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Construct validity of the National Adult Reading Test: a factor analytic study

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Summary—Factor analysis was carried out on the National Adult Reading Test (NART) and Wechsler Adult Intelligence Scale (WAIS) performance of 139 normal subjects. The NART loaded very highly on factor I extracted by principal components analysis (PCA), suggesting that the NART has high construct validity as a measure of general intelligence. Varimax rotation of the three factors extracted by PCA produced a factor structure that was consistent with previous factor analytic studies of the WAIS. The NART loaded highly on Factor I (verbal intelligence) but not on Factor II (non-verbal intelligence) or Factor III (attention/concentration).

INTRODUCTION

The National Adult Reading Test (Nelson, 1982) has rapidly become widely used by clinical psychologists to provide an estimate of premorbid intelligence. In addition, an increasing number of research studies have used the NART for this purpose (e.g. McKenna and Pratt, 1983; Kopelman, 1985, 1986; McCarthy, Gresty and Findley, 1985; Oyebode, Barker, Blessed, Dick and Britton, 1986; Acker, Jacobson and Lishman, 1987).

Two assumptions are involved when using a test as a measure of premorbid intelligence: (1) that the test provides a valid measure of general intelligence (in the normal population) and (2) that test performance is unaffected by neurological or psychiatric disorder. With regard to the second assumption predominantly encouraging results have been obtained with the NART (e.g. Nelson and O'Connell, 1978; O'Carroll and Gilleard, 1986; Crawford, Besson, Parker, Sutherland and Keen, 1987; Crawford, Parker and Besson, 1988). However, to date, there has been no independent investigation of the NART's validity as a measure of general intelligence.

When factor analysis is performed on measures of cognitive ability, principal components analysis almost invariably extracts a factor, usually interpreted as representing general intelligence *(g),* which has high loadings from all items and accounts for a large percentage of the variance. Factor analytic studies of the Wechsler Adult Intelligence Scale (WAIS) have extracted a *g* factor and, commonly, two others. When these three factors are rotated to a terminal solution the factor structure that emerges has led to them being labelled 'verbal intelligence', 'perceptual organistion'/'nonverbal intelligence' and 'attention concentration'/'distractability' (e.g. see Matarazzo, 1972).

In the present study combined factor analysis of the NART and WAIS was carried out to determine if the NART can be viewed as a valid measure of general intelligence and to further explore its relationship with WAIS measures by examining its loading on the three rotated factors referred to above.

METHOD

A total of 139 subject (70 males and 69 females) were administered the full WAIS and the NART according to the standardised procedures. All subjects were free of neurological, psychiatric, or sensory disability. Summary statistics for the sample's demographic characteristics and psychometric performance are presented in Table 1.

RESULTS

Factor analysis was performed on age-graded scaled scores for the WAIS subtests, both alone and in combination with NART error scores.* In both cases principal components analysis extracted three factors with eigen values greater than 1.00. Principal components Factor I *(g)* accounted for 48.6% of the variance when analysis was restricted to the WAIS and 50.2% when the NART was included (see Table 2). It can be seen from Table 2 that the NART loads highly on *g.* Varimax rotation was used to rotate the extracted factors to a terminal solution. As can be seen from Table 2 the resulting factor structure is similar to that obtained in previous factor analytic studies of the WAIS (although the Block Design subtest's loading on Factor I is higher than is commonly obtained). The Information, Comprehension, Similarities, and Vocabulary Subtests, all load highly on Factor I ('verbal intelligence'). Performance subtests load highly on Factor II ('nonverbal intelligence/perceptual organisation'). An attention-concentration/distractibility factor (Factor III) also emerged. It can be seen that the NART loaded highly on Factor I but exhibited a minimal loading on the other two factors.

*Nelson (1982) has proposed that the Schonell Graded Word Reading Test should be administered with the NART for the estimation of premorbid IQ in poor readers. Factor analysis with NART and Schonell errors yielded results that were essentially identical to those obtained with NART errors alone. Space constraints do not permit presentation of the results but they can be obtained from the first author.

Table 1. Demographic characteristics and psychometric performance of subjects

	Mean	SD	Range
Age Education (years) WAIS FSIQ NART errors	42.2 12.4 111.5 20.9	17.2 2.9 12.4 10.5	16-88 7-20 75-136 3-45

Table 2. Factor analysis of the WAIS and NART: principal components (PC) Factor I and varimax rotated factor structure (results for WAIS alone in parentheses)

			Varimax rotation					
	PC Factor I		Factor I		Factor II		Factor III	
Information	0.88	(0.87)	0.82	(0.82)	0.33	(0.32)	0.15	(0.18)
Comprehension	0.82	(0.81)	0.82	(0.82)	0.21	(0.19)	0.15	(0.18)
Arithmetic	0.69	(0.69)	0.57	(0.58)	0.19	(0.16)	0.49	(0.52)
Similarities	0.76	(0.76)	0.84	(0.85)	0.16	(0.15)	0.03	(0.01)
Digit Span	0.40	(0.39)	0.15	(0.11)	0.10	(O.H)	0.89	(0.89)
Vocabulary	0.88	(0.87)	0.83	(0.82)	0.25	(0.25)	0.28	(0.31)
D Symbol	0.53	(0.55)	0.14	(0.13)	0.72	(0.73)	0.19	(0.19)
Pet Completion	0.65	(0.67)	0.33	(0.35)	0.62	(0.60)	0.22	(0.23)
B Design	0.73	(0.75)	0.57	(0.60)	0.56	(0.54)	0.10	(0.07)
P Arrangement	0.52	(0.55)	0.10	(O.H)	0.81	(0.81)	0.08	(0.07)
O Assembly	0.59	(0.60)	0.41	(0.45)	0.56	(0.54)	0.18	(0.17)
NART errors	-0.85		-0.80		-0.22		-0.30	

Loadings > 0.50 printed in **bold.**

DISCUSSION

The present results indicated that the NART has high construct validity as a measure of general intelligence. Indeed the NART's loading on *g* (0.85) was higher than the majority of WAIS subtests (only Information and Vocabulary had higher loadings). Comparison of the subtest loadings obtained when analysis was restricted to the WAIS indicates that this was not a result of the NART biasing Factor I towards verbal items as the subtest loadings were very similar in both analyses.

The Vocabulary subtest of the WAIS has probably been the test most commonly used to estimate premorbid IQ (Lezak, 1983). Although numerous studies have demonstrated that Vocabulary loads highly on *g* it does not appear to be as resistant to the effects of dementia and depression as the NART (Crawford, 1989). In view of this, and given that in the present study the loadings of the two tests on *g* were essentially equivalent, the NART should be used in preference to Vocabulary to estimate premorbid IQ.

The varimax rotated factor structure indicates that the NART provides a valid measure of verbal intelligence. However, as might be expected, the NART does not load on the non-verbal intelligence factor. As was noted, Factor III in factor analytic studies of the WAIS has been viewed as an attention-concentration or distractibility factor. The Mental Control subtest of the Wechsler Memory Scale (WMS), which has been regarded as another measure of attention/distractibility, also loads on this factor when the WAIS and WMS are factor analysed together (Larrabee, Kane and Schuck, 1983) lending some support to this view. The rationale underlying the use of the NART is that it taps previous knowledge while minimising the demands on current cognitive capacity. It is encouraging to note therefore that the NART does not have a high loading on the attention-concentration/distractibility factor.

Finally, the NART was developed to provide an estimate of *premorbid* IQ in *cognitively impaired* clinical groups. However, the rapidity with which it can be administered and scored and the present demonstration of its validity as a measure of general intelligence suggests that it can play a useful role in other areas of psychological research, e.g. as a variable in community surveys where practical constraints would preclude the use of more lengthy measures of IQ, or as an additional criterion for establishing the comparability of clinical or experimental groups.

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