EVALUATION OF THEORIZED FACTOR STRUCTURE OF THE MMPI FOR MALE AND FEMALE POPULATIONS*

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Introduction

Many tests require different scoring keys for males and females. In doing so the test manufacturers are implying that, along the dimensions that the tests measure, males and females are not represented adequately by the same items or by items scored in the same direction. The women's movement, on the other hand, has been trying to break down sex role stereotypes and asserts that women and men share the same characteristics along any continuum.

This paper looks at four current theories about the factor structure of the Minnesota Multiphasic Personality Inventory (MMPI) as related to the issue of male-female differences. The four theories tested are the conventional scoring of the clinical scales (Hathaway & McKinley, 1951), Lushene's (1967) theory, Tryon's (1966) theory, and the factor scale theory of Barker, Fowler, and Peterson (1971).

The Lushene theory provides different subscales for males and females using 18 subtests for males and only 9 for females. The clinical scales score all subtests with the same key for males and females except the M-F scale. This scale postulates differences accounted for by sex. The Tryon theory scores subtests with one key for both males and females, making no distinction between the sexes. The Barker et al theory, because it originated from a male population, makes no provision for females at all.

Various methods of analysis were used in arriving at the theories for the MMPI examined here. The clinical scales were constructed through item analysis and subjective content validity. Tryon's theory involved factoring random subsets of items and converging on salient clusters. This theory was derived from 310 adult subjects, sex not specified. At no time were all 566 items in the same analysis. Lushene used an obverse factor analysis method to factor subjects (people) rather than items or variables. Lushene factored separately 189 males and 253 females. Because of the small number of subjects used, the subscales are of questionable validity. The Barker et al theory was based on a direct factor analysis of 373 items from a short-form of the MMPI. Subjects were 1575 male hospitalized VA patients. The 373 items contained all conventional clinical scale items. To date, the 566-item MMPI has been too large to factor directly, and thus, none of these theories is based upon the representation of all items in a conventional factor analysis.

Horst (1965) proposed an indirect factor analysis method which can be applied to very large numbers of variables. Horst's indirect method was implemented by Barker in 1971 in a computer program, CORR99. The program has been revised and tested over more than five years (Sloan, 1973; Stallings, 1973; Barker & Barker, 1975), and provides a method for testing theories about large data matrices (Barker & Barker, 1976a; Hamlett, 1976). This paper proposes to evaluate by Horst's indirect method the four theories of the MMPI scales as they relate to women, and then to compare the theories with the male counterparts. The best theory for females will be compared through rotation to the equivalent male theory.

Methodology

The original MMPI standardization sample was used for data. The 511-item MMPI was administered to 315 female friends and relatives of hospitalized neuropsychiatric patients. Fifty-five items were subsequently added to the scale and identified in the theories. Since these items were not present in the original testing, they were not considered in the analyses. The MMPI items were factor analyzed by the indirect factor-analytic method (CORR99, Barker, 1973) on a Univac 1110 computer. Items with a factor load equal to or greater than .30 (positive or negative) on only one factor were used.

Each of the four theories was tested separately and the information measure D (relative uncertainty reduction was computed. The D measure is used to relate the degree of association between theorized factor structure and actually obtained factor structure. The paper by Barker and Barker (1976b) supplied the computed D measures from each of the theories for the males. Differences in adequacy among the four theories for males and females were compared. The results of the theory supplying the most accurate

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results for women were used as a reference criterion to which the equivalent male theory results were rotated (CORR22).

Results

Matrices for the four D measures are shown in Tables 1 through 4. For the D measure, 1.00 is a perfect certainty or prediction capability. To the extent that more uncertainty or error in prediction exists, the D measure will approach 0.00. Relative ranking of the D measures from least to most agreement for males and females are:

D measure for	Females	Males
1. Conventional	.32	.42
2. Tryon	.42	.42
3. Lushene	.43	.56
4. Barker et al	.59	.52

The low D measures for the females from these four theories would seem to indicate little agreement between existing theory and the actual factor structure for the 566 item instrument. Relatively, the theory for women based on the factored 373-item instrument was the most accurate. If one accepts the view that the factor structure should differ for male and female, this is puzzling in that there were no females in the Barker et al sample. The rank ordering for males differed from females with the Lushene theory being slightly more adequate than the factor-based theory of Barker et al. The results from Tryon's theory produced identical D measures for males and females which one could postulate as he does not differentiate between the sexes. The conventional clinical scales and Lushene's theory appear to define male dimensions better than female. Since the Barker et al theory was so much better than the Lushene theory for females, and because of the different numbers of factors in Lushene's theory for male and female, the results of the Barker et al solutions for males and females were rotated to maximum alignment to determine the similarity of the factor solution for the two sexes. Results of this rotation are given in Table 5.

Approximately two-thirds of the cosines between items for males and females were over .70 indicating much agreement between the two solutions. If the basic factor structure is the same for male and female, it is conceivable that the female factor solution is more accurate than that obtained for the males. This seems reasonable due to the larger and more adequate sampling of females (females = 315; males = 225).

An inspection of the cosines showed some negatively related items. This would indicate that males and females tended to answer in opposite directions on these items. There appeared to be no apparent patterning on subscales in these differences. A few representative items are:

46. My judgment is better than it ever was.
183. I am against giving money to beggars.
113. I believe in law enforcement.
376. Policemen are usually honest.
199. Children should be taught all the main facts of sex.
176. I do not have a great fear of snakes.
522. I have no fear of spiders.
454. I could be happy living all alone in a cabin in the woods or mountains.

Summary

Four current theories about the factor structure of the MMPI as they relate to male-female differences were compared by an indirect factor analytic method. None of the theories proved adequate in estimating the factor structure of the 566-item MMPI.

The most impressive theory for females was the Barker et al theory with a D measure of .59. For the males, the Lushene theory with a D measure of .56 was virtually identical in adequacy to the Barker et al theory (D = .52). Factor results for females, based on the Barker et al theory, were used as a reference criterion to which the male factors of the same theory were rotated.

References

Barker, H. R. Behavioral Sciences Statistics Program Library. University of Alabama: Reproduction Services, 1973.

Barker, H. R., and Barker, B. M. Summary of research on a novel, indirect factor analytic solution. Proceedings of the Social Statistics Section, American Statistical Association, 1975, 298-301.

Barker, H. R., and Barker, B. M. An indirect factor method for testing the dimensionality of large data sets. Paper presented at Southeastern Psychological Association, New Orleans, La., March 19, 1976.(a)

Barker, H. R., and Barker, B. M. An indirect method for testing the dimensionality of large data sets. Paper presented at American Statistical Association, Boston, Mass., August 23, 1976.(b)

Barker, H. R., Fowler, R. D., and Peterson, L. D. Factor analytic structure of the short form MMPI items in a VA hospital population. Journal of Clinical Psychology, 1971, Vol. XXVII, No. 2, 228-233.

Hamlett, C. C. Validation of the theorized factor structure of the Personal Orientation Inventory. Paper presented at American Statistical Association, Boston, Mass., August 23, 1976.

Hathaway, S. R., and McKinley, J. C. MMPI Manual, Revised Ed. New York: Psychological Corp., 1951.

Horst, P. Factor analysis of data matrices. New York: Holt, 1965.

Lushene, R. E. Factor structure of the MMPI item pool. Unpublished master's thesis, Florida State University, 1967.

Sloan, H. C. A simplified procedure for estimating the factor structure of large data matrices. Unpublished doctoral dissertation, University of Alabama, 1973.

Stallings, N. A. Evaluation of an indirect method of estimating the factor structure of large data matrices. Unpublished doctoral dissertation, University of Alabama, 1973.

Tryon, R. C. Unrestricted cluster and factor analysis, with applications to the MMPI and Holzinger-Harman problems. Multivariate Behavioral Research, 1966, Vol. 1, 229-244.

Table 5.

Frequency Distribution of Cosines

Cosines	Freq.	Cum. Freq.	Cum. %ile
.90+	92	92	18
.80+	152	244	48
.70+	88	332	65
.60+	66	398	78
.50+	43	441	86
.40+	23	464	91
.30+	18	482	94
.20+	8	490	96
.10+	8	496	97
.01+	13	511	100

TABLE 1

ASSOCIATION BETWEEN ITEM SUBSETS AND VARIMAX FACTORS (CONVENTIONAL THEORY)

ITEM SUBSETS X	Factors (Y) I	II	III	IV	V	VI	VII	VIII	IX	False -	Sum
1	8										8
2					2		3	2		16	23
3							7			9	16
4				2			2			17	21
5					4		1			16	21
6						3	2			12	17
7							14			4	18
8							4	4		30	38
9							2			17	19
False +	3				1		42	2			48
Sum	11			2	7	3	77	8		121	229

H(X) = 3.473 H(X,Y) = 4.043

H(Y) = 1.690 HT = 1.121 D = .323

TABLE 2

ASSOCIATION BETWEEN ITEM SUBSETS AND VARIMAX FACTORS (TRYON THEORY)

	Factors (Y)							False	
X ITEM SUBSETS	I	II	III	IV	V	VI	VII	-	Sum
1	23							2	25
2		19						13	32
3			2		4			19	25
4	1			4	1		2	19	27
5					12			8	20
6					5		1	16	22
7							23	12	35
False +		4		1	8		3		16
Sum	24	23	2	5	30		29	89	202

H(X) = 2.962 H(X,Y) = 3.981

H(Y) = 2.252 HT = 1.232 D = .416

TABLE 3

ASSOCIATION BETWEEN ITEM SUBSETS AND VARIMAX FACTORS (LUSHENE THEORY)

	Factors (Y)									False	
X ITEM SUBSETS	I	II	III	IV	V	VI	VII	VIII	IX	-	Sum
1	19	1	1		1					45	67
2		26								22	48
3			17							10	27
4				3						17	20
5					6					6	12
6						4				7	11
7							5			2	7
8								2		1	3
9	1								3		4
False +	17	12	5				2				36
Sum	37	39	23	3	7	4	7	2	3	110	235

H(X) = 2.817 H(X,Y) = 3.918
H(Y) = 2.312 HT = 1.211 D = .430

TABLE 4

ASSOCIATION BETWEEN ITEM SUBSETS AND VARIMAX FACTORS
(BARKER, FOWLER, AND PETERSON THEORY)

ITEM SUBSETS X	Factors (Y) I	II	III	IV	V	VI	VII	VIII	IX	False -	Sum
1	31									11	42
2	1	25								23	49
3	2		9							16	27
4				9						13	22
5					13					1	14
6	4					6				8	18
7	1						7			25	33
8	1							10		1	12
9									3	5	8
False +	51	7	4			1	1	1			65
Sum	91	32	13	9	13	7	8	11	3	103	290

H(X) = 3.072   H(X,Y) = 3.748

H(Y) = 2.483   HT = 1.807   D = .588