	119.7
	2 (3)	.900	.440	.000	.011	1.000	1.001	26.7
	3 (7)	33.937		.190	.173	.700	.572	253.6
	4, 5 (4)	1.696	.148	.028	.016	.996	.991	28.8
	6 (2)	1.764	.171	.029	.011	.998	.990	29.5
SAPA data	1 (5)	455.740		.094	.037	.928	.857	2298.7
	2 (3)	27.289		.023	.008	.998	.992	105.9
	3 (7)	2848.857		.235	.185	.373	.104	19,958.0
	4, 5 (4)	560.550		.104	.036	.927	.824	2264.2
	6 (2)	795.501		.124	.040	.950	.750	1617.0
EapAS data	1 (5)	5.775		.122	.057	.886	.772	48.9
	2 (3)	1.236	.295	.027	.023	.997	.989	27.8
	3 (7)	11.658		.183	.157	.644	.491	97.7
	4, 5 (4)	4.582		.106	.041	.932	.829	40.4
	6 (2)	5.274		.116	.044	1.000	.999	36.6
EapEU data	1 (5)	5.498		.137	.062	.876	.752	47.5
	2 (3)	.523	.667	.000	.015	1.000	1.026	25.6
	3 (7)	13.500		.228	.216	.518	.312	110.5
	4, 5 (4)	3.582		.104	.040	.943	.858	36.3
	6 (2)	6.787		.155	.040	.936	.681	39.6

Yik data	1 (5)	56.39		.291	.109	.761	.552	302.0
	2 (3)	5.218		.080	.023	.989	.964	39.7
	3 (7)	41.789		.250	.278	.754	.648	308.5
	4, 5 (4)	27.193		.200	.063	.910	.774	130.8
	6 (2)	26.509		.197	.052	.956	.780	79.0
CLUES data	1 (5)	19.042		.113	.040	.954	.908	115.2
	2 (3)	7.524		.068	.017	.990	.967	46.6
	3 (7)	122.856		.293	.299	.564	.377	876.0
	4, 5 (4)	17.131		.107	.033	.967	.918	90.5
	6 (2)	11.320		.085	.019	.989	.947	48.6
Aziz data	1 (5)	1.477	.194	.060	.044	.974	.928	27.4
	2 (3)	.085	.968	.000	.008	1.000	1.098	24.3
	3 (7)	5.364		.180	.180	.672	.531	53.5
	4, 5 (4)	1.295	.269	.047	.035	.987	.968	27.2
	6 (2)	1.477	.194	.060	.062	1.000	1.000	27.4
Mi Kyoung Jin data	1 (5)	5.609		.148	.087	.797	.594	48.0
	2 (3)	.745	.525	.000	.023	1.000	1.022	26.2
	3 (7)	5.299		.143	.119	.735	.621	53.1
	4, 5 (4)	1.508	.197	.049	.041	.982	.955	28.0
	6 (2)	2.971	.051	.097	.057	1.000	.999	31.9
BoUS data	1 (5)	15.529		.088	.041	.931	.863	97.6
	2 (3)	4.268		.042	.017	.991	.969	36.8
	3 (7)	92.484		.220	.170	.395	.136	663.4
	4, 5 (4)	5.877		.051	.024	.982	.954	45.6
	6 (2)	5.500		.049	.022	1.000	.999	37.0
BoEU data	1 (5)	15.414		.088	.041	.931	.863	97.1
	2 (3)	4.205		.042	.016	.991	.970	36.6
	3 (7)	91.797		.220	.170	.395	.136	658.6
	4, 5 (4)	5.834		.051	.024	.982	.954	45.3
	6 (2)	5.604		.050	.017	.991	.956	37.2

Continued

Table 7.3 Fit indices for the six models of the confirmative analyses of 21 source data—cont'd

Source	Model (df)	Chi df	p > .05	RMSEA	SRMR	CFI	TLI	AIC
MountMeta data	1 (5)	155.774		.197	.096	.782	.564	798.7
	2 (3)	11.682		.052	.018	.991	.970	59.0
	3 (7)	94.254		.153	.158	.816	.737	675.8
	4, 5 (4)	20.952		.071	.030	.978	.944	105.8
	6 (2)	6.704		.038	.009	.997	.984	39.4
Cook250 data	1 (5)	5.475		.134	.039	.952	.904	47.4
	2 (3)	1.004	.390	.004	.015	1.000	1.000	27.0
	3 (7)	25.737		.315	.333	.628	.467	196.2
	4, 5 (4)	4.748		.123	.031	.968	.919	41.0
	6 (2)	5.732		.138	.034	1.000	.999	37.5
Cook325 data	1 (5)	13.455		.196	.059	.910	.820	87.3
	2 (3)	1.346	.257	.033	.014	.999	.995	28.0
	3 (7)	33.223		.315	.383	.673	.534	248.6
	4, 5 (4)	2.170	.070	.060	.022	.993	.988	30.7
	6 (2)	2.254	.105	.062	.013	.996	.982	30.5
Hartman data	1 (5)	2.092	.063	.061	.033	.972	.945	30.5
	2 (3)	.231	.875	.000	.010	1.000	1.039	24.7
	3 (7)	9.263		.169	.273	.708	.582	80.8
	4, 5 (4)	2.114	.076	.062	.029	.977	.944	30.5
	6 (2)	.259	.772	.000	.009	1.000	1.037	26.6
DigmanMeta data	1 (5)	159.536		.188	.093	.774	.548	817.7
	2 (3)	15.058		.056	.022	.988	.960	69.2
	3 (7)	113.141		.158	.162	.776	.680	808.0
	4, 5 (4)	37.83		.091	.035	.958	.895	173.3
	6 (2)	36.705		.089	.021	.980	.898	99.4

Biesanz data	1 (5)	6.673		.130	.056	.886	.772	53.4
	2 (3)	1.432		.032	.021	.996	.986	28.0
	3 (7)	17.183		.219	.187	.545	.350	136.3
	4, 5 (4)	4.145		.096	.039	.950	.874	38.6
	6 (2)	3.024		.077	.028	.984	.919	32.0
Hogan data	1 (5)	10,386.400		.258	.088	.748	.496	51,952
	2 (3)	555.633		.060	.019	.992	.973	1690.9
	3 (7)	2623.967		.129	.069	.962	.873	7895.9
	4, 5 (4)	2950.85		.137	.038	.971	.857	5927.7
	6 (2)	1262.6		.090	.029	.994	.939	1290.6
Van der Linden data	1 (5)	3568.4		.157	.067	.855	.710	17,862.0
	2 (3)	687.067		.069	.019	.983	.944	2085.2
	3 (7)	4786.714		.182	.171	.727	.610	33,523.0
	4, 5 (4)	724.05		.071	.022	.976	.941	2918.2
	6 (2)	736.5		.071	.018	.988	.940	1499.0
Buchanan data	1 (5)	39.152		.125	.057	.836	.673	215.8
	2 (3)	24.652		.098	.036	.939	.797	98.0
	3 (7)	79.449		.179	.123	.529	.327	572.1
	4, 5 (4)	36.135		.120	.048	.879	.698	166.5
	6 (2)	38.913		.124	.045	.935	.675	103.8

AIC, Consistent Akaike Information Criterion; *CFI*, Bentler Comparative fit index; *Chi df*, ratio of chi-square values subtracted from the degrees of freedom in the model; *Model*, structural models from 1 to 6 with the degrees of freedom in parentheses; *p*, *p* value if nonsignificant (>.05); *RMSEA*, Root-mean-square error of approximation; *SRMR*, Standardized root-mean-square residual; *TLI*, Tucker Lewis Non-normed fit index.

confirmatory SEM analyses routinely prefer the solutions with more than one factor to the comparable solutions with only one factor, the decisive test of the importance of general factor should be based on the comparison of both hierarchical models with the models without general factor.

Table 7.3 provides the fit indices of all six models for all 19 correlation matrices derived from the investigations included in this study. We selected the indices that are well suited for the comparison of different models, namely chi-square statistics divided by the degrees of freedom (chi df), the RMSEA, the SRMR, the CFI, the TLI or NNFI, and the Consistent Akaike Information Criterion (AIC). In regard to use of the fit indices, the relevant suggestions in the literature were considered (Akaike, 1987; Bentler, 1990; Bentler & Bonett, 1980; Bollen, 1989, 1990; Browne & Cudeck, 1989, 1993; Hu & Bentler, 1995, 1999; Steiger, 2000; Tucker & Lewis, 1973).

As we can see from Table 7.3, in the majority of cases Models 4, 5, and 6 had better fits than Models 1 and 3. The model with two uncorrelated factors (Model 3) showed poor fit in all cases and therefore proved to be quite unacceptable. Rather poor fit is typical also for Model 1. Yet, as said before, the one-factor solution is often routinely rejected in confirmatory SEM analyses except in the case of relatively homogeneous high correlations in the variable matrix. The modifications of one-factor models (Model 2) dramatically improved fit indices yielding best fits. The corresponding modifications, which also resulted in better fits in all other models, were not displayed in the table because they are not of great interest for our analysis. What is of interest is the fact that both complex models including general factor and primary factors, the classical hierarchical model (Model 5) and bifactor model (Model 6), are as a rule the most acceptable models with the general factor included. The model with two correlated factors (Model 4) had best fits among the models without the general factor.

Quite logically, the classical hierarchical model (Model 5) yielded the same fit indices as the model with correlated primary factors (Model 4). Nevertheless, the correlation between the primary factors (if substantial) implies the existence of a second-order factor. Consequently, a full pyramidal structure containing all levels of the generality should be preferred for the sake of consistency. If the first-order factors are based on the correlations between variables, then the correlations between first orders also request a second-order dimension to fulfill the entire structure. Thus, the classical hierarchical solutions with three levels of generality should be preferred over the solution with only two levels that ignore the common denominator of primary factors. Note also that the parsimony (degrees of freedom) of both Model 5 and Model 4 solutions is exactly the same.

It is worth mentioning that unmodified Models 5 and 6 show acceptable or almost acceptable fit in the majority of cases. Nevertheless, some modifications of the models are theoretically justified (especially those assuming the error terms correlated on the basis of social desirability). Under these modifications, all models became very well fitted including even the simple one-factor model (Model 2).

CONCLUSIONS

The data analyzed in this study confirmed the substantial strength of the first factor extracted from the Big Five correlation matrices in almost all cases. Moreover, this strength in the majority of cases resembles the strength of the general factor in the scope of cognitive abilities, where the role of g is rarely seriously doubted. Consequently, it is very hard to deny the very strong role of the first factor extracted on the basis of correlated Big Five. It is comparable to the role of g in the realm of cognitive abilities.

On the basis of our results, we could also throw some more light on the nature of the dimensional structure of personality above the level of the Big Five. The models comprising the complete structural hierarchy (which means the levels of the Big Five, primary factors, and general factor) fit essentially better than more restricted models (Model 1 and Model 3). In any case, the GFP proved to be a part of the best structural solutions regarding the higher-order structure of the Big Five.

However, it is difficult to say which hierarchical model is better, the classical hierarchical model or the bifactor model. Although the classical hierarchical model is more parsimonious by definition, the bifactor model has better fit indices in most cases. On the whole, both the classical hierarchical model and the bifactor model should be almost equally preferred. In roughly half of the cases, the bifactor model clearly has better fit indices, while in the other half, the classical hierarchical model has better or equal fit indices and should therefore be preferred as more parsimonious.

It is quite obvious that the viability of classical hierarchical versus bifactor model depends on the amount of correlation between primary factors (the Big Two, for example). The bigger this correlation, the stronger is the fit of the classical hierarchical model; and, vice versa, the weaker this correlation, the stronger is the fit of the bifactor model. Thus, the decision of the preference of one model over the other could be quite specific in regard to the sample or the method used in the particular study. In Chapter 11, we will examine more thoroughly the suitability of different models concerning the structure of personality dimensions (including higher-order factors).

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