UNRESOLVED ISSUES IN THE DIMENSIONALITY OF THE MYERS-BRIGGS TYPE INDICATOR

ROBERT J. HARVEY, WILLIAM D. MURRY, AND DEAN T. STAMOULIS
Virginia Polytechnic Institute and State University

The Myers-Briggs Type Indicator (MBTI) has achieved widespread use in organizational settings, despite the fact that research on its dimensionality has been scarce and that some studies have questioned the validity of its four-factor scoring system. Confirmatory factor analyses of 94 MBTI items (N = 1,091) were performed, the results of which provided qualified support for the four-factor model; the qualifications arose from the fact that model-fit indexes for even the best-fitting models were considerably below their maximum desirable values. In an attempt to identify areas in which model fit could be improved, exploratory factor analyses were also conducted; these analyses strongly supported a four-factor view of the MBTI and indicated several additional factor loadings that could be freed to improve model fit.

According to its developers, the Myers-Briggs Type Indicator (MBTI) (Briggs & Myers, 1976) assesses four underlying bipolar constructs: *introversion* (I) versus *extroversion* (E), *sensing* (S) versus *intuition* (N), *thinking* (T) versus *feeling* (F), and *perceiving* (P) versus *judging* (J). However, despite its wide popularity in applied settings, fundamental questions remain to be answered regarding the *construct validity* of the MBTI—in particular, to what degree does empirical support exist for the position (e.g., Myers, 1962) that the MBTI items measure these four constructs, and that each item has a significant loading on only one latent construct?

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To date, most of the evidence relevant to this question has come from exploratory factor analyses of the MBTI, and support for the predicted four-factor structure has been mixed. Sipps, Alexander, and Friedt (1985) conducted an exploratory factor analysis of 1,291 undergraduates that produced a six-factor solution; Sipps et al. concluded that there is "only limited support for the item validity of the MBTI" (p. 789). Comrey (1983) factored data from 241 subjects and reported a five-factor solution that somewhat paralleled the predicted four-factor model, yet split the T-F dimension. He concluded that "many items are functioning poorly" (p. 115). Other studies have reported more supportive results. For example, Thompson and Borrello (1986) analyzed data from 359 students. A four-factor exploratory solution resulted in which only a small number of items failed to exhibit strong loadings on their predicted factor. Likewise, Tzeng, Outcalt, Boyer, Ware, and Landis (1984) reported finding "clear simple structures with the resultant empirical factors being matched almost perfectly with the theoretical scales of the MBTI" (p. 255).

It has been argued (e.g., James, Mulaik, & Brett, 1982; Kenny, 1979) that the most powerful method for assessing the validity of the predicted factor structure of an instrument is *confirmatory* factor analysis; in such studies, the important question is concerned with the degree to which a given factor model (i.e., the predicted pattern of free loadings, factor correlations, and unique item variances) is capable of providing a strong "fit" to the obtained item variance/covariance matrix. We are aware of only one confirmatory factor analytic study of the MBTI (Thompson & Borrello, 1989) that examined the validity of the MBTI authors' predicted item-factor linkages. Thompson and Borrello analyzed MBTI data from 582 students. They tested a null model (i.e., 0 common factors), a four-factor orthogonal model, and a four-factor oblique model. However, the goodness-of-fit (GFI) (Jöreskog & Sörbom, 1981) indexes reported by Thompson and Borrello for their orthogonal and oblique models were only a relatively modest .78; this value suggests that significant discrepancies exist between the correlations reproduced by the model and the actual data, and that additional model modifications might be necessary.

In summary, the evidence supporting the validity of the predicted four-construct MBTI scoring system is mixed: Some exploratory studies (e.g., Comrey, 1983; Sipps et al., 1985) have been strongly critical of the four-factor structure; other exploratory studies have been supportive (e.g., Thompson & Borrello, 1986; Tzeng et al., 1984), and the results of the single confirmatory item-level MBTI study are in need of replication and extension (i.e., to test other substantive factor models in addition to the four-factor structure predicted by authors of the MBTI, and to replicate its findings in larger samples of subjects). A confirmatory factor analysis was employed to test orthogonal and oblique versions of several substantively different MBTI models: (a) the four-factor model advanced by the authors of the MBTI, (b) the six-factor model proposed by Sipps et al. (1985), and (c) the five-factor model advocated by Comrey (1983). The model constraints tested were (a) the degree to which correlated versus uncorrelated factors were present (which was assessed by comparing the fit indexes produced by the orthogonal versus oblique models *within* each of the cited model classes); and (b) the relative ability of the three different substantive models to fit the given data (which was assessed by comparing model fit indexes *across* the three substantive models). Because only a single sample of MBTI data was analyzed, it was not possible to assess the invariance of the MBTI factor structure (e.g., factor loadings, factor correlations, or unique item variances) across multiple groups of subjects.

In the event that none of the confirmatory factor analyses succeeded in producing high levels of model fit (e.g., GFI values in the .90s and average correlation residuals < .05)—which one might expect if the Thompson and Borrello (1989) findings are generalizable—we planned to conduct post hoc exploratory factor analyses in an attempt to identify model modifications (e.g., additional factor loadings) that could be added to improve model fit. The goal of these exploratory analyses was to identify modifications that would form the basis for subsequent *confirmatory* factor studies conducted in *new* samples of data. That is, because there must be independence between the samples in which confirmatory factor model modifications are *derived* versus *tested* (e.g., James et al., 1982; Kenny, 1979), one would be unable to conduct follow-up confirmatory analyses in the original sample of data. Thus the purpose of this study was to examine through confirmatory factor analysis the factor structure of the MBTI, and to identify potential areas of model modification designed to improve model fit.

Method

Subjects

A sample of 1,091 people was drawn from a total pool of 1,194 subjects who completed the MBTI; subjects with more than two items of missing data on the 94 scored items were deleted. Of the 1,194 subjects that formed the sample, undergraduates who received course credit for volunteering or who participated in noncredit class exercises comprised 42% of the sample. The remaining subjects completed the MBTI under a variety of conditions (e.g., in the context of management development training).

Instrument and Data Collection

Form F of the MBTI was used. It has 166 items, most of which are rated in a two- or three-alternative, forced-choice format. Ninety-five items are used in the MBTI to produce the four dimension scores; of these 95 items, 94 items were analyzed (number 68 was dropped because it allows raters to mark more than one response alternative). The MBTI item responses were given a value of 1 if the individual's response was in the I, N, F, or P direction, and 0 if the response was in the E, S, T, or J direction.

Factor Analyses

CONFIRMATORY ANALYSES

Each of the three substantive classes of models described previously was analyzed by using the SAS CALIS procedure, which fit restricted common factor models. Unweighted least squares (ULS) estimates of the free model parameters were obtained (the large number of items being analyzed precluded obtaining maximum-likelihood parameter estimates for the confirmatory analyses; thus χ^2 values were unavailable). The ULS fitting function, the GFI, the adjusted GFI (AGFI) of Jöreskog and Sörbom (1981), and the root mean square residuals (RMSR) were used to quantify model fit. The factor loading patterns are summarized in Figure 1, which uses the item numbers from Form F to identify items, as well as a prefix code (I, N, F, or P) to denote its dimension.

EXPLORATORY ANALYSES

Several exploratory methods were employed; SAS PROC FACTOR was used in all cases. To compute fit indexes, we used maximum likelihood (ML) factoring with squared multiple correlation (SMC) estimates of communalities; solutions from 1 to 20 dimensions were obtained. To extract the eigenvalues for the scree test, noniterative principal axis factoring of the reduced correlation matrix was used. The fit of each ML unrestricted model was assessed using χ^2, eigenvalue discontinuities, Akaike's information criterion (AIC) (Akaike, 1987), and Schwarz's Bayesian criterion (SBC) (Schwarz, 1978). For the final rotated solutions, oblique Harris-Kaiser (HK) (Harris & Kaiser, 1964) rotation (power = 0.5) was used. To assess the possibility that the dichotomous nature of the item responses might affect the factor structure of the MBTI, these analyses were conducted by using both the raw item data (i.e., phi correlations) as well as *tetrachoric* correlations. Although opinions are mixed regarding the necessity of factoring tetrachoric correlation matrices (e.g., Gorsuch, 1983, p. 296; Horst, 1965, p. 515; and Rummel, 1970, p. 304, list arguments *against* factoring tetrachoric *r*s), past research has not addressed the question of whether the factor structure of the MBTI might change depending on the choice of correlation coefficients.

Results and Discussion

Confirmatory Factor Analyses

With respect to the need for correlated MBTI factors, the fit indexes presented in Table 1 indicate that, contrary to the results of Thompson and Borrello (1989), the orthogonal models of the MBTI provided consistently inferior levels of model fit than did the corresponding oblique versions of each model (i.e., the GFI and AGFI values were higher in oblique models, and the RMS residual was lower). Thus the confirmatory factor results indicated that an oblique solution provided superior fit for each of the three substantive models.

With respect to the question of which of the three substantive models provided the most plausible representation of the obtained MBTI correlations, the results in Table 1 indicate that the Sipps et al. (1985) model exhibited a noticeably lower fit to the data than did either the Comrey or a priori MBTI models; however, consistent with the findings of Thompson and Borrello (1989), none of these models exhibited a particularly high level of fit when standard rules of thumb were used. For example, RMSRs for all models exceed .05 *r* units—an outcome indicating that, on average, there is a fairly sizable difference between the *r*s reproduced from the factor models and the actual data (e.g., see Kenny, 1979). Additionally, the results for the models in Table 1 revealed that both the Comrey (1983) and Sipps et al. (1985) models demonstrate problems in their factor correlations: Specifically, the Comrey model T-F factors were extremely highly correlated (r_{34} = .99), and similarly excessive *r*s were present in the Sipps et al. model (e.g., $r_{16} = -.98$, $r_{36} = .96$, $r_{13} = -.88$). Factor correlations of this magnitude suggest that the models might be fundamentally misspecified. Only the a priori MBTI model failed to demonstrate excessive factor correlations, although its factors were not uncorrelated—a finding consistent with that of past studies (e.g., Johnson & Saunders, 1990).

In summary, of the models that were compared, the four-factor model developed by the authors of the MBTI offers the most plausible representation of its latent structure. However, the absolute levels of the model fit statistics indicated that even the oblique four-factor MBTI model demonstrated appreciable room for improvement. Therefore, the results of exploratory factor analyses were examined next in an attempt to identify model parameters (e.g., additional loadings) that could be included to improve overall model fit.

			Factor Model										
			Sipps et al.						Comrey				
MBTI Item	*M*	*S*	1	2	3	4	5	6	1	2	3	4	5
P1	0.206	0.404		x									x
N2	0.405	0.491					x			x			
F4	0.784	0.411	x								x	x	
I6	0.543	0.498				x			x				
P9	0.397	0.489		x									x
N11	0.570	0.495					x			x			x
P13	0.418	0.493		x									x
I15	0.565	0.495				x			x				
N17	0.528	0.499					x			x			
I19	0.694	0.460				x		x	x				
P20	0.370	0.483											x
I25	0.294	0.455				x			x				
F26	0.445	0.497									x	x	
P27	0.569	0.495		x									x
F29	0.604	0.489									x	x	
I33	0.355	0.478				x		x	x				
P35	0.402	0.490		x									x
N37	0.677	0.467								x			
I41	0.422	0.494							x				
P42	0.459	0.498		x									x
I47	0.339	0.473							x				
P49	0.167	0.373		x									x
I50	0.449	0.497				x			x				
N53	0.483	0.499					x			x			
P55	0.479	0.499		x									x
I58	0.619	0.485							x				
P60	0.303	0.459		x									x
N64	0.670	0.470					x	x		x		x	
I66	0.339	0.473				x			x				
N70	0.504	0.500					x			x			
F72	0.794	0.404	x					x			x	x	
N73	0.758	0.428			x					x	x		
P74	0.613	0.487	x	x						x		x	x
N76	0.312	0.463					x			x	x		
I77	0.356	0.479						x	x	x			
N78	0.563	0.496					x			x			
F79	0.339	0.473						x				x	
F81	0.412	0.492	x									x	
F84	0.530	0.499			x						x		
P85	0.338	0.473		x									x
F86	0.497	0.500	x							x	x	x	
I87	0.450	0.497	x			x			x				
N88	0.671	0.469						x		x			
F89	0.738	0.439			x						x	x	
N90	0.646	0.478	x							x			
F91	0.746	0.435			x						x		
I92	0.361	0.480				x			x				
F93	0.648	0.477			x						x		
P94	0.439	0.496		x				x			x		x

I95	0.362	0.481				x			x		x		
P97	0.425	0.494		x				x					x
N98	0.676	0.468	x					x		x			
P99	0.679	0.467										x	x
F100	0.548	0.497						x			x	x	
N102	0.615	0.486	x							x		x	
F103	0.561	0.496			x						x	x	
N104	0.418	0.493	x				x			x			
F105	0.306	0.461	x								x	x	
I106	0.385	0.487	x			x			x				
N107	0.737	0.440	x							x			
F108	0.837	0.368	x										x
P109	0.714	0.451	x							x		x	x
F111	0.689	0.463			x						x		
N112	0.262	0.440								x			
P113	0.307	0.461						x					x
F114	0.530	0.499	x					x			x	x	
N115	0.109	0.313	x							x			
I116	0.128	0.334			x				x		x		
N117	0.600	0.490	x							x			
P118	0.551	0.497	x									x	x
N119	0.490	0.500	x							x			
F120	0.780	0.414			x						x		
N121	0.548	0.497			x					x			
F122	0.258	0.437			x						x		
P124	0.472	0.499											x
I126	0.529	0.499				x		x	x				
N128	0.417	0.493					x	x		x			
I129	0.739	0.439							x		x		
P132	0.295	0.456		x									x
F133	0.805	0.395	x									x	
I134	0.528	0.499				x			x				
I138	0.604	0.489				x			x				
N140	0.815	0.387								x			
P142	0.435	0.496		x									x
N145	0.502	0.500					x			x			
F147	0.156	0.363									x		
I148	0.493	0.500				x			x				
N149	0.532	0.499								x			
P151	0.251	0.433		x									x
P153	0.254	0.435											x
F154	0.457	0.498			x						x		
F158	0.289	0.453			x			x			x		
I160	0.339	0.473				x			x				
N165	0.585	0.492								x		x	

Figure 1. MBTI item statistics and predicted factor loadings in confirmatory models.
Note. An "x" denotes a predicted factor loading (free parameter); the prefix on the item name denotes the a priori MBTI dimension into which the item was categorized by the MBTI's authors.

Exploratory Factor Analyses

The first issue in the exploratory analyses was concerned with the number of factors to retain; unrestricted solutions in varying dimensionalities were

Table 1
Summary of Confirmatory Factor Analysis Models

Model	Function	GFI	AGFI	RMSR
Null	77.11	.379	.365	.131
MBTI orthogonal	27.63	.777	.768	.079
MBTI oblique	14.37	.884	.879	.057
Comrey orthogonal	24.43	.803	.793	.074
Comrey oblique	12.35	.900	.895	.053
Sipps orthogonal	48.69	.608	.590	.104
Sipps oblique	31.79	.744	.732	.084

Note. Function = value of the ULS fitting function; GFI = goodness-of-fit index; AGFI = adjusted GFI; RMSR = root mean square residual.

extracted to determine the degree to which each solution could reproduce the MBTI correlations. The scree plots revealed a pronounced discontinuity after four factors, and plots of the Tucker-Lewis (Tucker & Lewis, 1973), χ^2, Akaike (1987), and Schwarz (1978) indexes also supported the view that four major factors are present. The results of these exploratory factor analyses were effectively identical when phi versus tetrachoric *r*s were used. It was suggested that the dichotomous nature of the MBTI items exerts no appreciable impact on the latent dimensionality of the instrument. Consistent with this conclusion, inspection of the means and standard deviations (Figure 1) reveals no problems with respect to items possessing extreme means or variances, which, if present, might cause the so-called "difficulty factor" problem that tetrachoric correlations attempt to remedy. Examination of the rotated four-factor solutions revealed that (a) the pattern of loadings was functionally identical when phi versus tetrachoric *r*s were analyzed and (b) the MBTI items were loaded almost exactly as predicted by the authors of the MBTI. Specifically, only two MBTI items exhibited their highest loadings on a nonpredicted factor (P99 and F122), although in both cases substantial secondary loadings on the predicted factor were also present. Only a few items exhibited secondary loadings on a nonpredicted factor, and these loadings were easily interpreted. The low factor correlations varied between –.02 and .21.

Thus the results of the exploratory analyses strongly supported the notion that four major factors are present in the MBTI, although the necessity of including additional nonpredicted free loadings to improve overall model fit must be considered. Specifically, the results indicated that the following free loadings should be added in subsequent confirmatory factor analyses: Items F122, P20, and P99 on the S-N factor; Items N64, P74, N102, P118, P94, P109, and P97 on the T-F factor; and Item I77 on the J-P factor. In the case of Items P118 and P94, the results of the Thompson and Borrello (1986) study also suggested that these items be given additional free secondary loadings. In all cases, adding these new secondary loadings would be interpretively consistent with the substantive meaning of the underlying factors.

Conclusions

The results have presented a "good news and bad news" message regarding the validity of the a priori four-factor view of the MBTI. On the positive side, the oblique four-factor model provided the most plausible representation of the MBTI's latent structure of the three confirmatory factor models tested; on the negative side, the fit indexes from even the best four-factor confirmatory model indicated that considerable room for improvement was present and that model modifications might be necessary to afford a closer fit to the data. The goal of the exploratory factor analyses was to identify such model modifications; these analyses revealed strong support for the validity of a four-factor view of the MBTI, and they identified a number of additional secondary factor loadings that need to be tested in subsequent confirmatory factor studies of the MBTI.

Although the exploratory factor results were consistent with those found in some previous studies (e.g., Thompson & Borrello, 1986; Tzeng et al., 1984) that supported a four-factor view of the MBTI, they were inconsistent with those of other studies (e.g., Comrey, 1983; Sipps et al., 1985) that rejected such a view. The findings raised the question of why such divergence would occur. One cannot rule out the possibility that the factor structure of the MBTI varies significantly as a function of the specific sample of respondents being analyzed; however, it would seem much more likely for such divergence to have been simply the result of methodological differences between studies. For example, Sipps et al. (1985) used principal components analysis instead of common factor analysis; because the components model makes no provision for unique item variance (e.g., variance because of unsystematic measurement error), research has shown (e.g., Cliff, 1987; Snook & Gorsuch, 1989) that components analysis produces biased factor loadings. Similarly, the small sample size (2.5:1 ratio of subjects to items) used in Comrey (1983) suggests that sampling error might have affected his results. The only way to answer this question conclusively is to conduct confirmatory factor analyses in several populations and to evaluate the performance of models that constrain the factor patterns to be invariant across samples.

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