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A COMPARISON OF SEX DIFFERENCES ON THE SCOTTISH AND AMERICAN STANDARDISATION SAMPLES OF THE WISC-R

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Summary—Sex differences in the Scottish standardisation sample of the WISC-R are analysed and compared with those in the American standardisation sample. The two data sets showed virtually identical sex differences. Boys obtained higher means on the Full Scale IQ and the Verbal and Visuospatial factors, while girls obtained a higher mean on the Memory factor. The sex differences were not greater in older children as compared with younger. Boys tended to show greater variabilities.

INTRODUCTION

It is generally stated that research literature shows no overall difference between males and females for general intelligence, but that males have some advantage on visuospatial abilities which is counterbalanced by a female advantage on verbal abilities. The earlier literature indicating this position was thoroughly reviewed by Maccoby and Jacklin (1974) and a review of the more recent literature has confirmed these conclusions (Vogel, 1990). Recent American literature has suggested some tendency for these sex differences to diminish (Hyde & Linn, 1986; Jacklin, 1989), except for the studies of Benbow and Stanley (1983) finding an overrepresentation of boys among high level ability in mathematics.

Most of the recent reviews of sex differences in abilities have not picked up an analysis of the American standardisation sample of the WISC-R carried out by Jensen and Reynolds (1983). This analysis, based on whites only, showed that boys obtained a significantly higher mean Full Scale IQ and Verbal IQ, but not Performance IQ. Girls obtained significantly higher means on the Coding and Digit Span tests, generally considered to be tests of short term memory. None of the sex differences showed any tendency to increase in the post puberty age group as compared with the younger. Finally, boys showed significantly greater variabilities, with approximately a 1 IQ point larger standard deviation than girls.

While the female superiority in Coding and Digit Span, and the greater male variability, have been found in many other studies, the higher male Full Scale IQ and Verbal IQ are not consistent with previous reports. These results are so anomalous that they may be due to sampling errors in the American standardisation sample. The differences in the American WISC-R seem sufficiently interesting to be worth checking in another WISC-R standardisation. For this purpose we have examined the sex differences in the sample used for the standardisation of the WISC-R in Scotland. The results form the subject of this report.

METHOD

The WISC-R was standardised in Scotland in 1982 on approximately 1400 children aged 6–16 drawn as a representative sample in terms of socio-economic status and urban–rural residence. While the target sample was 1400, the actual numbers of children tested fell slightly short of this and there were also small variations on the individual subtests in the numbers tested. The content of the test is the same as the American except where small changes in a few items were required to make them more suitable for Scottish children.

RESULTS

The mean scaled scores for males and females on each subtest and on the Verbal, Performance and Full Scale IQs are shown in Table 1. The male–female difference scores are shown first as the difference between the male and female means (M–F), and secondly in standard deviation units (Ds). Column 9 gives the Student's *t* values and significance levels for the male–female differences.

Finally, column 10 gives the American sex differences expressed in standard deviation units for comparison with the Scottish.

The results show that the boys obtained significantly higher means on the tests of Information, Arithmetic, Vocabulary, Comprehension, Picture Completion, Block Design and Object Assembly. Females obtained significantly higher means on Digit Span and Coding. Males obtained significantly higher means on the Verbal and Full Scale IQs, but not on the Performance IQ.

Comparison of the sex differences in Scotland with those in the U.S.A. shows a close similarity. In both countries the females performed best on Coding followed by Digit Span, while males performed best on Information. The product–moment correlation between the two sets of Ds is 0.98 and is statistically highly significant ($P < 0.001$). The statistical significance of the difference in mean Ds between the two groups was also tested and found to be non-significant ($t = 1.19$). Taken together, these results indicate that the male–female differences on the various subtests are virtually identical for the Scottish and U.S.A. samples.

In their analysis of the American data Jensen and Reynolds divided the sample into the 6–11 year group and the 12–16 year group in order to ascertain whether the sex differences among the pre-pubertal children differed from the post-pubertal. They found that there were no differences between the two age groups. We have carried out the same analysis and the data for the two age groups are shown in Table 2. It can be seen by inspection that there are no differences between the two groups.

A number of studies have found greater variability in intelligence test scores among males. The literature on this subject was reviewed by Jensen (1980, pp. 627–628) who concluded that the male standard deviation is typically about 1 IQ point greater than the female. The data set out in Table 1 show that the expected greater standard deviation among the boys is present on the Full Scale IQ, where it amounts to 0.3 of a standard deviation, and on the Verbal IQ, where it amounts to 1.15 of a standard deviation. However, on the Performance IQ the standard deviation is greater among the girls. The statistical significance of the sex differences in the variances was tested for all the differences set out in Table 1 by calculating the *F*-ratios. The results are that the greater male variance is statistically significant for Information and Vocabulary at $P < 0.01$ and for Arithmetic and Verbal IQ at $P < 0.05$. None of the other differences are statistically significant.

Factor analyses of the WISC and WISC-R have virtually always shown the presence of three factors (Matarazzo, 1972; Jensen and Reynolds, 1983). These consist of a verbal factor comprising the verbal tests except for Digit Span; a performance factor, generally considered to be visuospatial ability, consisting of the four performance tests excluding Coding; and a third factor defined by Digit Span and Coding and generally interpreted as short term memory but sometimes as 'freedom

Table 1. Scaled scores of WISC-R subtests and verbal, performance and FSIQ for males and females (all ages)

	Males			Females						
	n	Mean	SD	*n*	Mean	SD	M–F	Ds	*t*	US Ds
Information	687	10.61	3.39	708	9.40	2.80	1.21	0.39	7.28***	0.37
Similarities	687	10.17	3.26	709	9.90	3.06	0.27	0.08	1.60	0.07
Arithmetic	687	10.30	3.45	708	9.91	3.16	0.39	0.12	2.20*	0.06
Vocabulary	687	10.44	3.22	709	9.60	2.88	0.85	0.28	5.14***	0.14
Comprehension	687	10.23	3.12	709	9.87	3.20	0.36	0.11	2.13*	0.09
Digit Span	662	9.73	3.13	687	10.22	3.25	−0.49	−0.15	2.82**	−0.10
Picture Completion	687	10.36	3.17	709	9.76	3.14	0.59	0.19	3.55***	0.15
Picture Arrangement	687	10.15	3.10	707	9.96	3.13	0.19	0.06	1.44	0.11
Block Design	686	10.28	3.03	707	9.79	3.14	0.50	0.16	2.96**	0.15
Object Assembly	683	10.40	3.14	707	9.75	3.10	0.65	0.21	3.88***	0.18
Coding	685	9.12	2.90	706	10.74	3.00	−1.63	−0.55	10.23***	−0.53
Verbal IQ	668	101.56	14.52	700	98.51	13.37	3.05	0.22	4.04***	0.19
Performance IQ	669	100.43	13.63	697	100.34	14.24	0.09	0.01	0.12	0.01
Full Scale IQ	665	101.16	14.08	696	99.38	13.78	1.78	0.13	2.36*	0.12

Asterisks 1–3 denote statistical significance at *5, **1 and ***0.1% levels respectively.

Table 2. Scaled scores of WISC-R subtests and verbal, performance and FISIQ for males and females by age group

	Males			Females					
	n	Mean	SD	*n*	Mean	SD	M–F	Ds	*t*
Under 12									
Information	396	10.42	3.43	401	9.52	2.82	0.90	0.29	4.05***
Similarities	396	10.05	3.34	402	9.87	2.98	0.18	0.06	0.80
Arithmetic	396	10.24	3.41	401	9.78	3.05	0.46	0.14	2.01*
Vocabulary	396	10.48	3.18	402	9.68	2.82	0.81	0.27	3.76***
Comprehension	396	10.31	3.10	402	9.74	3.13	0.57	0.18	2.58**
Digit Span	382	9.72	3.10	389	10.22	3.23	−0.50	−0.16	2.19*
Picture Completion	396	10.24	3.18	402	9.82	3.08	0.42	0.13	1.89
Picture Arrangement	396	10.04	3.05	402	10.07	3.19	−0.02	−0.01	1.37
Block Design	395	10.34	3.06	402	9.63	3.09	0.71	0.23	3.26**
Object Assembly	394	10.36	3.11	402	9.79	3.07	0.57	0.18	2.60**
Coding	394	9.25	2.99	401	10.62	2.93	−1.37	−0.46	6.52***
Verbal IQ	383	101.14	14.31	395	98.39	12.79	2.75	0.20	2.81**
Performance IQ	385	100.42	13.73	395	100.37	13.86	0.05	0.00	0.05
Full IQ	380	100.90	13.89	394	99.22	13.20	1.67	0.12	1.72
12 and over									
Information	291	10.67	3.34	307	9.24	2.77	1.63	0.53	6.51***
Similarities	291	10.32	3.15	307	9.93	3.17	0.39	0.12	1.51
Arithmetic	291	10.38	3.50	307	10.07	3.29	0.31	0.09	1.12
Vocabulary	291	10.39	3.28	307	9.49	2.94	0.90	0.29	3.54***
Comprehension	291	10.11	3.15	307	10.04	3.30	0.07	0.02	0.26
Digit Span	280	9.74	3.18	298	10.22	3.28	−0.48	−0.15	1.78
Picture Completion	291	10.52	3.14	307	9.69	3.21	0.83	0.26	3.19**
Picture Arrangement	291	10.29	3.15	305	9.82	3.06	0.47	0.15	1.85
Block Design	291	10.20	3.00	305	9.99	3.21	0.21	0.07	0.82
Object Assembly	289	10.46	3.18	305	9.70	3.15	0.75	0.24	2.92**
Coding	291	8.93	2.77	305	10.91	3.09	−1.98	−0.67	8.22***
Verbal IQ	285	102.11	14.79	305	98.66	14.08	3.45	0.24	2.90**
Performance IQ	284	100.45	13.49	302	100.30	14.73	0.15	0.01	0.13
Full IQ	285	101.52	14.33	302	99.59	14.50	1.92	0.13	1.62

Asterisks 1–3 denote statistical significance at *5, **1 and ***0.1% respectively.

from distractability'. In order to ascertain the factor structure in the Scottish sample the correlation matrix was factored by principal components and rotated by varimax. The principal components analysis showed two factors with eigenvalues above unity and a third factor with an eigenvalue of 0.95. To allow comparison with a number of previous factor analyses of the WISC and WISC-R the first three factors were rotated. The results are shown in Table 3.

The first principal component is generally considered to be the general factor or Spearman's *g*. It accounts for 46% of the variance, a typical figure, and all the tests are well loaded on it. The highest loading tests are Vocabulary and Information, while Digit Span and Coding have the lowest loadings, as in the Jensen and Reynold's results for the American WISC-R. The varimax rotation shows the usual three factors with Digit Span and Coding defining the third (memory) factor. Sex differences on the three factors can be calculated from the Ds weighted by the factor loadings for the five verbal tests, the four visuospatial tests and the two memory tests. This gives Ds of 0.21 ($P < 0.001$) in favour of boys for the verbal factor, 0.16 ($P < 0.01$) favouring boys for the visuospatial factor, and 0.35 ($P < 0.001$) favouring girls for the memory factor.

Table 3. First principal components and three rotated Varimax factors identifiable as Spearman's *g*, verbal, visuospatial and memory abilities

Test	First principal component	Varimax factors 1	2	3
Information	80	79	29	17
Similarities	78	78	27	15
Arithmetic	67	57	11	51
Vocabulary	81	80	30	15
Comprehension	75	72	28	16
Digit Span	51	33	00	72
Picture Completion	64	35	68	00
Picture Arrangement	57	28	57	10
Block Design	71	25	69	35
Object Assembly	63	17	81	13
Coding	48	01	34	73

DISCUSSION

The sex differences on the WISC-R found in Scotland show a close agreement with those previously reported by Jensen and Reynolds for the U.S.A. In both countries girls obtained higher means than boys on Coding and Digit Span, while boys obtained higher means on the other subtests. The correlation of 0.98 between the differences on the two sets of data shows a remarkable degree of similarity.

The sex differences on the WISC-R in both Scotland and the U.S.A. do not conform to the pattern generally reported to the effect that there is no difference on the Full Scale IQ but that boys obtain higher means on the visuospatial tests and girls on the verbal tests. On the contrary, in both data sets boys obtained higher Full Scale IQs than girls, and the male advantage was greater on the verbal tests than on the visuospatial.

The higher means obtained by boys on the WISC-R stands in contrast to the absence of any significant sex differences on the Full Scale, Verbal and Performance IQs in the earlier WISC, reported by Kaufman (1975). This prompts us to wonder whether the increases which have taken place in mean intelligence levels during recent decades may have been greater in boys than in girls. It is possible that boys were more vulnerable to the sub-optimal environment of earlier decades in the century, which we believe were largely nutritional (Lynn, 1990), and have benefited more from environmental improvements. The possibility that different rates of secular increase of intelligence may be taking place in the two sexes could usefully be examined in other data sets.

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