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EXTRAVERSION–INTROVERSION AND INTELLIGENCE

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Summary—Robinson (*Personality and Individual Differences, 6*, 203–216, 1985; *7*, 153–159, 1986) suggests that intelligence test performance and personality are related. The present study examined Wechsler Intelligence Scale for Children—Revised subtest and IQ score patterns in a sample of children classified as introverts, ambiverts and extraverts. In general, the results support Eysenck's hypothesis that intelligence and personality are uncorrelated.

INTRODUCTION

There is a divergence of opinion and data regarding the relationship between personality and intelligence. Eysenck (1971) contends that intelligence test performance is uncorrelated with the major personality dimensions of extraversion–introversion and neuroticism–stability although the psychoticism (P) factor and lie (L) scale of the various Eysenck personality measures tend to be negatively correlated with intelligence. In contrast, extraversion and neuroticism, both separately and interactively, show particular relationships with school achievement (e.g. McKenzie, 1989; Southworth, 1989) and McCord and Wakefield (1981) have demonstrated that extraversion–introversion and school achievement are related to teacher presented reward and punishment. While several studies lend some support to Eysenck's position of the independence of intelligence and personality (Eysenck, 1971; Saklofske, 1985; White, 1973; Yackulic & Saklofske, 1988), more recently Robinson (1985, 1986) has argued that differences in the thalamocortical activity or sensitivity of introverts and extraverts are also associated with different factors and styles of intelligence.

Robinson (1982a, b, 1983, 1985, 1986) has employed the Pavlovian and Eysenckian model of brain function and behaviour to hypothesize specific differences in intelligence test profiles between extraverts (E), amibiverts (A) and introverts (I). Introverts acquire better 'associative' intelligence in contrast to Es, who develop better 'operational' intelligence and are better able to learn more complex motor skills. Such differences in intelligence are linked to differences in conditionability with Es manifesting enhanced operant conditionability and Is showing better classical conditioning. Thus, Robinson (1985, pp. 204–205) hypothesizes that the "more intense and irradiating thalamocortical activity of introverts" would give them an advantage in tasks that require sensory associative learning such as those included in the verbal subtest battery of the original and revised versions of the Wechsler Adult Intelligence Scale (Wechsler, 1955, 1981). Alternatively, the inhibition of brain stem systems due to the "greater tonic level of activity sustained by the thalamocortical processes of introverts" would have a negative effect on tasks requiring either or both overt and mental manipulation skills. High E individuals should then have some advantage on tasks that require motor associative learning and which are included on the performance factor of the Wechsler scales.

Robinson's (1985, 1986) studies with adult *S*s have demonstrated that Is earn higher scores on the WAIS verbal tests, with the exception of arithmetic, and Es have higher scores on the performance tests. No difference in full scale IQ was observed between the I and E *S*s. WAIS profiles for As were found to be further related to age and sex as well as P and L scores. For example, younger adult males tended to perform better on the WAIS picture arrangement and block design subtests and also on the factor that is loaded by tests measuring attention and concentration. These findings have been employed by Robinson (1985, 1986) in the development of WAIS introversion–extraversion profiles for adults.

The purpose of the present study was to investigate further the relationship between I–E and intelligence in children. The Wechsler Intelligence Scale for Children—Revised (Wechsler, 1974) was selected to permit an examination of subtest scores among children differing on the I–E dimension.

METHOD

Subjects

The initial sample included 507 children, ages 11–14 yr, in grades 6–8 from five schools. All children were administered the extraversion scale of the Junior Eysenck Personality Questionnaire (JEPQ; Eysenck & Eysenck, 1975). Based on the E score distributions and Canadian JEPQ norms (Eysenck & Saklofske, 1983), children scoring 1 SD below the mean (scores of 15 or less) and those with scores of 22–24 (approx. 25% of this sample) were classified as I and E respectively; As fell in the 17–20 score range. Following this preliminary screen, 60 children were randomly selected from each of the three personality groups for possible inclusion in the study. For those children who were then given parental permission to participate, the full JEPQ was administered to them to permit the selection of the final sample. Based on this double-screen method in which a child's second JEPQ E score must also remain within the previously set cutoff points, 25 Is ($\bar{x} = 11.4$, SD = 3.52), 22 As ($\bar{x} = 19.00$, SD = 1.02) and 37Es ($\bar{x} = 23.14$, SD = 0.82) formed the study sample of 41 girls and 43 boys ($\bar{x}$ age = 12.42 yr, SD = 0.91).

Procedure

The WISC-R was administered to each student according to the procedures described in the manual with the exception that Vernon's (1977) recommended changes for Canadian children were made for selected items on the information subtest. A random rescoring of WISC-R protocols by a different qualified person ensured scoring consistency and accuracy.

Instruments

The Wechsler Intelligence Scale for Children—Revised (Wechsler, 1974) is one of the most frequently used individual tests in North America to assess the global intelligence of children in the 6–16 yr age range. It is also considered to be a highly reliable and valid measure of intelligence. The WISC-R yields full scale (FSIQ), verbal (VIQ) and performance (PIQ) intelligence quotients based on the administration of 5 verbal and 5 performance subtests. There is also an optional subtest at each level and the digit span subtest was used in this study.

The Junior Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975) is the most recent of the Eysenck scales for measuring the major personality dimensions of E, N and P. A lie scale is also included. The instrument may be used with children in the 8–15 yr age range. A large number of research studies have supported both the psychometric properties of the scales as well as the personality dimensions described by Eysenck.

Table 1. WISC-R IQs and subtest scores for introverts, ambiverts and extraverts

	Introverts (n = 25)		Ambiverts (n = 22)		Extraverts (n = 37)	
WISC-R	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
VIQ	98.72	12.82	102.55	10.24	101.97	9.62
PIQ	101.40	16.14	109.27	11.58	107.11	12.49
FSIQ	99.80	13.92	106.14	10.63	104.70	10.13
Inf	9.68	2.87	10.36	1.97	10.22	1.78
Sim	9.92	2.83	10.73	1.98	10.78	2.24
Ari	9.84	2.53	10.23	2.25	9.65	2.15
Voc	10.04	2.59	10.82	2.42	10.54	2.14
Com	9.68	2.53	10.27	2.12	10.73	2.39
DS	8.84	2.61	10.00	3.56	9.46	2.34
PC	9.04	2.26	10.77	2.86	10.41	3.02
PA	10.88	2.83	11.68	2.21	11.30	3.24
BD	9.92	3.41	11.05	2.36	10.78	2.74
OA	11.24	3.84	11.55	3.25	10.73	2.95
Cod	9.88	3.92	12.14	2.85	12.14	2.64

RESULTS

WISC-R IQ and subtest mean scores and standard deviations for I, A and E children are reported in Table 1. Significantly ($P < 0.01$) higher PIQ than VIQ scores were attained by the A, $t(21) = -2.91$, and E, $t(36) = -2.47$, groups. An ANOVA showed no significant differences at the $P < 0.05$ level between the three groups in VIQ, PIQ or FSIQ although the A and E children did manifest a tendency toward slightly higher scores compared to Is. This finding was maintained when *S*s were classified further by gender and personality.

An examination of the WISC-R subtest means contained in Table 1 shows that only coding differed significantly, $F(2,81) = 4.58$, $P < 0.01$, between groups with introverted children earning the lowest scores. In comparing the three groups, it is interesting to note a trend toward generally lower WISC-R performance subtest scores among I children but they also tended to score slightly lower on the verbal subtests in contrast with Robinson's findings. As well as the significant difference on the coding subtest favoring the E and A children, the latter group also had the highest scores on the other two 'freedom from distractibility' measures of arithmetic and digit span. Gender differences were not found in this analysis.

Robinson's (1985) argument of a non-linear relationship between extraversion and intelligence, together with a link with other personality scales, prompted an examination of the pattern of correlations between the WISC-R measures and the four JEPQ scales for both the total sample and for children classified as I, A, and E. These results are described in Table 2. First, the JEPQ extraversion and neuroticism scales did not correlate significantly with any of the IQ indices for the total sample or for any of the three groupings. However, P showed a significant ($P < 0.05$) positive correlation with all three IQ scores for the total sample and with PIQ and FSIQ for the E children. The lie scale correlated negatively ($P < 0.05$) with VIQ and FSIQ for the combined sample. Second, the correlations between the individual WISC-R and JEPQ scales varied in relation to the I–E classification. The only significant correlations between extraversion and the WISC-R subtests was with coding for the combined sample and with vocabulary for the high E children.

DISCUSSION

Eysenck (1970) hypothesized that personality and intelligence are uncorrelated. Alternatively, Robinson (1985, 1986) contends that a further examination of the Pavlovian/Eysenckian model of brain function and behaviour supports a hypothesis that recognizes differences in introversion–extraversion as well as differences in learning and the kind of intelligence that introverts and extraverts could be expected to acquire or manifest.

The present study of WISC-R score patterns among I, A and E children did not generally support Robinson's findings with adult *S*s. While Robinson (1985) reported that adult introverts score higher on the WAIS verbal tests compared to extraverts who show an advantage on the performance measures, this study found no significant differences between VIQs, PIQs or between 10 of the 11 subtests across the three personality groupings; only the coding subtest was significantly higher for E and A children. Ambiverts tended to perform only slightly better on the other two 'freedom from distractibility' subtests. However, A and E children had significantly higher PIQ scores in relation to their VIQs.

More recently, Rawlings and Carnie (1989) have offered an alternative explanation for Robinson's findings. Based on the position of I–E differences in the tonic level of arousal and an inverted U relationship between performance and arousal, Rawlings and Carnie found that E *S*s performed better on WAIS timed tasks but that Is did better when these same tasks were not timed. In the present study, the finding that I and E children did not differ in their WISC-R results, except on the coding subtest, also argues against this conclusion reached by Rawlings and Carnie. All of the WISC-R performance tests are timed and this is apparent to the *S* through the test instructions and the presence of a stop watch in contrast to the untimed verbal tests, except for arithmetic.

While this study does not replicate Robinson's findings, it should be noted that he used adult *S*s and the WAIS, while the results reported here are for children and WISC-R data. Although certainly not identical, the two intelligence tests do yield three factors labelled verbal comprehension, perceptual organization and freedom from distractibility (Sattler, 1988). Similarly the EPQ

Table 2. Correlations between WISC-R and JEPQ scores for *Ss* classified as introverts, ambiverts and extraverts†

	JEPQ															
	Introverts				Ambiverts				Extraverts				Total			
WISC-R	E	N	P	L	E	N	P	L	E	N	P	L	E	N	P	L
VIQ	−12	−03	17	−26	07	−10	28	−10	22	−15	21	−25	11	−13	23*	−24*
PIQ	−07	10	16	−17	00	−10	−20	−25	09	−05	34*	−04	16	−06	21*	−17
FSIQ	−11	04	19	−24	04	−11	06	−21	20	−12	34*	−16	16	−11	26*	−23*
Inf	04	08	13	−29	09	−07	43*	02	26	−19	37*	−31*	13	−08	30*	−25*
Sim	−17	−15	13	−21	00	−16	27	−04	−04	−15	−03	−14	10	−19*	12	−17
Ari	05	03	18	−15	−04	20	08	−12	06	07	33*	−47*	−02	11	19*	−27*
Voc	−13	02	24	−37*	08	00	35*	−19	32*	−16	11	03	08	−08	20*	−17
Com	−13	−14	00	00	13	−35	−08	−03	26	−11	06	−10	17	−23*	08	−09
DS	−19	17	04	−11	18	04	12	−13	−06	−24	−10	−14	07	−04	02	−14
PC	−18	01	−04	08	−28	−32	−15	37*	17	05	24	−04	17	−12	15	03
PA	16	−02	06	−06	06	−21	−23	−24	−07	−19	−04	20	09	−14	−04	03
BD	−14	06	16	−29	−32	08	−02	−21	14	−13	39*	−18	09	−05	25*	−25*
OA	07	02	28	−30	00	−09	−14	−24	02	02	26	−08	−04	−03	13	−18*
Cod	−11	19	07	04	20	30	−07	−30	00	11	24	−04	26*	06	19*	−12

*$P < 0.05$.

†Decimal points omitted.

and JEPQ measure the three major personality dimensions of extraversion, neuroticism and psychoticism and both include a lie scale. However, Canadian norms (Eysenck & Saklofske, 1983) for the E scale do show a skewed distribution and this is reflected in the designated cutoff scores for grouping the children in the present study. Thus it may be that any relationship that might exist between personality and intelligence could be masked by the measuring instruments or is less obvious in children.

Finally, any relationships between intelligence and Eysenck's major personality dimensions may not be simple linear ones. Robinson (1985) has observed how P and L interact with E in determining performance on memory tests in young adult male *S*s. McKenzie (1989) demonstrated the relevance of the 'Furneaux Factor' in the relationship between N and academic achievement and Southworth (1989) described the complex interaction between sex, E and N in accounting for performance differences in various mathematics skill areas. Collard (1988) summarized several studies that show a relationship between I–E, modes of reinforcement and achievement. In this study, P had an unexpected positive correlation with the IQ scores and several subtests for the total sample but these findings varied in relation to the I–E classification of the children. Further examination of these more complex interactions is required to determine the relationship between personality and intelligence.

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