DOCUMENT RESUME

ED 303 489 TM 012 694

AUTHOR Thompson, Bruce; Borrello, Gloria M.
TITLE A Confirmatory Factor Analysis of Data from the Myers-Briggs Type Indicator.
PUB DATE 4 Jan 89
NOTE 20p.; Paper presented at the Annual Meeting of the Southwest Educational Research Association (Houston, TX, January 27, 1989).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS College Students; Factor Analysis; Factor Structure; *Goodness of Fit; Higher Education; Maximum Likelihood Statistics; Measures (Individuals); *Personality Measures; Personality Traits; *Psychological Testing; Psychometrics; *Test Validity
IDENTIFIERS *Confirmatory Factor Analysis; *Myers Briggs Type Indicator

ABSTRACT

The Myers-Briggs Type Indicator (MBTI) measures variations in normal personality. The validity of the measure has only recently been examined by analyses of the structure underlying MBTI responses; and these investigations have used exploratory factor analyses, rather than confirmatory factor analytic methods. A confirmatory factor analysis was performed using data from 582 adult undergraduates and graduate students (78% female) at an urban university. Three models were fit to the data from these subjects using the LISREL VI computer program. All models involved extraction of maximum-likelihood estimates of structures based on analysis of correlation matrices. Two of the models fit the data nearly equally well. Overall, the results support the conclusion that the MBTI measures expected factor structure. Three tables list study data, and one appendix lists the unsorted confirmatory factor structure. (Author/SLD)

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A CONF MATORY FACTOR ANALYSIS OF DATA FROM THE MYERS-BRIGGS TYPE INDICATOR

Bruce Thompson Gloria M. Borrello

University of New Orleans 70148

Paper presented at the annual meeting of the Southwest Educational Research Association, Houston, January 27, 1989.

ABSTRACT

The Myers-Briggs Type Indicator (MBTI) measures variations in normal personality. Although many practitioners have high regard for the MBTI, the validity of the measure has only recently been examined by analyses of the structure underlying MBTI responses, and these investigations have employed exploratory factor analytic as against confirmatory factor analytic methods. The present study reports a confirmatory factor analysis of MBTI data from 582 subjects.

Psychological measures that emphasize variations in normal behavior rather than psychopathology have been increasingly emphasized in research and in educational practice. Form F of the Myers-Briggs Type Indicator (MBTI) (Briggs & Myers, 1976) is representative of these types of measures. The MBTI has particular appeal since the test has both instructional (McCaulley, 1981, p. 295) and counseling applications (Myers, 1962, pp. 4-5, 76-82).

The MBTI is also noteworthy since the measure is grounded in a recognized personality theory, Jung's (1971/1921) theory of psychological types. The Extraversion-Introversion (EI) scale of the MBTI measures characteristics that Jung considered fundamental to personality--preferences for the outer world of people as opposed to the inner world of ideas. The MBTI also includes two scales measuring what Jung regarded as orienting functions. The Sensing-Intuition (SN) scale measures a preference for orienting toward the observable as opposed to orienting via insight. The Thinking-Feeling (TF) scale measures a preference to be guided by logic rather than by needs for affiliation and warmth. The final scale, Judging-Perceiving (JP), measures a preference for order and rules as opposed to a preference for flexibility.

Interest in the MBTI has stimulated a number of reliability and validity studies that have been summarized by others (Carlyn, 1977; Carskadon, 1979). In various studies internal stability reliability coefficients for the four scales have tended to vary between .80 and .90, while stability coefficients have tended to be slightly lower. However, as McCaulley (1981, p. 319) notes, "construct validity studies are most relevant in establishing the validity of the MBTI, since the Indicator was constructed specifically to implement a theory." A variety of these construct validity studies have been conducted and have involved diverse phenomena including short-term memory (Carlson & Levy, 1973) and clinical orientations of psychotherapists (Levin, 1979). Myers and Davis (1964) and later McCaulley (1977) conducted an impressive longitudinal study of the specialties selected by several thousand medical students over several decades.

Nunnally (1978, p. 112) notes that "factor analysis is intimately involved with questions of validity... Factor analysis is at the heart of the measurement of psychological constructs." Indeed, Nunnally notes (p. 111) that construct validity has been referred to as "factorial validity." Thus it is surprising that few validity studies involving the MBTI have used these methods. Thompson and Borrello (1986b) report a study of MBTI performance using second-order factor-analytic methods. As Kerlinger (1984, p. xivv) noted, "while ordinarily factor analysis is probably well understood, second-order factor analysis, a vitally important part of the analysis, seems not to be widely known and understood." Basically, second-order methods involve the extraction and oblique rotation of "first-order" factors, followed by the extraction and rotation of "second-order" factors from the matrix of intercorrelations among the first-order factors.

Thompson and Borrello (1986b) extracted 32 first-order factors based on Guttman's eigenvalues-greater-than-one criterion. Four second-order factors were then extracted from the interfactor correlation matrix. Subjective interpretation and factor adequacy coefficients (Thompson & Pitts, 1981/82) indicated that the MBTI measures four dimensions and that items generally measure the scales the items are expected to measure.

Although the results of the analysis were highly supportive of the MBTI's construct validity, as Gorsuch (1983) has noted, "there is nothing sacred about either primary or higher-order factors" (p. 254) and in some cases "interest would be in both primary and secondary factors" (p. 255). As Gorsuch (1983, p. 240) emphasizes:

> The essential difference between the primary factors and the higher-order factors is that the primary factors are concerned with narrow areas of generalization where the accuracy is great. The higher-order factors reduce accuracy for an increase in the breadth of generalization. In some analyses, the reduction in accuracy when going from primary to second-order factors will be small; in other studies it may be quite great. It depends upon the data being analyzed.

Thompson and Borrello (1986a) report a reanalysis of the same data using conventional first-order factor analytic methods. Again, results were highly supportive of the measure's validity.

However, the previous studies (Thompson & Borrello, 1986a, 1986b) employed exploratory factor extraction methods, and not more recently developed confirmatory maximum-likelihood factor analytic techniques (Joreskog & Sorbom, 1984). These newer methods are extremely powerful relative to traditional *exploratory* factor analytic methods which do not consider the researcher's *a priori* expectations regarding factor structure. *Confirmatory* methods offer statistical tests of how well *a priori* models characterize actual data, and thus these newer methods are less subject to the criticisms that have been levelled against exploratory methods (Cronkhite & Liska, 1980, p. 102; Tryon, 1979). Gorsuch (1983, p. 134) concurs, noting that:

> Confirmatory factor analysis is powerful because it provides explicit hypothesis testing for factor analytic problems. Exploratory factor analysis should be reserved only for those areas that are truly exploratory, that is, areas where no prior analyses have been conducted... [In comparison with traditional exploratory methods,] confirmatory factor analysis is the more theoretically important--and should be much more widely used--of the two major factor analytic approaches.

Confirmatory methods may be underutilized in part because the methods require large samples of several hundred subjects that may not be readily available to all researchers (Gorsuch, 1983, pp. 128-129). The present study was conducted to employ newer confirmatory factor extraction methods to evaluate the structure underlying MBTI data.

Method

Subjects

Subjects in the study were students enrolled in various undergraduate and graduate classes at an urban comprehensive university. The classes were selected to include students with various majors. The subjects were 582 adults whose average age was 27 (SD=6.9). The sample consisted of more females (78%) than males. The subjects included the 359 students who participated in previous MBTI studies (Thompson & Borrello, 1986a, 1986b), and a supplement of an additional 223 subjects.

Results

Form F of the MBTI consists of 166 items. However, 71 items were added as part of a research program (McCaulley, 1981, p. 312) and are not scored. Scores were computed in the recommended manner using only the scored 95 items (McCaulley, 1981, p. 314; Myers, 1962, p. 9).

Three models were fit to the data from the 582 subjects using the LISREL VI computer program developed by Joreskog and his colleagues. All models involved extraction of maximum-likelihood estimates of structures based on analysis of correlation matrices.

The first model tested the fit of a no-common-factor model in which 95 uncorrelated factors (corresponding to items) were postulated as fitting the data. The chi-square associated with the fit of this model was 13,984.00 (df=4,370); the goodness-of-fit index for the model was .47.

The second model postulated the existence of four uncorrelated factors in which each item only measured the theoretically-expected factor. The chi-square associated with the fit of this model was 7,385.00 (df=4,370); the goodness-of-fit index for the model was .78.

The third model postulated the existence of four correlated factors in which each item only measured the theoretically-expected factor. The chi-square associated with the fit of this model was 7,248.08 (df=4,364); the goodness-of-fit index for the model was .78. Table 1 presents the factor structure identified for this model, and Table 2 presents the interfactor correlation matrix.

INSERT TABLES 1 AND 2 ABOUT HERE.

In order to gain some additional insight regarding which fixed parameters most contributed to imperfect model fit, iterative relaxation of the model was performed for several thousand seconds of CPU time. This analysis was expensive, but does suggest which model specifications most contributed to misfit difficulties. These results for models #2 and #3 are presented in Table 3.

INSERT TABLE 3 ABOUT HERE.

Discussion

The Myers-Briggs Type Indicator (MBTI) (Briggs & Myers, 1976) is a popular theory-grounded measure of variations in normal personality. The MBTI has proven useful in explaining diverse phenomena, including vocational choice and success in interpersonal relations. Although many practitioners have high regard for the measure, the validity of the MBTI has only recently been explored by analyses of the structure (cf. Thompson

& Borrello, 1986a, 1986b) underlying MBTI responses. The present study reports a confirmatory factor analysis of MBTI data. Apparently confirmatory methods have not been previously applied with MBTI data, perhaps because the MBTI involves polychotomous responses to 95 items, and computational expenses associated with analyzing such a large data set using these methods are enormous. Nevertheless, it is particularly important to evaluate the construct validity of measures for which specific applications of findings have been recommended as regards both instruction and counseling (Myers, 1962, pp. 76-82), and confirmatory methods may be particularly useful in this regard.

The chi-square test statistics associated with the evaluation of the three models must be interpreted with caution, since these statistics are heavily influenced by non-normality in data and even by sample size. However, the statistics can be interpreted across different models, and various fit statistics can also be consulted to minimize this difficulty.

The extremely large chi-square (13,984.00, df=4,370) for the model postulating no common factors suggests that common factors are present, as does the poor index of fit (.47) for this model. This result is not surprisingly, and is mainly useful in establishing a baseline for interpreting results for other models.

The chi-square values for the uncorrelated four-factor model (7,385.00, df=4,370) and for the correlated four-factor model (7,248.08, df=4,364) suggest that both models fit the data about equally well, though the correlated four-factor model provides a slightly better fit. The goodness-of-fit indices (.775 and .778, respectively) support this conclusion.

The finding that more than one model fits the data about equally well is not unprecented. Confirmatory methods may help the researcher identify plausible models for data, but several models may be plausible and the methods do not necessarily identify a single correct model for a given data set.

However, it is not entirely surprising that both models fit the data roughly equally well. Myers and McCaulley (1985, p. 151) summarize results from an MBTI data bank involving 55,971 subjects. The researchers found that the four MBTI scales are generally uncorrelated, with the exception of correlation coefficients involving the Sensing-Intuition (SN) and the Judging-Perceiving (JP) scales (*r*=.38, squared *r*=14.4%) and the Thinking-Feeling (TF) and the Judging-Perceiving (JP) scales (*r*=.23, squared *r*=5.3%). Thus, even when MBTI factors are allowed to correlate with each other, most of the six pairwise combinations of scales do not do so, and so the last two models tested in the present study turn out to be roughly equivalent in their fit to the data.

This was generally the result in the present study, as reported in Table 2. The largest correlation coefficient (*r*=.474, squared *r*=22.5%) in the present study involved the Sensing-Intuition (SN) and the Judging-Perceiving (JP) scales. The remaining correlation coefficients each accounted for less than about 4% of common variance across pairs of scales.

The iterative model relaxation reported in Table 3 provides some insight regarding the source of imperfect fit for the models. Both analyses end up "freeing" the same parameter specifications initially restricted to being zero. The first two steps in model relaxation yield the most improvement in model fit, as reported in Table 3. However, fit improvement apparently declines rapidly after the first two steps of model relaxation, and even these initial steps yield relatively small improvements in chi-square fit statistics (e.g., 52.97/7248.08 = 0.7%). This analysis suggests that less than perfect fit does not originate in only one or two items being incorrectly specified in the model.

In conventional MBTI scoring, some item responses are weighted more heavily than are some other responses on the same scale. Such items are indicated within the notation used for the item names presented in Table 2. Items weighted "2" on both ends of a scoring continuum (e.g., item "E2I2-050") tended to have larger structure coefficients. Again, this result would be expected.

Of course, more confidence could be vested in results reported here if an even larger sample size had been employed. Still, based on data from 582 subjects, the results are generally supportive of a conclusion that the MBTI measures expected factor structure.

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Table 1
Maximum-Likelihood Structure Matrix

Variable	Factor ExtrIntr	SensIntu	ThinkFee	JudgPerc
E2I2-050	0.737			
E2I1-087	0.570			
E2I2-148	0.536			
E1I2-033	0.533			
E1I2-006	0.510			
E2I2-126	0.497			
E1I1-138	0.472			
E1I2-092	0.470			
E1BB-015	0.455			
E1I2-025	0.445			
E1I1-106	0.436			
E1I2-134	0.421			
E2I1-019	0.405			
I1BB-095	0.373			
E1I1-066	0.335			
E2I1-041	0.332			
E1I1-160	0.330			
E1I1-116	0.330			
E1BB-077	0.298			
E1I2-047	0.294			
E2I1-058	0.238			
I2BB-129	0.209			
S2N2-128		0.573		
S1N2-104		0.546		
S2BB-098		0.495		
S1N2-002		0.483		
S2N1-102		0.470		
S1N2-076		0.445		
NSBB-112		0.440		
S1BB-017		0.436		
S2N1-088		0.432		
S1N1-119		0.431		
S2N2-145		0.407		
S1N2-070		0.406		
S2BB-107		0.391		
S2BB-073		0.387		
S1BB-117		0.377		
S2N1-078		0.372		
S1N2-037		0.360		
S2BB-064		0.349		
S1N1-011		0.332		
S2N1-149		0.327		
S1BB-090		0.323		
S1BB-121		0.314		
S1BB-165		0.271		
S1N1-053		0.271		
S1BB-140		0.187		
NSBB-115		0.075		
TFTF-114			0.665	
TFTF-086			0.538	

TBTB-072	0.493	
TFTF-029	0.463	
TFTF-026	0.456	
TFTF-103	0.452	
TFTF-079	0.451	
TFTF-154	0.403	
TBTB-089	0.395	
TFTF-100	0.371	
TFTF-084	0.365	
TBTB-091	0.342	
TFTF-105	0.342	
TFTB-111	0.334	
FBFB-158	0.325	
TBTB-120	0.299	
TBTB-133	0.290	
TBTB-004	0.265	
TBTB-093	0.260	
TFTF-081	0.238	
TBTB-108	0.221	
FBFB-147	0.212	
FBBB-122	0.081	
J2P2-085		0.721
J2P2-001		0.577
J2P2-055		0.546
J2P1-027		0.529
J1P1-060		0.517
J1P1-042		0.507
P2BB-049		0.496
J1P1-151		0.491
J2P2-074		0.490
J1P1-020		0.459
J1P2-132		0.450
J2P1-035		0.446
J1P1-097		0.429
J1P2-094		0.429
J1P1-013		0.409
P1BB-142		0.404
J2P2-118		0.398
J1P1-068		0.375
J2P1-109		0.351
J1BB-124		0.340
P1BB-113		0.331
P1BB-009		0.302
J1P1-153		0.285
J1BB-099		0.279

Note. The item names convey the MBTI item number as the last three digits of each name, and generally convey the scoring system used on the MBTI. Responses on some items are scored more heavily and on both ends of a given continuum (e.g., "E2I2-050"--MBTI item #50), while other items are scored more heavily on one end of the continuum but not on the other end (e.g., "E2I1-087"--MBTI item #87, for which one response increments the Extraversion score by 2, but for which an alternative response increments the Intraversion score by only 1). More detail on the scoring system is available in the MBTI manual.

Table 2

Factor Intercorrelation Matrix

	ExtrIntr	SensIntu	ThinkFee
SensIntu	-.149		
ThinkFee	-.149	.227	
JudgPerc	-.073	.474	.143

Table 3

Iterative Model Modification Scenarios

Step	"Freed" Variable	"Freed" Factor	df	chi-square	Change in chi-square	Fit
Model #2 (Uncorrelated Factors Model)						
0	--	--	4370	7385.29	--	.775
1	J2P1-109	ThinkFee	4369	7332.00	53.29	.778
2	J2P2-118	ThinkFee	4368	7277.56	54.44	.781
3	E1I2-033	SensIntu	4367	7251.17	26.39	.781
CPU time: 12,912 seconds						
Model #3 (Correlated Factors Model)						
0	--	--	4364	7248.08	--	.778
1	J2P1-109	ThinkFee	4363	7195.11	52.97	.780
2	J2P2-118	ThinkFee	4362	7142.99	52.12	.783
3	E1I2-033	SensIntu	4361	7112.63	30.36	.784
CPU time: 15,690 seconds						

APPENDIX A:
Unsorted Confirmatory Factor Structure Matrix for Correlated Factor Model

Variable	Factor ExtrIntr	SensIntu	ThinkFee	JudgPerc
J2P2-001				0.577
S1N2-002		0.483		
TBTB-004			0.265	
E1I2-006	0.510			
P1BB-009				0.302
S1N1-011		0.332		
J1P1-013				0.409
E1BB-015	0.455			
S1BB-017		0.436		
E2I1-019	0.405			
J1P1-020				0.459
E1I2-025	0.445			
TFTF-026			0.456	
J2P1-027				0.529
TFTF-029			0.463	
E1I2-033	0.533			
J2P1-035				0.446
S1N2-037		0.360		
E2I1-041	0.332			
J1P1-042				0.507
E1I2-047	0.294			
P2BB-049				0.496
E2I2-050	0.737			
S1N1-053		0.271		
J2P2-055				0.546
E2I1-058	0.238			
J1P1-060				0.517
S2BB-064		0.349		
E1I1-066	0.335			
J1P1-068				0.375
S1N2-070		0.406		
TBTB-072			0.493	
S2BB-073		0.387		
J2P2-074				0.490
S1N2-076		0.445		
E1BB-077	0.298			
S2N1-078		0.372		
TFTF-079			0.451	
TFTF-081			0.238	
TFTF-084			0.365	
J2P2-085				0.721
TFTF-086			0.538	
E2I1-087	0.570			
S2N1-088		0.432		
TBTB-089			0.395	
S1BB-090		0.323		
TBTB-091			0.342	
E1I2-092	0.470			

TBTB-093			0.260	
J1P2-094				0.429
I1BB-095	0.373			
J1P1-097				0.429
S2BB-098		0.495		
J1BB-099				0.279
TFTF-100			0.371	
S2N1-102		0.470		
TFTF-103			0.452	
S1N2-104		0.546		
TFTF-105			0.342	
E1I1-106	0.436			
S2BB-107		0.391		
TBTB-108			0.221	
J2P1-109				0.351
TFTB-111			0.334	
NSBB-112		0.440		
P1BB-113				0.331
TFTF-114			0.665	
NSBB-115		0.075		
E1I1-116	0.330			
S1BB-117		0.377		
J2P2-118				0.398
S1N1-119		0.431		
TBTB-120			0.299	
S1BB-121		0.314		
FBBB-122			0.081	
J1BB-124				0.340
E2I2-126	0.497			
S2N2-128		0.573		
I2BB-129	0.209			
J1P2-132				0.450
TBTB-133			0.290	
E1I2-134	0.421			
E1I1-138	0.472			
S1BB-140		0.187		
P1BB-142				0.404
S2N2-145		0.407		
FBFB-147			0.212	
E2I2-148	0.536			
S2N1-149		0.327		
J1P1-151				0.491
J1P1-153				0.285
TFTF-154			0.403	
FBFB-158			0.325	
E1I1-160	0.330			
S1BB-165		0.271		