DOCUMENT RESUME

ED 091 429 TM 003 643

AUTHOR Roberds, Jeannette
TITLE The Bender Gestalt and the Ravens Progressive Matrices Measures of Perceptual Behavior, Motor Behavior and Perceptual-Motor Behavior.
PUB DATE [74]
NOTE 21p.; Paper presented at the Annual Meeting of the American Educational Research Association (59th, Chicago, Illinois, April 1974)

EDRS PRICE MF-$0.75 HC-$1.50 PLUS POSTAGE
DESCRIPTORS Comparative Analysis; Elementary School Students; *Factor Structure; *Perception Tests; Perceptual Motor Learning; *Psychomotor Skills; *Tests; Visual Measures; *Visual Perception
IDENTIFIERS Bender Gestalt Test; Raven Colored Progressive Matrices

ABSTRACT

The scores of 79 second-grade pupils on the Ravens Colored Progressive Matrices and the Bender Gestalt were factor-analyzed using six different factor-analytic procedures. Sex, age, and vocabulary test scores were included in the analysis as marker variables. The original factor solutions were subjected to oblique transformation and the transformed solutions were compared. Ten factors were found to be robust across factoring methods and were interpreted. Four perceptual factors were defined by Ravens items; three motor factors were defined by Bender items, and three perceptual-motor factors were defined by a combination of Bender and Ravens items. (Author)

Session 19.05

ED 091429

THE BENDER GESTALT AND THE RAVENS PROGRESSIVE MATRICES MEASURES OF PERCEPTUAL BEHAVIOR, MOTOR BEHAVIOR AND PERCEPTUAL-MOTOR BEHAVIOR

Jeannette Roberds
Miami University
Oxford, Ohio

Paper Presented to Annual Meeting
American Educational Research Association
April, 1974

TM 003 643

The purpose of this study was to apply exploratory factor analytic techniques to a body of data consisting of item scores from the Bender Gestalt Test, the Raven's Colored Progressive Matrices and certain marker variables. These measures were administered individually to pupils from three second grade classrooms during the middle three months of the school year. Marker variables included were age, sex, and a "learning problem" variable determined by asking the teachers to designate those children who were exhibiting serious problems in school learning.

Objective

The objective of this study was exploratory in that an investigation was being made of the factor structure of the combined item scores of two widely used instruments both of which rely on visual perception. The Raven's Colored Progressive Matrices (Raven, 1956) requires the subject to select which of six pictured response choices would correctly complete an incomplete visual pattern. For the purposes of this study subjects were asked to point to or touch the chosen response. The Bender Gestalt Test (Bender, 1938) was administered by asking the subject to copy each of the nine designs presented one at a time. Although both instruments depend upon the visual modality, the fact that the complex motor act of copying the Bender designs was sufficiently different from the type of response required by the Colored Progressive Matrices was taken as a point of departure in the process of interpreting the factors which emerged.

Strategy

The strategy used in this study was that proposed by Hofmann (1973). Three factoring methods -- alpha factor analysis, incomplete image analysis, and incomplete components analysis -- were used to obtain initial orthogonal factor solutions and transformed solutions were derived using the obliquimax transformation (Hofmann, 1970). These factors which were robust with respect to method were then interpreted.

Subjects

The 79 subjects of this study were pupils in an elementary school in an Indiana city of 50,000 population. They were in second grade at the time the data were gathered. The school population was predominantly white middle and working class but included children of poverty level families as well as offspring of wealthy professional parents. Fewer than ten per cent of the subjects were Negro. The subjects were relatively homogeneous with respect to age, average 99.6 months, standard deviation 5.85. There were 46 boys and 33 girls.

Data Collection

The Bender Gestalt Test (BG) and the Raven's Colored Progressive Matrices (CPM) were administered individually by two examiners during a seven week period from the end of January through the first week in March, 1973. Scores were compared between the two examiners in order to assess for an examiner effect; none was found. All Bender protocols were scored by an experienced school psychologist according to the scoring system developed by Koppitz (1963). The results of the CPM consisted of 36 item responses coded as correct or incorrect and each Bender protocol was scored for errors with a total of 30 errors possible according to Koppitz. All of the subjects chose correct responses on two of the CPM items and none of the subjects exhibited either of two of the error categories on the BG; therefore, those four items were eliminated as variables in the factor analysis procedures. After the testing was completed, the three classroom teachers were asked to indicate the names of those children who were exhibiting problems in school learning to the extent that special, individual instruction was required on a regular basis.

Types of Factors

A common factor was defined as having at least two variables with transformed loadings deemed substantive. A comparable common factor was defined as one having two or more of the same relevant variables on two of the three different factor solutions. A comparable specific factor was defined as one having a single relevant variable on two of the three different factor solutions.

Summary of Analyses

The frequency and types of common factors by factoring method are noted in Table 1. The incomplete image analysis indicated more factors

---

Insert Table 1 about here

---

than did either of the other two factoring methods. Upon closer examination it was determined that the additional image factors were specific factors which loaded as common factors on the other two methods.

The 21 comparable common factors and the two comparable specific factors are presented in Tables 2, 3, and 4. To facilitate interpretation the six comparable common factors defined by CPM items only are listed in Table 2. In order to simplify the reporting process only the

---

Insert Table 2 about here

---

relevant variables are included in the tables. The relevant CPM variables are identified according to the item numbers given in that instrument. The three comparable common factors defined by Bender Gestalt items only are presented in Table 3. The relevant BG variables are

---

Insert Table 3 about here

---

described in the table according to the Bender design number and the type of error. The twelve comparable common factors defined by combinations of both CPM and BG items are presented in Table 4 as well as

---

Insert Table 4 about here

---

the two comparable specific factors. The non-comparable factors are not presented except where note was made relative those factor for which the incomplete image method specified factors with single variable loadings similar to that variable's loading on a common factor determined by the other two methods.

In order to summarize the factor results, the magnitude of the pattern values were categorized according to the scheme suggested by Hofmann (1973). The comparable factors are summarized in Tables 5 and 6 for the purpose of simplicity; only the relevant variables are presented. If more than one-half of the loadings were negative, the symbol

---

Insert Tables 5 & 6 about here

---

has a negative sign in the table. In those cases in which the loadings fell within different criteria, the loadings were averaged and the criterion defining the average was indicated as definitive of all loadings for that variable. The comparable common factors are assumed to be representative of the common factors that exist in the universe of content from which the variables were sampled. These comparable common factors were interpreted with respect to their content as defined by the matrix presented in Tables 5 and 6. The discussion which follows is based on this matrix.

Interpretation

Since both of the psychometric instruments utilized in this study are based on responses to stimuli presented visually, the factors which emerged from the analyses might be labeled as perceptual factors. However, since the Bender requires complex motor response, it was necessary to hypothesize the possibility that some factors defined by BG item variables were, at least in part, motor factors. Therefore, three groups of factors were labeled according to the instrument(s) which defined them. Factors one through six (Table 5) were defined by CPM variables only, i.e. variables which were "perceptual" without complex motor involvement; thus, these factors are described as perceptual factors. Factors seven through nine (Table 5) were defined by BG variables only and for the purposes of this paper are labeled as motor factors. Factors 10 through 21 (Table 6) were defined by both CPM items and BG items and are described herein as perceptual-motor factors. Factors 22 and 23 were comparable specific factors and are included for completeness.

Comparable Common Factor 1

This factor was defined by five CPM items (see Table 5) which appeared to involve rather straightforward visual matching of design with regard to size or gross shape of the figures.

Comparable Common Factor 2

This factor was defined by six of the most difficult items on the CPM. A careful examination of the content of these items suggests not only a visual perception component but also an element of reasoning. In essence, the type of item involved in this factor is a visual analogy problem.

Comparable Common Factor 3

The item with the highest loading on this factor also loaded on factor 2. (see Table 5) The fact that the Incomplete Components analysis coalesced factors 2 and 3 suggests the strong similarity between the two. The difference may lie in the fact that the items defining factor 3 are less difficult visual analogies based on simple patterns associated with diamond and square shapes.

Comparable Common Factor 4

This factor was defined by three items which appear to involve the ability to visualize a complete, single figure from the parts given; that is, the completed four parts do make one whole design. An element of rotation is used in the distractors as well as simple matching part for part.

Comparable Common Factor 5

The two items which define this factor are relatively simple completion type situations. The completions required for both examples involve the visualization of extensions of the presented vertical and horizontal lines.

Comparable Common Factor 6

The bipolar relationship of the two items with high and medium loadings on this factor presented a problem in interpretation. The high loading item (A2) was one which was answered correctly by nearly all of the subjects while the item with the medium loading (A12) was missed by most of the subjects; yet, both items defined the same factor but with the negative relationship. Item A2 appeared to have one obvious correct response to complete the overall regular pattern while item A12 seemed to require careful study and comparison among the six alternatives, any of which might appear to be correct at first glance.

Consideration of the third item which defined this factor suggests that perhaps a vertical matching response set would explain the bipolar relationship; that is, if the subject were to choose the alternative which matched the stimulus picture directly above the missing part, he would be correct on item A2 and incorrect on items A12 and B9.

Comparable Common Factor 7

This factor and the two which follow immediately (Factors 8 and 9, see Table 5) were defined by Bender Gestalt items only and thus were interpreted herein as motor factors. Factor 7 illustrates the reasoning which led to the designation of motor factors as contrasted from perceptual and perceptual-motor factors. In this instance three of the items which defined factor 7 were rotation errors of designs which clearly had horizontal presentation. Although many of the CPM items provided opportunities to select error responses in terms of rotations, no CPM items loaded on this factor. This evidence suggests that the errors were in the motor expression rather than the visual reception. This becomes especially apparent when the negative loading of the distortion error category on one of the same designs is noted. That is, subjects who exhibited the rotation error on Bender design #8 tended not to distort it - to draw the shape correctly; therefore, the visual reception of the shape of the figure was adequate.

Comparable Common Factor 8

A single Bender design (Fig. 2) was the stimulus for the two error categories which loaded heavily on this factor. The design presented three horizontal rows of dots; the errors defining factor 8 were integration (i.e. an extra row or a missing row) with a very high loading and rotation (i.e. rows rotated 45° or more) with a medium loading. These errors were associated to some degree with a distortion of Figure 8.

Again the assumption has been made that the motor involvement is the key since no CPM items loaded on this factor.

Comparable Common Factor 9

Both error categories which defined this factor were rotations; but, in contrast to factor 7, these rotations (Fig. 4 and 5) involved a diagonal element. Apparently the motor response of copying a design with a diagonal connection is different from the horizontal only orientations which defined factor 7.

Comparable Common Factor 10

The high loadings which defined this factor resulted from distortion errors of two Bender figures involving designs of dots (see Table 6). In both cases the error consisted of the substitution of circles for dots. It is important to note that the BG items were scored for errors; thus, the relationship with the CPM correct responses is bipolar as expected. The three CPM items associated with the "circles for dots" responses of BG Fig. 3 and 5 appeared to involve the visualization of a completed shape in order to select the part needed to complete the shape correctly. It was assumed that both perceptual and motor components contributed to the combinations of items defining this factor.

Comparable Common Factor 11

The marker variable age defined this factor heavily along with a BG "circles for dots" on Fig. 1. Since the BG was scored for errors and the two variables did not load in a bipolar fashion, the evidence suggests that the older subjects tended to exhibit an increase in this particular error category rather than a decrease as hypothesized by Koppitz (1963). It is interesting to note also that the "circles for dots" on Figure 1 defined a different factor from the other two "circles for dots" items mentioned above, although the same two CPM items loaded on both factors at a low level (see Table 6). Another point to consider is that subjects who drew circles for dots on Figure 1 tended to make fewer rotation errors on Figure 3.

Comparable Common Factor 12

This factor was defined by two perseveration error types (see Table 6) which have been generally described as motor response difficulties; however, the association of four CPM items involving visual matching responses suggests that the visual input may contribute to the perseveration error. Further support for this view is provided by the "line for dots" error on Figure 5 which also loaded on this factor.

Comparable Common Factor 13

The variables with the highest loadings on this factor were a rotation of a single row of dots presented horizontally (Fig. 1) and an integration error on another dot design (Fig. 3). The other variables which defined this factor were rotations of dot designs (Fig. 2 and 3) and to a lesser extent, a perseveration error on Figure 6. Associated with these Bender errors were two CPM items but in a bipolar fashion (see Table 6). CPM item #B2, involving a response in terms of size comparison, loaded as might be expected, i.e. the subjects who were correct on CPM #B2 tended to make fewer errors on the BG categories which defined this factor. In contrast, subjects who correctly responded to CPM #AB9 (involving a visual rotation) tended to make more of the BG error types which loaded on this factor. What might have appeared to be a motor factor evidently was complicated by visual perception.

Comparable Common Factor 14

This factor was defined to the greatest extent by an integration error (Fig. 4) as well as by a rotation error (Fig. 7) and by the marker variable labeled "learning problem" (see Table 6). The related CPM items loaded in opposite directions on this factor. CPM item AB4, involving the visualization of a complete figure in order to choose the part to complete the figure correctly, loaded as expected on this factor, i.e. subjects who were correct on this item tended to make fewer of the BG error types which defined this factor. On the other hand, CPM item AB3 which required a simple matching in order to attain the correct response loaded in such a way to suggest that subjects who made the BG errors described above tended to be correct on CPM #AB3. This combination of variables may indicate a tendency of the subjects designated as having learning problems to respond to visual stimuli in a part by part fashion rather than as a whole.

Comparable Common Factor 15

The very high loading of the initial CPM item (A1 - an introduction to the CPM) on this factor along with the moderate loading of an integration error on BG Figure 5 (line for dots) suggests the possibility that factor 15 may involve the ability to attend to the relevant aspects of the task at hand. The other variables which defined this factor to some extent (see Table 6) lend some support to this view. It is quite possible that impulsivity could also contribute to the particular pattern of responses to the items which defined this factor.

Comparable Common Factor 16

Distortion of shape on Bender Figure A and loss of shape on Figure 5 defined this factor to a high degree while disproportion of size on Figure A and two CPM items (see Table 6) also loaded on this factor to some extent. The bipolar loadings of the two CPM items suggest that those subjects who made the above mentioned Bender errors tended to respond correctly to CPM item B8. This relationship may have occurred because B8 involved a comparison of circle and square shapes with rather simple shaded areas, requiring a response to shape but not details of shape.

Comparable Common Factor 17

This factor was defined by an integration error on Bender Figure 6 and by three CPM items which involved vertical and horizontal relationships in order to determine the solutions (see Table 6). The same variable which loaded negatively on factor 16 loaded in a similar fashion on this factor. Perhaps the simplicity of the shapes involved was the key to the correct response rather than the ability to relate to the horizontal-vertical relationship which was also a part of the solution.

Comparable Common Factor 18

The three CPM tiems and the Bender error category which defined this factor involved an element of matching as well as a rotation problem (see Table 6). The bipolar relationship between CPM item B7 and the other items suggests that a response set for matching without considering the rotation problem served to produce an incorrect response to B7 while contributing to correct responses on the other items.

Comparable Common Factor 19

Both Bender errors which defined this factor involved Figure 6, either distortion (angles for curves) or perseveration (see Table 6). The CPM items which loaded on this factor suggest that some visualization of the whole design was necessary in order to attain a correct response.

Comparable Common Factor 20

This factor was defined by variables which involved the relationships between different angles and curves at union points (see Table 6). The problem of position in space appeared to be the critical ability tapped.

Comparable Common Factor 21

Both the CPM item and the Bender error which defined this factor (see Table 6) involved an element of disproportion in size. The negative sign was expected since the Bender protocols were scored for errors.

SUMMARY

The three factor analytic techniques utilized in this study resulted in the delineation of 21 comparable common factors. Two comparable specific factors were also revealed, one defined by sex only and one defined by one CPM item only. Six of the factors were described as perceptual factors because they were defined by CPM items only. Three factors were labeled as motor factors since they were defined by Bender items only. The remaining twelve factors were described as perceptual-motor factors defined by items from both the CPM and the Bender. A large number of variables were not relevant to any of the factors which were robust across factoring methods. Incomplete Image Analysis derived a number of specific factors in addition to the factors which were common to the other methods. The fact that a total of 66 variables were included in the analyses on data from only 79 cases may have attributed the breaking up of factors on Image.

This study was intended to be exploratory. The need has been clearly established for more research into the factor structure of these combined instruments with a much larger sample. A number of the factors revealed here show promise for future research possibilities, perhaps to increase the usefulness of these instruments for special purposes with specific types of subjects.

References

Bender, Loretta. Visual-Motor Gestalt Test and Its Clinical Use. Research Monograph No. 3. New York: American Orthopsychiatric Association, 1938.

Hofmann, R. J. Baconian and Aristotelian Factor Analysis: Interpretative Factor Analytic Models. Paper presented at the annual meeting of the Northeastern Educational Research Association, Ellenville, New York, 1973.

Hofmann, R. J. The oblique Transformation. Unpublished Doctoral Dissertation, State University of New York at Albany, 1970.

Koppitz, Elizabeth M. The Bender Gestalt Test for Young Children. New York: Grune and Stratton, Inc., 1964.

Raven, J. C. The Colored Progressive Matrices. New York: Psychological Corp., 1956.

Table 1

Frequency of Factor Types

	Factor Types			
	Comparable			
	Common	Specific	Non-comparable	Total
Alpha Factor Analysis	20	2	1	23
Incomplete Components	20	1	2	23
Incomplete Image	20*	2	13**	35

* This includes 3 specific factors which were comparable to common factors derived by the other two methods.

** Of this number 7 were specific factors which loaded as common factors on the other two methods. See notes on Tables 2 and 3.

Table 2

Comparable Factor Number	Variable Number and Name	Alpha Factor Analysis	Incomplete Components	Incomplete Image
1	6 CPM #A4	48	44	--a.
1	7 CPM #A5	75	79	80
1	8 CPM #A6	68	77	67
1	26 CPM #B1	75	78	79
1	27 CPM #B2	30	35	30
2	21 CPM #AB8	40	43*	--
2	24 CPM #AB11	33	--	33
2	33 CPM #B8	41	31*	37
2	35 CPM #B10	78	61*	86
2	36 CPM #B11	48	78*	--
2	37 CPM #B12	61	76*	50
3	34 CPM #B9	57	46*	69
3	36 CPM #B11	48	78*	64
4	25 CPM #AB12	72	82	86**
4	18 CPM #AB5	28	29	--b.
4	19 CPM #AB6	25	30	--
5	9 CPM #A7	65	42	79**
5	17 CPM #AB4	28	80	--
6	5 CPM #A2	-40	-82	-81**
6	14 CPM #A12	69	45	--c.
6	34 CPM #B9	26	31	--

* Incomplete Components coalesced Factors 2 and 3 into one factor.

** Loaded as specific factor on Incomplete Image analysis.

a. This variable was defined as a specific factor on Image analysis with a loading of 79.
b. This variable was defined as a specific factor on Image analysis with a loading of 64.
c. This variable was defined as a specific factor on Image analysis with a loading of 77.

Table 3

Comparable Factor Number	Variable Number and Name	Alpha Factor Analysis	Incomplete Components	Incomplete Image
7	40 BG Fig. A rot.*	53	52	34
7	45 BG Fig. 2 rot.	32	39	35
7	47 BG Fig. 2 per.	30	25	--
7	63 BG Fig. 7 int.	32	46	--a.
7	65 BG Fig. 8 rot.	77	84	91
7	64 BG Fig. 8 dis.	-29	-29	--b.
8	45 BG Fig. 2 rot.	47	45	37
8	46 BG Fig. 2 int.	82	85	90
8	64 BG Fig. 8 dis.	29	34	--b.
9	51 BG Fig. 4 rot.	27	66	--
9	54 BG Fig. 5 rot.	52	72	--

a. This variable was defined as a specific factor on Image analysis with a loading of 72.

b. This variable was defined as a specific factor on Image analysis with a loading of 77.

* BG error types: rotation, perseveration, integration, distortion. (Koppitz, 1963)

Table 4

Comparable Factor Number	Variable Number and Name	Alpha Factor Analysis	Incomplete Components	Incomplete Image
10	48 BG Fig. 3 dis.	83	85	87
10	53 BG Fig. 5 dis.	78	73	76
10	54 BG Fig. 5 rot.	31	27	26
10	61 BG Fig. 7 dis.	28	--	26
10	22 CPM #AB9	-25	-28	--
10	30 CPM #B5	-28	-32	--
10	29 CPM #B4	--	-37	-32
11	1 age	81	85	59
11	42 BG Fig. 1 dis.	51	60	80
11	29 CPM #B4	-27	-27	-30
11	30 CPM #B5	-26	-28	--
11	49 BG Fig. 3 rot.	-26	-29	--
11	55 BG Fig. 5 int.	33	32	--
12	44 BG Fig. 1 per.	84	89	93
12	47 BG Fig. 2 per.	55	66	55
12	11 CPM #A9	-29	-39	--
12	20 CPM #AB7	-25	-25	--
12	27 CPM #B2	-31	-33	-41
12	56 BG Fig. 5 int.	27	27	--
12	15 CPM #AB2	--	-27	-37
13	43 BG Fig. 1 rot.	84	83	85
13	45 BG Fig. 2 rot.	57	56	57
13	49 BG Fig. 3 rot.	42	44	38
13	50 BG Fig. 3 int.	80	88	91
13	59 BG Fig. 6 per.	26	29	--
13	22 CPM #AB9	28	29	--
13	27 CPM #B2	-27	-29	-27
14	52 BG Fig. 4 int.	83	53	77
14	62 BG Fig. 7 rot.	27	78	51
14	66 Learn. Prob.	41	--a.	40
14	16 CPM #AB3	--	25	32
14	17 CPM #AB4	-36	--	-36
15	4 CPM #A1	-82	-87	-61
15	56 BG Fig. 5 int.	53	49	84
15	42 BG Fig. 1 dis.	28	35	--
15	49 BG Fig. 3 rot.	29	36	--
15	15 CPM #AB2	-28	-30	--
16	38 BG Fig. A dis.	75	84	86
16	55 BG Fig. 5 int.	61	62	41
16	39 BG Fig. A dis.	26	31	--
16	33 CPM #B8	35	39	--
16	20 CPM #AB7	-30	-30	--

Table 4 (continued)

Comparable Factor Number	Variable Number and Name	Alpha Factor Analysis	Incomplete Components	Incomplete Image
17	58 BG Fig. 6 int.	74	74	79
17	11 CPM #A9	-39	-47	--b.
17	27 CPM #B2	-34	-44	--
17	33 CPM #B8	30	--	40
18	32 CPM #B7	72	85	69
18	15 CPM #AB2	-46	-42	-64
18	16 CPM #AB3	-59	-36	-51
18	49 BG Fig. 3 rot.	29	--	29
19	57 BG Fig. 6 dis.	78	79	52
19	59 BG Fig. 6 per.	28	41	76
19	19 CPM #AB6	-26	-34	--
19	11 CPM #A9	-26	-25	--
20	13 CPM #A11	35	75	39
20	23 CPM #AB10	77	56	--c.
20	51 BG Fig. 4 rot.	--	28	38
21	28 CPM #B3	--	-75	-71
21	60 BG Fig. 7	--	35	63
22	2 sex	66	78	65
23	10 CPM #A8	63	--	84

a. This variable was defined on Components analysis with a loading of 69.
b. This variable was defined on Image analvsis with a loading of 63.
c. This variable was defined on Image analysis with a loading of 78.

Table 5

Comparable Factor Loading Matrix

Variable	Comparable Factor								
	1	2	3	4	5	6	7	8	9
CPM #A4	M	--	--	--	--	--	--	--	--
CPM #A5	H	--	--	--	--	--	--	--	--
CPM #A6	H	--	--	--	--	--	--	--	--
CPM #B1	H	--	--	--	--	--	--	--	--
CPM #B2	L	--	--	--	--	--	--	--	--
CPM #AB8	--	M	--	--	--	--	--	--	--
CPM #AB11	--	L	--	--	--	--	--	--	--
CPM #B8	--	L	--	--	--	--	--	--	--
CPM #B10	--	H	--	--	--	--	--	--	--
CPM #B11	--	H	H	--	--	--	--	--	--
CPM #B12	--	H	--	--	--	--	--	--	--
CPM #B9	--	--	M	--	--	L	--	--	--
CPM #AB12	--	--	--	VH	--	--	--	--	--
CPM #AB5	--	--	--	L	--	--	--	--	--
CPM #AB6	--	--	--	L	--	--	--	--	--
CPM #A7	--	--	--	--	H	--	--	--	--
CPM #AB4	--	--	--	--	M	--	--	--	--
CPM #A2	--	--	--	--	--	-H	--	--	--
CPM #A12	--	--	--	--	--	M	--	--	--
BG Fig. A rot. *	--	--	--	--	--	--	M	--	--
BG Fig. 2 rot. *	--	--	--	--	--	--	L	M	--
BG Fig. 2 per. *	--	--	--	--	--	--	L	--	--
BG Fig. 7 int. *	--	--	--	--	--	--	L	--	--
BG Fig. 8 rot.	--	--	--	--	--	--	VH	--	--
BG Fig. 8 dis. *	--	--	--	--	--	--	-L	L	--
BG Fig. 2 int.	--	--	--	--	--	--	--	VH	--
BG Fig. 4 rot.	--	--	--	--	--	--	--	--	M
BG Fig. 5 rot.	--	--	--	--	--	--	--	--	H

Key: blank spaces denote trivial or non-existent loadings
L - low - below 40
M - medium - between 40 and 60
H - high - between 60 and 80
VH - very high - above 80

* BG error types: rotation, perseveration, integration, distortion. (Koppitz,1963)

Table 6

Comparable Factor Loading Matrix

Variable	Comparable Factor													
	10	11	12	13	14	15	16	17	18	19	20	21	22	23
BG Fig. 3 dis.	VH	--	--	--	--	--	--	--	--	--	--	--	--	--
BG Fig. 5 dis.	H	--	--	--	--	--	--	--	--	--	--	--	--	--
BG Fig. 5 rot.	L	--	--	--	--	--	--	--	--	--	--	--	--	--
BG Fig. 7 dis.[a]*	L	--	--	--	--	--	--	--	--	--	--	--	--	--
CPM #AB9	-L	--	--	L	--	--	--	--	--	--	--	--	--	--
CPM #B5	-L	-L	--	--	--	--	--	--	--	--	--	--	--	--
CPM #B4	-L	-L	--	--	--	--	--	--	--	--	--	--	--	--
age	--	H	--	--	--	--	--	--	--	--	--	--	--	--
BG Fig. 1 dis.	--	H	--	--	--	L	--	--	--	--	--	--	--	--
BG Fig. 3 rot.	--	-L	--	M	--	L	--	--	L	--	--	--	--	--
BG Fig. 5 int.[a]*	--	L	--	--	--	--	H	--	--	--	--	--	--	--
BG Fig. 1 per.	--	--	VH	--	--	--	--	--	--	--	--	--	--	--
BG Fig. 2 per.	--	--	M	--	--	--	--	--	--	--	--	--	--	--
CPM #A9	--	--	-L	--	--	--	--	-M	--	-L	--	--	--	--
CPM #AB7	--	--	-L	--	--	--	-L	--	--	--	--	--	--	--
CPM #B2	--	--	-L	-L	--	--	--	-L	--	--	--	--	--	--
CPM #AB2	--	--	-L	--	--	-L	--	--	-M	--	--	--	--	--
BG Fig. 5 int.[b]*	--	--	L	--	--	H	--	--	--	--	--	--	--	--
BG Fig. 1 rot.	--	--	--	VH	--	--	--	--	--	--	--	--	--	--
BG Fig. 2 rot.	--	--	--	M	--	--	--	--	--	--	--	--	--	--
BG Fig. 3 int.	--	--	--	VH	--	--	--	--	--	--	--	--	--	--
BG Fig. 6 per.	--	--	--	L	--	--	--	--	--	M	--	--	--	--
BG Fig. 4 int.	--	--	--	--	H	--	--	--	--	--	--	--	--	--
BG Fig. 7 rot.	--	--	--	--	M	--	--	--	--	--	--	--	--	--
Lrng. Prob.	--	--	--	--	M	--	--	--	--	--	--	--	--	--
CPM #AB3	--	--	--	--	L	--	--	--	-M	--	--	--	--	--
CPM #AB4	--	--	--	--	L	--	--	--	--	--	--	--	--	--
CPM #A1	--	--	--	--	--	-VH	--	--	--	--	--	--	--	--
BG Fig. A dis.[a]*	--	--	--	--	--	--	VH	--	--	--	--	--	--	--
BG Fig. A dis.[b]*	--	--	--	--	--	--	L	--	--	--	--	--	--	--
CPM #B8	--	--	--	--	--	--	L	L	--	--	--	--	--	--
BG Fig. 6 int.	--	--	--	--	--	--	--	H	--	--	--	--	--	--
CPM #B7	--	--	--	--	--	--	--	--	H	--	--	--	--	--
BG Fig. 6 dis.	--	--	--	--	--	--	--	--	--	H	--	--	--	--
CPM #AB6	--	--	--	--	--	--	--	--	--	-L	--	--	--	--
CPM #A11	--	--	--	--	--	--	--	--	--	--	M	--	--	--
CPM #AB10	--	--	--	--	--	--	--	--	--	--	H	--	--	--
BG Fig. 4 rot.	--	--	--	--	--	--	--	--	--	--	L	--	--	--
CPM #B3	--	--	--	--	--	--	--	--	--	--	--	-H	--	--
BG Fig. 7 dis.[b]*	--	--	--	--	--	--	--	--	--	--	--	M	--	--
sex	--	--	--	--	--	--	--	--	--	--	--	--	H	--
CPM #A8	--	--	--	--	--	--	--	--	--	--	--	--	--	H

Key: same as Table 5

* Error category from Koppitz scoring system. (see description in text)