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Sex differences on the progressive matrices among 15–16 year olds: some data from South Africa

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Abstract

It has been widely asserted that there is no sex difference in mean scores on the Progressive Matrices. This paper presents an alternative theory that a male advantage on the test begins to appear at the age of 15 years. This alternative theory is supported by data for the largest sample hitherto reported consisting of 3979 15–16 year olds in South Africa. In this sample males obtained a significantly higher mean equivalent to 2.35 IQ points among 15 year olds and to 4.65 IQ points among 16 year olds. © 2002 Published by Elsevier Science Ltd.

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1. Introduction

Raven's Progressive Matrices is one of the leading tests of abstract or non-verbal reasoning ability. It is widely regarded as the best, or one of the best, tests of Spearman's *g*, the general factor underlying all cognitive abilities. Court (1983, p. 54) has written that it is "recognised as perhaps the best measure of *g*" and Jensen (1998, p. 541) that "the Raven tests, compared with many others, have the highest *g* loading". Others have regarded the Progressive Matrices as an excellent test of "general intelligence". For instance, Mackintosh (1996, p. 564) has written that "general intelligence" can be equated with abstract reasoning ability and "fluid intelligence" (Gf), and that the Progressive Matrices is "the paradigm test of non-verbal, abstract reasoning ability".

It has frequently been stated that there is no sex difference in the mean scores obtained on the Progressive Matrices. Court (1983) reviewed 118 studies on sex differences on the Progressive

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Matrices and found that some showed higher mean scores by males, others found higher mean scores by females, and yet others showed no difference in mean scores. From this he concluded that "the accumulated evidence at all ability levels indicates that a biological sex difference cannot be demonstrated for performance on the Raven's Progressive Matrices" (p. 68). Mackintosh (1996, 1998) and Jensen (1998) have accepted Court's conclusion.

Because the Progressive Matrices is an excellent measure of *g* and of "general intelligence", and because there is apparently no sex difference on the Progressive Matrices, it follows that there is no sex difference on *g* or on "general intelligence". This conclusion was reached in the early decades of the twentieth century by Spearman (1923) and has been reasserted by Mackintosh (1996, 1998) and by Jensen (1998).

This widely held view that there is no sex difference on the Progressive Matrices and on other tests of abstract reasoning has been disputed by the writer (Lynn, 1994, 1998, 1999). I have argued that the issue of sex differences in abilities needs to be considered developmentally. According to this theory, girls mature earlier than boys both physically and mentally over the age range of 8–14 years, but from the age of 15 the growth of girls decelerates while that of boys continues. The effect of this is that girls do relatively well up to the age of 14 years but begin to perform progressively less well from the age of 15 years onwards. This theory states that this general principle of sex differences in the rate of maturation applies to the development of all cognitive abilities. Further evidence for the theory has been presented in Lynn, Allik, and Must (2000). I call this "the developmental theory of sex differences" because it states that sex differences in cognitive abilities have to be analysed developmentally, i.e. in regard to age, if any sense is to be made of them. In regard to abstract reasoning ability, it is proposed that there is virtually no sex difference between the ages of 6–9, that the earlier maturational growth spurt beginning in the ninth year in girls gives them an advantage of about 1 IQ point over the age range of 10–13, that from the age of 14 years the mental and physical growth of girls decelerates relative to that of boys and hence they begin to lose this advantage; and that from the age of about 15–16 years onwards boys begin to have an advantage that reaches 2.4 IQ points among adults (Lynn, 1994, p. 266). This estimate of the male advantage among adults was made on the basis of the data on sex differences on the abstract reasoning test in the American standardisations of the Differential Aptitude Tests.

Neither Mackintosh (1996) or Jensen (1998) pay any regard to the theory that sex differences on the Progressive Matrices, or on other tests, need to be considered developmentally. The present paper presents data designed to test two alternative hypotheses. The first is the Court–Mackintosh–Jensen hypothesis that there is no sex difference on the Progressive Matrices. The second is the writer's hypothesis that a male advantage begins to appear during the 15th year and, with a reasonably large sample size, should be statistically detectable in the 16th year.

2. Method

The data to be presented come from South Africa. The subjects of this study were drawn from Standard 7 classes in secondary schools and consisted of 1056 whites (mean age 15.0), 1063 Indians (mean age 15.0), 767 coloureds (mean age 15.4) and 1093 blacks (mean age 16.5). The Standard Progressive Matrices (Raven, 1981) was administered without time limits. The test was

Table 1
Mean scores of 15–16-year-old boys and girls in South Africa on Raven's Standard Progressive Matrices (minus signs = higher scores by girls)

Group	Sex	*n*	Mean	S.D.	Boy–girl difference	*d*	IQ difference	*t*
White	Boys	490	45.18	6.27	−0.16	−0.03	−0.45	1.1
	Girls	566	45.34	6.40				
Indian	Boys	530	43.01	7.90	2.04	0.25	3.75	4.25***
	Girls	533	40.97	8.45				
Coloured	Boys	386	37.50	8.38	1.64	0.18	2.85	2.56*
	Girls	381	35.86	9.31				
Black	Boys	554	29.29	10.59	3.33	0.33	4.65	8.12***
	Girls	539	25.96	10.60				

*$P < 0.05$;. ***$P < 0.001$.

usually completed within 40 min. A description of the sample and testing procedures has been given by Owen (1992) who presents the data (although not the sex differences) as representative of secondary school students in South Africa.

3. Results

Table 1 shows the numbers, mean scores, standard deviations, the differences between the means for the boys and girls, the *d* values (the sex differences expressed in standard deviation units obtained by dividing the differences by the combined standard deviation of the boys and girls), the *d* differences expressed as conventional IQs obtained by multiplying the *d* values by 15, and the *t* values for the statistical significance of the sex differences. These results show that among the whites, girls obtain a higher mean IQ of 0.45 IQ points, which is not significantly different from zero. Among the Indians, coloureds and blacks the boys obtained significantly higher means than girls by 3.75, 2.85 and 4.65 IQ points, respectively. As we are interested in sex difference for each year of age, it is useful to average the results for the three samples of 15 year olds. This, giving the three samples equal weight, gives a higher mean for boys of 2.35 IQ points.

4. Discussion

The results provide four points of interest. First, it should be noted that these are by far the largest samples of 15 and 16 year olds for which sex differences on the Progressive Matrices have been reported. Many of the studies in Court's (1983) review were of small samples so sex differences of one or two IQ points were not significant. The 1979 British standardisation sample consisted of 3250 children over the age range 6–15 and contained only 325 15 year olds (Raven, 1981). In the present samples there are 2886 15 year olds and a further 1093 16 years olds. These large numbers make quite small differences between males and females statistically significant and clarify the ambiguities of the interpretation of non-significant male advantages obtained in smaller samples like that of 15 year olds in the British standardisation sample.

Second, the results confirm the developmental theory of sex differences on abstract reasoning ability that a male advantage on the Progressive Matrices begins to appear during the 15th year and increases in the 16th year. If the samples of whites, coloureds and the Indians with a mean age of 15.2 are combined, the male advantage is 2.35 points. Among the blacks with a mean age of 16.5 the male advantage has increased to 4.65 IQ points.

Third, the sex differences obtained in the present study are consistent with those of previous studies of smaller samples. The British standardisation sample showed a male advantage among 15.5 year olds of 0.7 raw score points, approximately equivalent to 1.4 IQ points. A sample of 468 15–16 year olds reported by Conrad (1979) showed a male advantage 1.5 raw score points, approximately equivalent to 3.0 IQ points. Thus the present study finding a male advantage among 15 year olds of 2.35 IQ points falls intermediate between the two other studies and provides further confirmation that there is a male advantage on the Progressive Matrices among 15 year olds of somewhere between 1.4 and 3.0 IQ points. Aggregation of the three studies, according each study equal weight, gives a male advantage for 15 year olds of 2.25 IQ points. It is proposed that this should be regarded as the best estimate presently available of the male advantage on abstract reasoning ability among 15 year olds.

Some Israeli data on sex differences among a large sample of 17-year-old military conscripts on a test resembling the Progressive Matrices presented by Flynn (1998) provides further confirmation that there is a small male advantage on the Progressive Matrices in later adolescence. In this data set, a number of women were missing because they were exempted from military service, so males and females were not equally representative of the total populations. Flynn makes adjustments to correct for this problem and estimates a male advantage of 1.4, 1.7 or 2.0 IQ points, depending on different assumptions. It should be noted, however, that the Israeli test was only about half the length of the Progressive Matrices and this would almost certainly have had the effect of reducing its reliability and the magnitude of the true sex difference.

Considering the research literature as a whole, it is proposed that it supports the theory that a small male advantage on the Progressive Matrices begins to appear in the 15th year, when it is about 2 IQ points. The male advantage appears to increase in later adolescence, although the 4.65 IQ advantage of males in the 16 year olds in the present data looks too great when compared with the studies of sex differences among 15 year olds. The male advantage has been consistently found among adults in data containing reasonably large numbers. There are only three of these. These are the study by Heron and Chown (1967) of 600 British adults aged 20–79 years, among whom males had an advantage of 2.8 raw score points, approximately equivalent to 5.6 IQ points; the study by Wilson, De Fries, McClearn, Vandenberg, Johnson, and Rashad (1975) of 2352 18–55 year olds in Hawaii, among whom males had an advantage of 1.9 raw score points, approximately equivalent to 3.8 IQ points; and the study by Deltour (1993) of 2104 adults aged 20–80 in Belgium, among whom males had an advantage of 3.2 IQ points, approximately the equivalent of 6.4 IQ points. It is proposed that the evidence as a whole is sufficiently strong to enable us to reject the Court–Mackintosh–Jensen hypothesis that there is no sex difference on the Progressive Matrices and to adopt the Lynn (1994, 1998, 1999) hypothesis that a male advantage begins to appear in the 15th year and reaches around 3 to 5 IQ points among adults.

Fourth, the results may also be interpreted as supporting a more environmentalist theory of sex differences in cognitive abilities proposed by Mackintosh (1998) that states that these have been

decreasing over time, possibly because socialisation pressures on males and females have become less differentiated. This theory could be considered to receive some support from the findings that the sex difference greatest among blacks declines progressively among Indians and coloureds, and is absent among whites. It seems likely that modern socialisation pressures for less sex role differentiation follow the same gradient. The theory that sex differences have been decreasing over time deserves further investigation.

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References

Conrad, R. (1979). *The deaf schoolchild: language and cognitive function*. New York: Harper & Row.

Court, J. C. (1983). Sex differences in performance on Raven's Progressive Matrices. *Alberta Journal of Educational Research*, *29*, 54–74.

Deltour, J. J. (1993). *Echelle de vocabulaire Mill Hill de J. C. Raven*. Braine de Chateau, Belgium: Editions L'Application des Techniques Modern S.P.R.L.

Flynn, J. R. (1998). Israeli military IQ tests: gender differences small; IQ gains large. *Journal of Biosocial Science*, *30*, 541–553.

Heron, A., & Chown, S. (1967). *Age and function*. London: Churchill.

Jensen, A. R. (1998). *The g factor*. Westport, CT: Praeger.

Lynn, R. (1994). Sex differences in brain size and intelligence: a paradox resolved. *Personality and Individual Differences*, *17*, 257–271.

Lynn, R. (1998). Sex differences in intelligence: a rejoinder to Mackintosh. *Journal of Biosocial Science*, *30*, 529–532.

Lynn, R. (1999). Sex differences in intelligence and brain size: a developmental theory. *Intelligence*, *27*, 1–12.

Lynn, R., Allik, J., & Must, O. (2000). Sex differences in brain size, stature and intelligence in children and adolescents: some evidence from Estonia. *Personality and Individual Differences*, *29*, 555–560.

Mackintosh, N. J. (1996). Sex differences and IQ. *Journal of Biosocial Science*, *28*, 559–572.

Mackintosh, N. J. (1998). Reply to Lynn. *Journal of Biosocial Science*, *30*, 533–539.

Owen, K. (1992). The suitability of Raven's Standard Progressive Matrices for various groups in South Africa. *Personality and Individual Differences*, *13*, 149–160.

Raven, J. (1981). *Manual for Raven's progressive matrices and Mill Hill vocabulary scales*. Oxford: Oxford Psychologists Press.

Spearman, C. (1923). *The nature of intelligence and the principles of cognition*. London: Macmillan.

Wilson, J. R., De Fries, J. C., Mc Clearn, G. E., Vandenberg, S. G., Johnson, R. C., & Rashad, M. N. (1975). Cognitive abilities: use of family data as a control to assess sex and age differences in two ethnic groups. *International Journal of Aging and Human Development*, *6*, 261–276.