Raven's Coloured Progressive Matrices: Interpreting Results Through Analysis of Problem-type and Error-type

Jennifer Horner and Karen Nailling
Duke University Medical Center, Durham, North Carolina

INTRODUCTION

Raven's Coloured Progressive Matrices (RCPM, Raven, 1956, 1965), has been widely used as a measure of nonverbal reasoning ability in normal and pathologic groups of all types and as a measure of learning potential in mentally retarded children. (Budoff, 1970; Corman and Budoff, 1973; Budoff and Corman, 1976; Budoff and Gottlieb, 1976.) Questions about the RCPM asked by previous researchers include some of the following:

1. Is the RCPM a valid measure of nonverbal reasoning or intelligence, and is this crystallized or fluid in character? (Zaidel, Zaidel and Sperry, 1980)
2. Is performance on the RCPM more impaired as a result of right (Piercy and Smyth, 1962; Costa, Vaughn, Horwitz and Ritter, 1969; Costa, 1976) or left (Arrigoni and DeRenzi, 1964) side of lesion, or is there no difference? (Costa and Vaughn, 1962; DeRenzi and Faglioni, 1965; Basso, DeRenzi, Faglioni, Scotti and Spinnler, 1973; Horner, LaPointe and Hutchinson, 1979)
3. Is RCPM performance related to anterior or posterior locus of lesion? (Costa, 1976)
4. Is performance on the RCPM affected by the presence of aphasia (supportive--Archibald, Wepman and Jones, 1967; Culton, 1969); (nonsupportive--Zangwill, 1964; DeRenzi and Faglioni, 1965), by severity of aphasia (Weisenberg and McBride, 1935; Archibald, Wepman and Jones, 1967; Culton, 1969; Van Harskamp, 1973) or type of aphasia? (Costa et al., 1969; Kertesz and McCabe, 1975)
5. What is the pattern of performance on the RCPM during the spontaneous recovery period? (Culton, 1969; Campbell and Oxbury, 1976; Denes, Semenza and Stoppa, 1979)
6. Is RCPM performance affected by concomitant visual spatial and constructional deficits? (Colombo, DeRenzi and Faglioni, 1976)
7. Is RCPM performance related to visual and/or tactile searching ability (DeRenzi, Faglioni and Spotti, 1970), cognitive style (Horner, LaPointe and Hutchinson, 1979), or problem solving ability on such tasks as card sorting, paired associate learning, etc.? (Horner, LaPointe and Hutchinson, 1979)
8. Do patterns of error emerge on the RCPM with regard to:
   a. Problem type and difficulty? (Costa, 1976; Zaidel, Zaidel and Sperry, 1980)
   b. Locus and type of response choice? (Costa et al., 1969)
   c. Manipulability which offers the opportunity for self-correction? (Zaidel, Zaidel and Sperry, 1980)
   d. Type of foils available in response field? (Costa et al., 1969)

In addition to these questions, the aphasiologist may have other reasons for obtaining and analyzing performance on the RCPM. In the aphasic adult, performance on the RCPM may reflect relatively intact nonlanguage functions potentially important to spontaneous recovery (Culton, 1979; Pettit, 1976; Zaidel et al., 1980), prognosis for response to treatment (Smith, 1972; Wertz, Collins, Weiss, Brookshire, Friden, Jurtzke and Pierce, 1978), or the success of specific techniques thought to be biased toward right hemisphere capabilities such as Amer-Ind (Skelly, 1979), novel symbol learning (Baker, Gerry, Gardner, Zurif, Davis and Veroff, 1975; Glass, Gazzaniga and Premack, 1973; Horner and LaPointe, 1979) or Visual Action Therapy (Helm and Benson, 1978).

Thus, studies regarding the interactions among side and locus of lesion, visual and constructional abilities, cognitive style, etc., in the performance of a task such as the RCPM are contradictory and inconclusive. Furthermore, the interaction of aphasia and visual abstract reasoning remains unresolved. Abstract reasoning ability as measured by the RCPM may be related to the severity of aphasia, type of aphasia and/or to residual right hemisphere capabilities--issues which are of special interest to the aphasiologist. Until these relationships are better understood, the predictive value of performance on the RCPM will remain in question.

STATEMENT OF THE PROBLEM

The specific problem addressed in this presentation is that after obtaining a Raven's score, the clinician is likely to ask, so what? We feel a routine analysis of quality of performance in terms of types of problems erred and types of errors may enhance our interpretive skills. Furthermore, a look at the Raven's score as a possible measure of learning potential may directly influence our clinical expectations.

Therefore, the purposes of this paper are:

1. To describe two analysis forms developed by us,
   a. A Problem-Type Analysis form derived from Corman and Budoff's factor analysis study (1973), and
   b. An Error-Type Analysis form adapted from Raven, 1965;
2. To present RCPM performance data obtained from left and right brain damaged and normal subjects;
3. To introduce a "learning potential procedure" which we have developed from a model proposed by Corman and Budoff (1973); and
4. To briefly describe pilot data from two aphasic adults on this experimental learning potential procedure.

RESULTS

Appendix A is the Error-Type Analysis form derived from the RCPM manual (1965). This form can be used in place of the standard record form. In addition to an error type analysis, a preference for responding in either the left or right field can be readily observed. There are 5 types of responses: one is the correct response, designated "x"; while "a, b, c, and d" designate the 4 possible types of error: "a" difference; "b" inadequate individuation; "c" repetition of a pattern; and "d" incomplete correlate. The summary graph shows that the opportunities for each of the 4 error types are unequal: 46, 38, 54 and 42.

Appendix B is a Problem-Type Analysis form adapted from a factorial analysis of the RCPM conducted by Corman and Budoff (1973). Of the 36 problems on the RCPM, 4 types of abstract visual problems are tested.

I. Continuity and reconstruction of simple and complex structures.
II. Discrete pattern completions.
III. Reasoning by analogy.
IV. Simple continuous pattern completions.

Response pattern in terms of item difficulty can also be observed on the top half of this form. In general, items 1 - 6 within each set--A, A_B or B--are easier than items 7 - 12. Further, the test increases in difficulty across sets, A, A_B and B, respectively.

Thus, using these 2 forms, the clinician is able to gather five types of information:

1. overall accuracy
2. an analysis of the types of problems erred
3. an analysis of types of errors made,
4. an impression of performance breakdown with respect to problem difficulty, and
5. an impression with regard to field preference (potentially resulting from hemianopsia or inattention).

Subjects. Thirty-six adult male patients at the Fort Howard Veterans Administration Medical Center comprised the left, right and non-brain-damaged groups, 12 in each group. Mean ages were 54.1, 58.4 and 56.3; mean years of education were 12.2, 11.0 and 9.7, respectively. Pathologic groups were similar with respect to months post onset and handedness.

Problem and Error Analyses. The data in Figures 1 and 2 were derived from the analysis forms just described. Figure 1 shows the performance of the 3 groups with respect to problem type, which answers the question, "which types of problems are most susceptible to error?" Scores have been converted to percentage based on the opportunities for error. This figure shows that all subject groups have a similar pattern of error. The lowest accuracy occurred on problem type III, reasoning by analogy. Problem types II and IV, discrete pattern completions and simple continuous pattern completions, respectively, were most accurate. Problem type I, appreciation for continuity, was of intermediate difficulty.

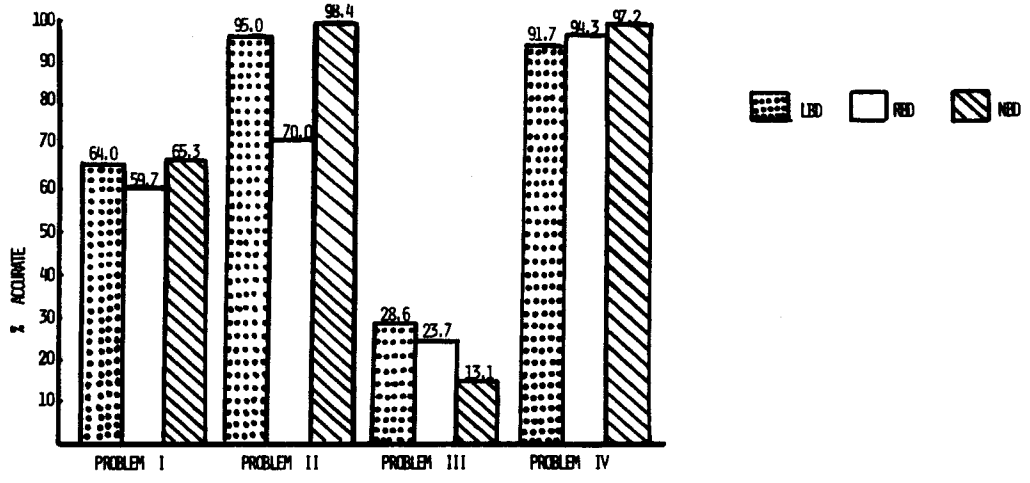


Figure 1. Performance by left-, right-, and non-brain-damaged male subjects on Raven's CPM analyzed by problem type.

Figure 2 shows the performance of the 3 groups with respect to response type and answers the question, "when an error is made on the Raven's, what type of error is it?" The number of correct responses are shown on the left; mean scores for left-, right- and non-brain-damaged subjects (23.8, 21.4 and 23.5) have been converted to percent correct, 66.0, 59.7 and 65.3 respectively. The remainder of the figure shows that the most frequent error type is "repetition of a pattern," error type "c."

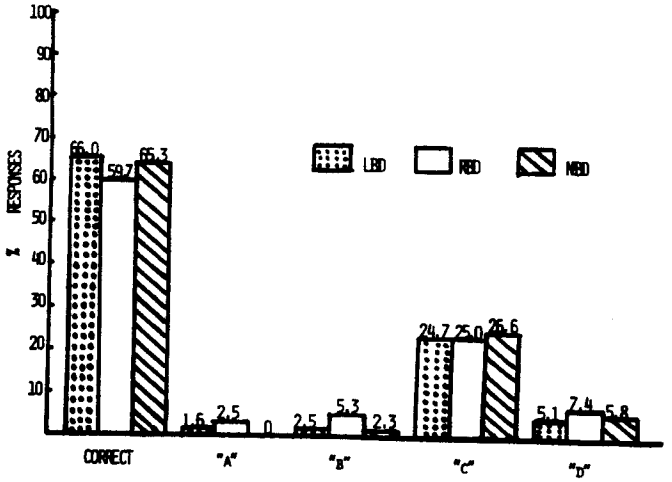


Figure 2. Performance by left-, right-, and non-brain-damaged male subjects on Raven's CPM analyzed by response type.

LEARNING POTENTIAL EVALUATION

With regard to the issue of learning potential evaluation, Corman and Budoff (1973), Budoff and Corman (1976), Budoff and Gottlieb (1976) have described their use of Raven's-like stimuli of graded difficulty to evaluate the dynamic or fluid aspect of visual abstract reasoning in mentally retarded children. The question they have asked is: Can mentally retarded children improve Raven's scores following training? In some retarded children, Raven's performance has improved significantly following the learning potential procedure.[1]

These researchers advocate a "test-teach-test" approach to evaluation. The goal of learning potential evaluation is to elicit the patient's best performance. According to Corman and Budoff,

> Test scores after training should reflect a (person's) ability under optimized conditions in which he is familiar with the task and its demands, had had success in solving problems similar to those on the test, and has had the opportunity to learn and apply relevant strategies (1973, p.1).

Modified Raven's Learning Potential Procedure (LPP). The Learning Potential Procedure (LPP) consists of 10 incomplete geometric forms, 4 versions each, which are presented in a manipulable format similar to that

---

[1]Budoff and Gottlieb (1976) found an aptitude-treatment interaction in "gainers" vs. "non-gainers."

of the RCPM, Board Form. The 10 problems were designed to be comparable to problems found on Set A_B of the RCPM and to problem type I. Thus, all problems require an appreciation for continuity and are of intermediate difficulty. An example is shown in Figure 3.

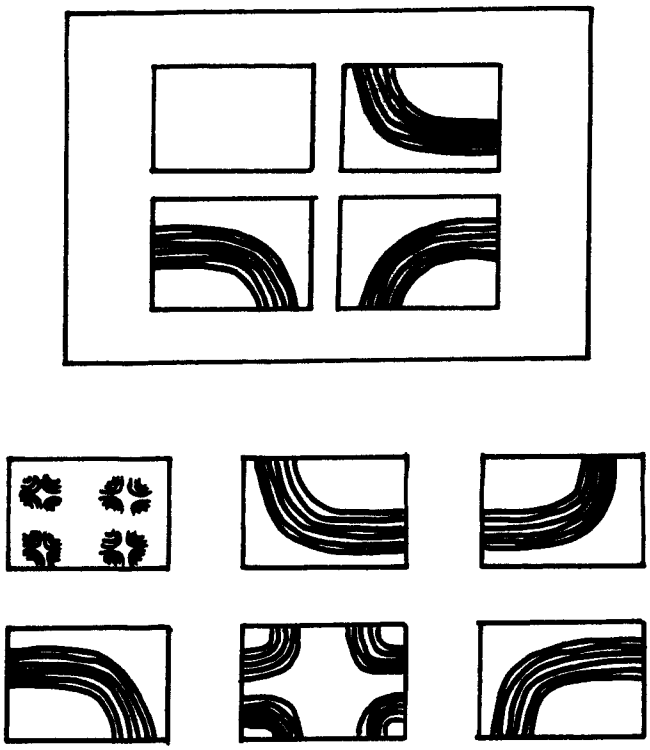


Figure 3. Sample problem from the Modified Raven's Learning Potential Procedure.

Four versions of each problem were constructed, rotating the incomplete quadrant and randomizing the locus of the correct response among the six foils. The response foils themselves are manipulable, allowing for self-correction of errors. Thus, the general purpose of the LPP was to evaluate the brain-damaged adult's ability to improve his Raven's score following training on Raven's-like problems. Specifically, there were three purposes:

1. To increase systematic scanning of both the design to be completed and the response choices.
2. To decrease "repetition of a pattern" which was described earlier as the most frequent error type.
3. To increase self-correction of errors.

Administration of the LPP involved a five-day test-teach-test procedure: Day 1, administration of RCPM; Day 2, repeat administration of RCPM; Day 3, administration of the 40-item LPP, and Days 4 and 5, repeat administrations of the RCPM.

Pilot testing has been conducted on 2 aphasic patients. The first was a 48 year old white male one month post onset of an extensive left middle

cerebral artery cerebral vascular accident who initially presented a very severe aphasia in all modalities. The baseline RCPM resulted in raw scores of 19 and 23 of 36, respectively (Figure 4). Scores are converted to percent accurate for illustration purposes.

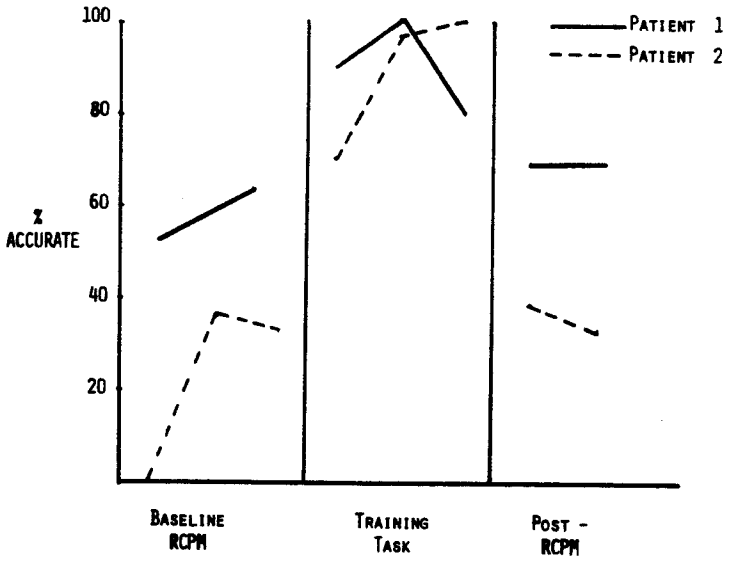


Figure 4. Performance by two severe aphasic patients on a five-day learning potiential evaluation procedure using Raven's CPM as a baseline and generalization measure.

The LPP was administered on Day 3 and consisted of:

1. A 10-item no feedback probe, for which the first response was recorded.
2. A 30-item training set for which multiple trials and self-corrections were allowed.
3. A 10-item no feedback probe, for which the first response was recorded.

The RCPM was readministered at the end of the week. Patient #1 achieved raw scores of 14 and 12 of 36, shown in the figure as percent correct.

Patient #2, also shown in Figure 4, was a 52 year old white male, 4 months post onset of an extensive left cerebral vascular accident who, like Patient #1, presented a very severe aphasia in all modalities.

On the first presentation of the RCPM, he was unable to perform the task, and received a score of 0. On Day 2, he achieved 13 correct and on the following day, 12 of 36 correct. Following the LPP, performance was 14 and 12 on Days 4 and 5, respectively.

After reviewing both profiles, we return to our original question: is the individual patient able to improve his performance after training on a task with which he is familiar and has had the opportunity to apply relevant strategies? Patient #1's RCPM scores improved from the first to the fourth administrations from 19 to 25. Patient #2 improved from 0 to 13 after familiarization with task requirements, but did not improve his score further after the training procedure, as reflected in a final score of 12. In short, both patients benefited from repeated exposures to the RCPM. However, only Patient #1 appeared to benefit from the training procedure. These findings were consistent with change observed on standardized and clinical

tasks, and generalization to naturalistic situations. Patient #1 had shown a fair amount of change in the concurrent month of therapy; Patient #2 had shown minimal change.

These pilot data have generated more questions for us than they have answered. For example,

1. What is the test-retest reliability of the RCPM for aphasic adults?
2. When an improvement was observed was this a result of repeated exposures to the RCPM per se or was it a result of the LPP?
3. When improvement was observed was this a result of the opportunity for manipulation and self-correction?
4. Would training items of different types and/or difficulty yield as much or more improvement on the RCPM?
5. In terms of level and stability of performance and generalization effects, is this LPP a valid and prognostically significant measure of the learning potential of a given patient?

SUMMARY

The RCPM has been used as a measure of visual abstract reasoning, and as a tentative index of potential for recovery from aphasia; yet aphasiologists often fail to interpret the RCPM beyond the raw score and percentile. In this paper we have:

1. Described 2 forms to allow for Problem-Type and Error-Type analyses.
2. Presented group data from pathologic and normal subjects derived from these analyses.
3. Described pilot data from two aphasic patients using a modified Raven's Learning Potential Procedure.

The learning potential approach uses a test-teach-test format, and, as such, focuses on the dynamic character and trainability of the patient. The question remains, can such learning potential procedures, with qualitative analysis of performance, provide the aphasiologist with information that is prognostically significant?

APPENDIX A

ERROR TYPE ANALYSIS
COLOURED PROGRESSIVE MATRICES
J.C. Raven (1956)
Sets A, A_B, B

NAME_____ SEX_____ AGE_____ DATE_____

ETIOLOGY_____ ONSET DATE_____ TOTAL TIME_____

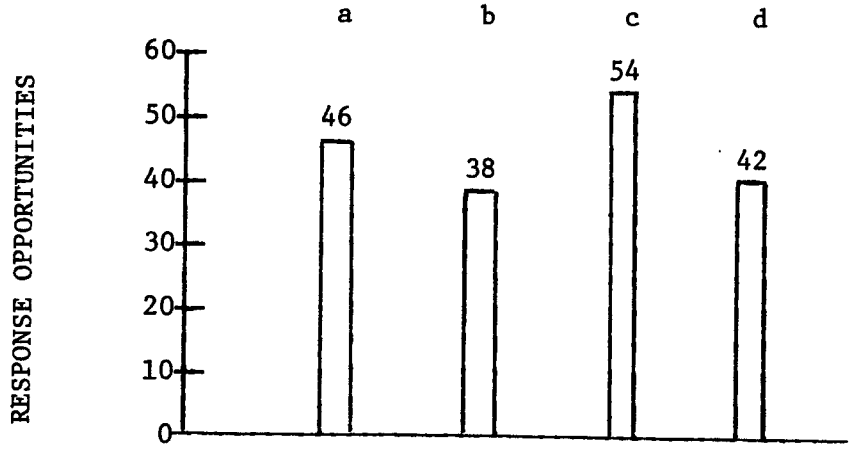
A				A_B				B			
1.	1a	2a	3a	1.	1c	2d	3d	1.	1a	2x	3a
	4x	5a	6d		4x	5a	6a		4a	5a	6a
2.	1a	2a	3a	2.	1a	2b	3a	2.	1a	2b	3b
	4a	5x	6a		4d	5x	6b		4b	5a	6x

	A	A_B	B
3.	1x 2a 3d 4a 5a 6a	1x 2b 3b 4b 5d 6d	1x 2b 3d 4b 5c 6b
4.	1a 2x 3d 4d 5a 6a	1c 2b 3a 4c 5a 6x	1d 2x 3b 4c 5b 6c
5.	1d 2b 3a 4d 5d 6x	1c 2x 3c 4a 5b 6c	1x 2a 3c 4c 5c 6a
6.	1d 2d 3x 4a 5a 6d	1x 2c 3c 4b 5c 6b	1c 2d 3x 4c 5d 6b
7.	1d 2d 3a 4b 5d 6x	1b 2c 3x 4a 5c 6b	1c 2c 3b 4d 5x 6d
8.	1c 2x 3c 4d 5b 6c	1b 2c 3b 4x 5c 6b	1b 2d 3c 4c 5c 6x
9.	1x 2a 3a 4a 5d 6d	1b 2c 3c 4b 5c 6x	1c 2b 3d 4x 5c 6c
10.	1a 2d 3x 4a 5d 6d	1b 2a 3x 4c 5b 6c	1c 2c 3x 4d 5b 6c
11.	1d 2c 3d 4x 5c 6a	1c 2a 3c 4b 5x 6a	1b 2c 3c 4x 5b 6c
12.	1d 2d 3d 4c 5x 6c	1c 2x 3b 4c 5d 6d	1d 2c 3c 4d 5x 6c

SUMMARY	x	a	b	c	d
# total possible*	(36)	(46)	(38)	(54)	(42)
# chosen					

* # of <u>total</u> opportunities for an <u>x</u>, <u>a</u>, <u>b</u>, <u>c</u> or <u>d</u> response

PATTERN OF PERFORMANCE FOR FOUR ERROR TYPES



Response Types (Adapted from Raven, 1956, p.5)

a = Difference: The piece has no figure of any kind on it; the figure shown is quite irrelevant.

b = Inadequate Individuation: The figure is contaminated by irrelevancies or distortions; it combines figures irrelevantly; it is the whole or half the pattern to be completed.

c = Repetition of the pattern: Above and to the left, immediately above or immediately to the left of the space to be filled.

d = Incomplete correlate: The figure is wrongly oriented; it is incomplete, but correct as far as it goes.

x = Correct choice: It completes the pattern both horizontally and vertically.

Horner & Nailling, 1980

APPENDIX B

PROBLEM-TYPE ANALYSIS
COLOURED PROGRESSIVE MATRICES (1956)
J.C. Raven
Sets A, A_B, B

NAME_____ SEX_____ AGE_____ DATE_____

ETIOLOGY_____ ONSET DATE_____ TOTAL TIME_____

#	F	RESPONSE	+,-
1	IV		
2	IV		
3	IV		
4	IV		
5	IV		
6	IV		
7	IA		
8	IA		
9	IA		
10	IA		
11	IA		
12	IA		
TOTAL CORRECT			

#	F	RESPONSE	+,-
1	II		
2	II		
3	II		
4	IB		
5	IB		
6	IB		
7	IB		
8	IC		
9	IC		
10	IC		
11	IC		
12	III		
TOTAL CORRECT			

#	F	RESPONSE	+,-
1	II		
2	II		
3	IB		
4	IB		
5	IB		
6	III		
7	ID		
8	III		
9	III		
10	III		
11	III		
12	III		
TOTAL CORRECT			

PROBLEM TYPES		# Correct	% Correct
I - CONTINUITY & RECONSTRUCTION OF SIMPLE & COMPLEX STRUCTURES			
IA = Discern continuity in a complex state: A7 - 8 - 9 - 10 - 11 -12	(6)		
** IB = Reconstruction of simple discontinuous structures: A_B4-5-6-7, B3-4-5	(7)		
IC = Reconstruction of structures based on symmetry: A_B8-9-10-11	(4)		
ID = Reconstruction of complex structures: B7	(1)	(18)	
II - DISCRETE PATTERN COMPLETIONS Discern similarity & continuity of a simple geometric background A_B1-2-3, B1-2		(5)	
III - REASONING BY ANALOGY: A_B12, B6, B8-9-10-11-12		(7)	
IV - SIMPLE CONTINUOUS PATTERN COMPLETIONS A1-2-3-4-5-6		(6)	
Total Score		(36)	
%-ile			

Adapted from Corman, L. and Budoff, M. Factorial composition of Raven's Progressive Matrices in the context of learning potential assessment. Studies in Learning Potential, 3(62), 1975.

**Item B3 includes characteristic of both Type I (IB) and Type II, but is higher on Type I (IB).

REFERENCES

Archibald, Y.M., Wepman, J.M. and Jones, L.V. Nonverbal cognitive performance in aphasic and nonaphasic brain-damaged persons. Cortex, 3, 275-294, 1967.

Arrigoni, G. and DeRenzi, E. Constructional apraxia and hemispheric locus of lesion. Cortex, 1, 180-197, 1964.

Baker, E., Berry, T., Gardner, H., Zurif, E., Davis, L. and Veroff, A. Can linguistic competence be dissociated from natural language functions? Nature, 254, 509-510, Apr. 10, 1975.

Basso, A., DeRenzi, E., Faglioni, G., Scotti, G., and Spinnler, H. Neuropsychological evidence for the existence of cerebral areas critical to the performance of intelligence tasks. Brain, 96, 715-728, 1973.

Budoff, M. Learning potential: Assessing ability to reason in the educable mentally retarded. Acta Paedopsychiatrica, 37, 293-309, 1970.

Budoff, M. and Corman, L. Effectiveness of a learning potential procedure in improving problem-solving skills of retarded and nonretarded children. American Journal of Mental Deficiency, 81, 260-264, 1976.

Budoff, M. and Gottlieb, J. Special-class EMR children mainstreamed: A study of an aptitude (learning potential) x treatment interaction. American Journal of Mental Deficiency, 81, 1-11, 1976.

Campbell, D.C. and Oxbury, J.M. Recovery from unilateral visuospatial neglect. Cortex, 12, 303-312, 1976.

Colombo, A., DeRenzi, E. and Faglioni, P. The occurrence of visual neglect in patients with unilateral cerebral disease. Cortex, 12, 221-231, 1976.

Corman, L. and Budoff, M. Factorial composition of Raven's Progressive Matrices in the context of learning potential assessment. Studies in Learning Potential, 3 (62), 1-12, 1973. (Research Institute for Educational Problems, 29 Ware St., Cambridge, MA 02138)

Costa, L.D. Interset variability on the Raven's Coloured Progressive Matrices as an Indicator of specific ability deficit in brain-lesioned patients. Cortex, 12, 31-40, 1976.

Costa, L.D. and Vaughn, H.G. Performance of patients with lateralized cerebral lesions. I: Verbal and perceptual tests. Journal of Nervous and Mental Diseases, 134, 162-168, 1962.

Costa, L.D., Vaughn, H.G., Horwitz, M. and Ritter, W. Patterns of behavioral deficit associated with visual spatial neglect. Cortex, 5, 242-263, 1969.

Culton, G.L. Spontaneous recovery from aphasia. JSHR, 12, 825-832, 1969.

Denes, F., Semenza, C., Stoppa, E. Note: Selective improvement by unilateral brain-damaged patients on Raven Coloured Progressive Matrices. Neuropsychologia, 16, 749-752, 1979.

DeRenzi, E. and Faglioni, P. The comparative efficiency of intelligence and vigilance tests in detecting hemispheric cerebral damage. Cortex, 1, 410-429, 1965.

DeRenzi, E., Faglioni, P., and Scotti, G. Hemispheric contribution to exploration of space through the visual and tactile modality. Cortex, 6, 191-203, 1970.

Glass, A.V., Gazzaniga, M.S. and Premack, D. Artificial language training in global aphasics. Neuropsychologia, 11, 95-103, 1973.

Helm, N. and Benson, D.F. Visual action therapy for global aphasia. Presented at the 16th annual meeting of the Academy of Aphasia. Chicago, 1978.

Horner, J. and LaPointe, L.L. Evaluation of learning potential of a severe aphasic adult through analysis of five performance variables using novel pictorial stimuli. In R.H. Brookshire (Ed.), Clinical Aphasiology: Conference Proceedings, 1979. Minneapolis, MN: BRK Publishers, 1979.

Horner, J., LaPointe, L.L. and Hutchinson, E.C. Nonverbal learning by aphasic adults relative to cognitive tempo and performance on Raven's Coloured Progressive Matrices. Paper presented to the International Neuropsychological Society, New York, 1979.

Kertesz, A. and McCabe, P. Intelligence and aphasia: Performance of aphasics on Raven's Coloured Progressive Matrices (RCPM). Brain and Language, 2, 387-395, 1975.

Lebrun, Y. and Hoops, R. Intelligence and Aphasia. Amesterdam: Swets & Zeitlinger B.V., 1974.

Pettit, J.M. Cerebral processing of nonverbal stimuli during recovery in adult aphasics. Paper presented at American Speech and Hearing Association, Houston, 1976.

Piercy, M. and Smyth, V.O.G. Right hemisphere dominance for certain nonverbal intellectual skills. Brain, 85, 775-790, 1962.

Raven, J.C. Coloured Progressive Matrices, Sets A Ab, B. London: H.K. Lewis and Co., Ltd., 1956.

Raven, J.C. Guide to Using the Coloured Progressive Matrices. London: H.K. Lewis & Co., Ltd., 1965.

Skelly, M. Amer-Ind Gestural Code Based on Universal American Indian Hand Talk. New York: Elsevier, 1979.

Smith, A. Diagnosis, intelligence and rehabilitation of chronic aphasics. Report SRS Grant, Univ. Michigan, Dept. PMR, July 1972.

Van Harskamp, F. Some considerations concerning the utility of intelligence tests in aphasic patients. Paper presented at the Brussels Conference on Intelligence and Aphasia. Summarized in Lebrun and Hoops, 1974.

Weisenburg, T.H. and McBride, K.E. Aphasia. New York: Commonwealth Fund, 1935.

Wertz, R.T., Collins, M., Weiss, D., Brookshire, R.H., Friden, T., Jurtzke, J.F. and Pierce, J. Veterans Administration Cooperative Study on Aphasia: Preliminary report on a comparison of individual and group treatment. Annual Meeting of the American Association for the Advancement of Science, Washington, D.C., 1978.

Zaidel, E., Zaidel, D.W. and Sperry, R.W. Left and right intelligence: Case studies of Raven's Progressive Matrices following brain bisection and hemidecortication. Paper presented to the International Neuropsychological Society, San Francisco, 1979.

Zangwill, O.L. Intelligence in aphasia. In DeReuck, A.V.S. and O'Connor, M. (Eds.), Disorders of Language. London: Churchill, 1964.

ACKNOWLEDGMENT

I would like to acknowledge the patients at Fort Howard Veterans Administration Medical Center who served as subjects, as well as Debra Campanella, M.A. and Nancy Schafer, M.S., who assisted in data reduction and preparation of this manuscript.

This research was supported in part by the Axe-Houghton Foundation, New York, New York.

DISCUSSION

Q: I am not aware of a study that reports a significant relationship between Raven's performance and language performance, starting with Zangwill (1964) and coming forward to the Lebrun and Hoops monograph (1974).

A: Archibald, Wepman and Jones (1967) concluded that there was a relationship to severity (see also Weisenberg & McBride, 1935 and Van Harskamp, 1973). And Culton (1969) found a good correlation within the first month of recovery between Raven's improvement and improvement on aphasia battery scores.

Q: They both got better?
A: Yes.

Q: I don't understand how performance on the Raven's is prognostic.
A: That's our question too, particularly with regard to some of the strategies that aphasiologists now are using that may be tapping right hemisphere capabilities. We wonder when the person is high on the Raven's, does this tell us about his residual capabilities (cf, Smith, 1972)? Of greater interest is, do the strategies that the person is using to solve the problems vary as a function of right hemisphere damage versus left hemisphere damage? What kind of scanning is involved? Does impulsivity vary with problem difficulty? Is the patient analytic or synthetic in his response, and could this guide us in saying that the person will do well using a particular treatment method? Secondly, at least on the learning potential procedure of the type we described, we feel that the first patient was showing us greater, more dynamic performance than the latter, even though the two patients were comparable on an aphasia battery. The Raven's, being a nonverbal task, seemed to be an appropriate type of learning potential procedure to differentiate the patient who is dynamic from the patient who is not, particularly with regard to generalization from a training procedure. The second patient we had showed poor generalization, and this was highly consistent with his performance on language tasks, going from the treatment setting out. The other patient, a very different type of patient, did generalize almost on a daily basis from interaction in treatment. This is how we get into prognostic issues.

Q: I wonder if we had just an indication of ability to learn. You could have shown that on some test other than the Raven's. It is nothing specific to the Raven's, right?
A: Right.

Comment: I find the Raven's extremely interesting during the diagnostic evaluation. You can get all kinds of interesting responses. For example, the patient who will not pay attention to the Gestalt of the pattern to be matched, but will look at the outline of it and try to see whether it fits into the larger pattern. Some patients may perseverate. And even the subtle aphasias that we discussed last night; very often the patient ostensibly will seem to have normal language but on a test like the Raven's, these tiny incapabilities can be teased out. Some patients who were terribly impaired language-wise do extremely well so that you know that nonverbal reasoning is extremely well intact. I think the Raven's can do many things.

Q: Did you score plus-minus on the Raven's?
A: We scored plus-minus, but I'm sure it's adaptable to other kinds of scoring systems.

Q: Do you have any indication of visual perceptual problems, field cuts, etc.?
A: The first patient did show a right field cut which resolved, and the second patient did not.

Q: Do you have any other measures of nonverbal intelligence on these patients to give us an indication of their abilities outside these visual tasks?
A: No.

Q: Do you feel comfortable calling it a nonverbal test?
A: Not completely. I think the strategies that the individual brings to bear on the task are highly idiosyncratic, and some of them may be overt; tracing, verbalizing, etc.

Q: I think that a higher level, more difficult task almost requires verbalization, whereas easier tasks do not. When you get to more difficult tasks most people use a verbal strategy even though we call the task nonverbal.

Q: Dr. Wertz, could you review for us what you found out about the Raven's in the VA study?
A: They kept getting better way out beyond six months post onset. We found no significant correlation between measures of language severity and Raven's performance. It seemed to us, and this is speculation, that the Raven's is either a measure of the patient's ability to understand the nature of the task, or perhaps is a measure of pre-morbid nonverbal visual problem solving, if you want to call that intelligence.