JOURNAL OF PERSONALITY ASSESSMENT, 1989, 53(4), 739-748

Discriminating Psychotic and Affective Disorders Using the WAIS-R

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Although there are compelling theoretical explications linking performance on the Wechsler Adult Intelligence Scale (WAIS) with specific nosological groups, research findings have been inconsistent in demonstrating such relations. Three shortcomings can be identified within this literature: (a) it focuses mostly on the WAIS, (b) it relies on pre-*Diagnostic and Statistical Manual of Mental Disorders* (3rd ed. [*DSM-III*], American Psychiatric Association, 1980) criteria, and (c) it employs transformed scores or composite indices of WAIS performance. This article attempts to link performance variability on the WAIS-R (Revised) with diagnostic membership. The hypotheses of Rapaport, Gill, and Schafer (1968) are used to evaluate the clinical significance of the resulting discriminant equation.

In their seminal work on psychological testing, Rapaport et al. (1968) attempted to link performance on structured, standardized tessts with specific intrapsychic dynamics. Underlying this coupling was what they referred to as the "projective hypothesis," a term that ". . . implies that every action and reaction of a human being bears the characteristic features of his individual make-up" (Rapaport et al., 1968, p. 52).

Proceeding from this perspective, Rapaport et al. saw the WAIS as a potential source for providing many rich insights into an individual's dynamic styles. Based on both their experiences with this instrument and their item analyses for each subscale, Rapaport et al. derived clinically meaningful hypotheses concerning the relations between performance outcomes and diagnostic groupings (e.g., Digit Span being significantly higher than Arithmetic is indicative of schizophrenia). The impact of this work continues to be felt in the field.

Clinicians and researchers continue to use the WAIS and the diagnostic suggestions of Rapaport et al. to discern nosological entities and facilitate diagnosis. However, these hypotheses have not received much empirical scru-

tiny. Attempts at using the WAIS (because the WAIS–R is relatively new; its appearance in the research literature is limited) to discriminate between schizophrenic and nonschizophrenic groups (e.g., organic, affective, and normals) have, at best, been mixed (Bersoff, 1970; Bigler, Tucker, & Piran, 1979; Saxe, 1966; Shawver & Jew, 1978; Wentworth-Rohr & Macintosh, 1972). Some researchers believe the WAIS to be of such poor predictive validity that it does not justify its cost of being administered to an inpatient population (Kliajic, 1984). Others find that patterns of subtest scores are reliably related to specific behavioral criteria (Amolsch & Henrichs, 1975). It should be pointed out that for those studies wherein the WAIS was unable to differentiate groups, transformed scores or composite indices were employed as discriminating variables. Only when actual subtest scores were included did more positive results emerge (e.g., Kay, 1979; Schucman & Thetford, 1968). The dearth of empirical inquiries makes any clear evaluation of this observation untenable at this time.

The purpose of this exploratory study is to determine if performance on the WAIS–R can be a valid discriminator between psychotic and affective disorders (as determined by *DSM–III* criteria). If so, it would be of interest to determine which scales are critical in making such a discrimination and how the pattern of results relate to the hypotheses generated by Rapaport et al. Although this article does not provide a direct test of these hypotheses, our data may provide some indirect support for their theoretical framework if it can accommodate the obtained pattern of results. We aim to initiate a program of research that attempts to derive empirically based psychodiagnostic indicators from the WAIS–R. It is anticipated that such a process will provide greater precision and insight to both our definitions of psychopathology and associated diagnostic schedules.

METHOD

Subjects

Subjects consisted of 141 psychiatric patients from the Massachusetts Mental Health Center and Boston University Medical Center (46 women, 95 men) ranging in age from 16- to 85-years-old ($M = 30.8$, $SD = 9.98$), with an average of 12.7 years of education $SD = 2.9$ years. These individuals represent all patients who received the WAIS–R as part of their psychological evaluations at these two institutions. The average Verbal IQ (VIQ) for this sample was 92.3 ($SD = 17.02$), and the mean Performance IQ (PIQ) was 84.59 ($SD = 14.6$). Concerning race, 62% were White, 27% Black, 3.5% Hispanic, 1.4% Asian with the remaining 6% unreported. Forty-one percent were on medication at the time of testing (this included both prescribed and illegal drug usage); 61% were inpatients at the time of testing; 37% were out patients. The status of the remaining 2% was unknown.

Diagnosis

During the course of their psychiatric treatment, all subjects received a *DSM–III* diagnosis either from their supervising clinician or from a psychologist evaluating their psychological test data. These impressions were formed either after treatment was well underway or as discharge diagnoses. When no explicit *DSM–III* diagnosis was made, the subject was retained in our sample only if sufficient background information was available in their files to make such a determination. In our final sample, 48 individuals fell in the *DSM–III* affective disorder range (having an Axis 1 diagnosis including: bipolar disorder with and without psychotic features, major depression with and without psychotic features, cyclothymic and dysthymic disorders, and atypical depression) and 93 fell into the *DSM–III* psychotic range (having an Axis 1 diagnosis including all schizophrenic, paranoid, and psychotic categories).[1]

As Morey, Blashfield, Webb, and Jewell (1988) pointed out, clinical diagnoses tend to be unreliable and are, therefore, a fallible criterion for the purpose of determining the validity of the WAIS–R to make diagnostic discriminations. Yet, there are no infallible criteria either. Given that the original diagnoses were formed after some period of evaluation, these clinical formulations may have been enhanced. Further, Cronbach and Meehl (1955) argued that a scale can be validated against an imperfect criterion and still eventually attain greater construct validity than the original criterion. Thus, the diagnoses used here serve as a first step in a continuing validation process. It is hoped that eventually the derived equations may prove more valid than the original diagnostic criterion (Morey et al., 1988).

RESULTS

A discriminant function analysis was performed using diagnostic group (affective or psychotic) as the criterion and the scaled scores on each of the WAIS–R subtests as the predictors. Table 1 presents the means and standard deviations for each diagnostic group. As can be seen, there are significant differences

[1]It is clear that there are many ways in which the psychotic and affective categories could be constructed. It could be argued that those having an affective disorder with psychotic features would be more appropriately classified in the psychotic rather than in the affective group. Another approach could justifiably exclude these individuals from any analyses because they do not provide a clear example of either category. We believe that the most compelling, and appropriate, classification scheme is the one which adheres to the diagnostic standard of the field—*DSM–III*. For better or worse, the *DSM–III* represents current formulations of psychopathology that are accepted and recognized by all health-care workers. Thus, the two criterion groups here represent psychotic and affective disorders as defined by the *DSM–III*. Further, our aim is to discriminate between major categories of disorders rather than making more specific differential diagnoses.

TABLE 1
Means and Standard Deviations for Scores on WAIS-R Subscales for the Affective and Psychotic Groups

Scale	*Affective*	*Psychotic*	*F*[a]
Verbal IQ	100.29 (15.74)	88.55 (16.13)	17.10***
Performance IQ	89.20 (14.01)	82.30 (14.34)	7.50**
Information	9.83 (3.3)	8.38 (3.5)	5.45*
Comprehension	9.83 (2.8)	7.27 (3.3)	20.87***
Arithmetic	8.89 (2.8)	7.57 (2.9)	6.46**
Similarities	9.43 (3.4)	7.40 (3.1)	12.58***
Digit Span	9.87 (3.1)	8.34 (3.0)	8.00**
Vocabulary	10.36 (3.1)	8.18 (3.8)	11.35***
Digit Symbol	6.94 (2.3)	6.16 (2.5)	3.17
Picture Completion	7.79 (2.7)	6.93 (3.0)	2.65
Block Design	8.21 (2.6)	7.56 (2.9)	1.69
Picture Arrangement	8.09 (3.2)	7.04 (3.0)	3.60
Object Assembly	7.87 (3.0)	7.18 (2.8)	1.87

[a] $df = 1, 135$.
*$p < .05$. **$p < .01$. ***$p < .001$.

between the two groups on 6 of the 11 subscales. In each case, those with affective disorders scored significantly higher than those in the psychotic group.

The discriminant analysis of these scales produced a canonical correlation coefficient of .396 (Wilks's lambda = .843), $\chi^2(11, N = 141) = 22.1$, $p < .05$, indicating that these subscales can differentiate between these two nosological categories. The results of this analysis are presented in Table 2. The mid-to-high positive correlations between all the subscales and the canonical discriminating variate (Column A) suggests this function may represent an Ability factor. The particularly high correlations of the Verbal subscales indicates this factor may

TABLE 2
Within Groups Correlations Between Discriminating Variables and Discriminating Function and Standardized Canonical Discriminant Function Coefficients

Variable	*Discriminating Function*	*Canonical Coefficient*
Information	.47	−.43
Comprehension	.91	.92
Arithmetic	.51	.05
Similarities	.71	.24
Digit Span	.56	.33
Vocabulary	.67	.05
Digit Symbol	.36	−.11
Picture Completion	.33	.01
Block Design	.26	−.26
Picture Arrangement	.38	.08
Object Assembly	.27	.05

represent more of a concept formation dimension: the ability to access, evaluate, and integrate information in a logical and appropriate manner. We were able to classify accurately 70.07% of the sample, $\chi^2(1, N = 141) = 19.45, p < .01$.

However, an examination of the standardized discriminant function coefficients in Table 2 (Column B) suggests that not all of the subscales may be necessary in making this discrimination. Three groups of variables emerge. The first are the three subscales with moderately negative weights (Information, Block Design, and Digit Symbol). Relatively high scores on these subscales are associated with a classification of psychotic. The second group of subscales has moderate-to-high positive weights (Digit Span, Comprehension, and Similiarities). Relatively high scores on these subscales are associated with an affective classification. The remaining cluster of five subscales all have weights close to 0.

A second discriminant analysis was performed using only the six subscales with nonzero loadings. A resulting canonical correlation of .395 (Wilks's lambda = .844), $\chi^2(6, N = 141) = 22.38, p < .001$, was obtained. The pattern of correlations between the remaining subscales and the canonical function remained consistent with the previous analysis (i.e., the four verbal subscales evidencing higher correlations than the two performance scales). In fact, the magnitude of the correlations and their rank order to one another remained constant, indicating that a Verbal Ability dimension continues to underlie the differences between the two diagnostic categories. Based on this reduced equation we were able to classify accurately 66.67% of the sample, $\chi^2(1, N = 141) = 14.08, p < .01$. Clearly, removing the five subscales with the near-zero standardized loadings does not appreciably compromise the ability of the WAIS–R to discriminate between the two nosological conditions.

At this point, two important issues emerge: base rate and cross-validation. Given the differences in size between the two groups, merely classifying all subjects as psychotic would result in a 66% classification rate. It is necessary, therefore, to determine whether the discriminant equation can provide a sufficient improvement in prediction to justify its use, and to estimate the extent to which the obtained equations can be cross validated in a new sample. To address these issues, random samples of 30 subjects were drawn from each group and a discriminant analysis was performed. The resulting discriminant weights were then used to classify those subjects not included in the analysis. This procedure was repeated 10 times, and the resulting standardized weights and classification rates for these analyses are presented in Table 3.

Two important results can be extrapolated from Table 3. First, when equal sample sizes were employed (hence a 50% base rate), the canonical correlation increased from .395 to an average of .48, and the classification rate also increased to an average of 69.6% (low: 63.8%; high: 78%). Thus, these equations enhanced our predictive power almost 20% over that expected by chance. Second, when each equation was used to predict group membership for those cases not

TABLE 3
Standardized Weights, Canonical Correlations, and Classifications Rates for Crossvalidation Analyses

	Trial										Total	
	1	2	3	4	5	6	7	8	9	10	M	SD
Parameters												
Digit Span	.67	.29	−.15	.41	1.28	.13	−.31	.30	.24	.61	.25	.30
Comprehension	.75	.94	.61	.98	.93	1.2	1.2	1.1	.49	.75	.90	.23
Similarities	.16	.28	.55	.05	.63	.22	.19	−.17	.78	.44	.31	.29
Block Design	−.58	−.06	−.16	.14	−.15	−.17	−.15	−.02	−.63	−.38	−.21	.25
Information	−.23	−.28	.09	−.42	−1.1	−.71	−.14	−.24	.01	−.51	−.35	.35
Digit Symbol	.11	−.27	.03	−.24	.10	−.35	−.27	.09	−.09	.01	−.09	.18
Canonical Correlations												
	.46	.55	.55	.40	.54	.43	.46	.39	.47	.57	.48	.07
Percent Correctly Classified[a]												
	70	67	75	67	73	67	64	65	71	78	70	4.6
Percent Correctly Classified (Crossvalidation)[b]												
	63	61	62	62	62	64	65	68	68	60	64	2.7

[a] $n = 60$. [b] $n = 81$.

included in the analysis, a comparable prediction rate of 63.6% was obtained (low: 60%; high: 68.3%). To further substantiate the generalizability of these data, a "jackknife" cross validation procedure was carried out. Specifically, 141 discriminant analyses were performed, with one case systematically removed each time. The weights generated by each analysis were then used to classify the unincluded case. This resulted in a 65% classification rate, which represents a less biased, more conservative estimate of external validity. These analyses cross validate the WAIS–R's ability to discriminant between these two diagnostic categories.

Finally, based on the 10 analyses presented in Table 3, average unstandardized weights were calculated for each subscale, and this equation was used to classify the entire sample. This resulted in 66% of the subjects being accurately classified. The following equation, based on aggregated values, is recommended for use in classification because it represents a more stable estimate of the parameters:

$$\begin{aligned}\text{Diagnostic Group} = {} & (.0834 \times \text{Digit Span}) + (.293 \times \text{Comprehension}) \\ & + (.103 \times \text{Similarities}) - (.057 \times \text{Block Design}) \\ & - (.105 \times \text{Information}) - (.034 \times \text{Digit Symbol}) \\ & - 2.48\end{aligned}$$

A derived value greater than −.001 results in an affective determination; if less than −.001, then the diagnosis is psychotic. It should be stressed that this

algorithm is useful only in discriminating between these two groups. It would not be appropriate to use this formula in distinguishing either of these conditions from "normals" or from other disorders (e.g., personality disorders). Furthermore, because the cutting score was determined from samples of equal size (i.e., a 50% base rate), the accuracy of this value will decrease as the underlying base rate diverges from this optimum. A more representative sample is needed to determine just how much of a bias such an unequality will introduce.

DISCUSSION

The results of this exploratory study offer some tentative speculations regarding our understanding of affective and psychotic processes and for empirically differentiating between them. The derived canonical variate in the just-discussed analyses addresses this first issue.

As was mentioned earlier, the high correlation of this dimension with the Comprehension (the subscale that mediates social judgment) and Similarities (the subscale that mediates abstract reasoning) subscales suggests it to be a type of Verbal Ability related to social insight and understanding. High scores on these subscales are associated with an affective classification which allows one to argue that such individuals, who may be or perceive themselves to be socially isolated and detached, retain a capacity to perceive, understand, and anticipate relevant social stimuli. A high score on the Information subscale (relative to their other subtest scores) leads toward a psychotic classification (individuals who may also be or perceive themselves to be socially isolated and detached), suggesting that although they may be able to store information about the world around them, their ability to apply this knowledge in socially appropriate ways may be impaired. This is consistent with current conceptualizations of the schizophrenias in that one hallmark of these disorders is diminished social capacity (cf. *DSM–III*; American Psychiatric Association, 1980).

Consistent with this interpretation are the hypotheses derived by Rapaport et al. (1968), which add clinical relevance to our discriminant dimension. As was mentioned, relatively high scores on Block Design, Information, and Digit Symbol were associated with a psychotic classification, whereas relatively high scores on Comprehension, Digit Span, and Similarities were associated with an affective ajudication. Rapaport et al. contended that high scores on Similarities and Comprehension were indeed associated with a neurotic disposition. Those with a psychotic process are anticipated to evidence greatly impaired performance. Regarding Digit Span, although a high score is not seen as indicating a neurotic or affective disorder, low scores are believed characteristic of psychotic disorders. According to the Rapaport et al. system of interpretation, low scores

may be indicative of the anxiety frequently experienced by psychotic patients. This is consistent with our findings.

With regard to the psychotic classification, high scores on Information are consistent with a schizophrenic-type disorder according to Rapaport et al. With Block Design, high scores are not necessarily associated with a psychotic process, but low scores are indicative of depression. Concerning Digit Symbol, Rapaport et al. were not as clear on what this dimension represents vis-á-vis our diagnostic groupings. They contended that low performance could reflect either depressive or psychotic processes. According to our findings, impaired performance reflects an affective disorder.

Although these results appear consistent with the Rapaport et al. hypotheses, it must be remembered that they also hypothesized that performance on the five nonincluded subtests also discriminated between affective and psychotic processes. Clearly, in terms of these data, performance on Vocabulary, Arithmetic, Picture Completion, Picture Arrangement, and Object Assembly play a minimal role in differentiating these two groups. Nonetheless, these data represent some empirical support for the heuristic value of their ego-psychological interpretations of performance on the various WAIS subscales. The encouraging results presented here warrant an empirical examination of their diagnostic hypotheses (i.e., the clinical relevance of differences between particular subscales).

Although the analyses presented provide significant effects, the magnitudes of these effects are clearly moderate in size. Therefore, it needs to be emphasized that there are several components in diagnosis formation of which the equation presented here is only one. The relationship between VIQ and PIQ, intra- and intertest scatter, content and style analyses, and item analyses are other elements that need to be considered (as well as background/interview information). Despite the moderate contribution of information provided by each component, collectively they may provide the clinician with a high degree of diagnostic efficacy. Therefore, classifications should not be made solely on the basis of the aforementioned algorithms, but should be augmented by each of these different components. Nevertheless, the equation presented here, albeit not having the appeal of a simple rule of thumb, provides an empirical approximation of psychopathology as defined by *DSM–III*. The value of this finding lies in its potential to become an objective, valid measure of psychopathological taxonomies (Morey & McNamara, 1987).

It appears from these data that the WAIS–R, an instrument originally designed as a measure of intellectual ability, may be an effective medium for deriving psychodiagnostic indicators. Although this statement appears self-evident to many clinicians, the need for empirical validation is necessary for three reasons: (a) it provides a measure of confidence in our hypotheses, (b) the results of empirical investigations can help fine tune and/or extend our theoretical hypotheses, and (c) it establishes standardized procedures for making our

evaluations thus enhancing not only the heuristic value but also the utility (i.e., reproducibility) of our diagnostic procedures. Clearly these results offer an encouraging first step in a continuing validation process. Much more work needs to be done in extending these findings to new and different samples and in determining the personological qualities associated with this derived dimension. These procedures would be useful in highlighting those psychological dynamics captured by this equation. Given the manner in which the groups were formed, it remains to be determined whether a truly psychotic versus affective discrimination has been made (i.e., the degree to which scores from the equation represent disordered thinking or disordered affective processes) or if scores represent a more general index of disturbance. In either case, scores from the discriminant equation can be a very useful addition to the diagnostic process. Finally, given the inconsistencies in the research findings noted earlier with the WAIS, the fact that the WAIS–R was able to discriminate clearly between these diagnostic groupings suggests that it may represent an important psychometric improvement over the WAIS.

ACKNOWLEDGMENTS

We thank Arje Latz, PhD, and June G. Wolf, PhD, for providing access to their testing files and James Bernhard, Naomi Brunner, Timothy Scott, and Deborah Streeter for their assistance in collecting the data. Special thanks are also extended to Douglas McNair and Daniel Ozer for their helpful comments on an earlier draft.

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Received March 22, 1988
Revised June 15, 1988