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Article *in* Mankind Quarterly · March 2010

DOI: 10.46469/mq.2010.51.1.5

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Sex Differences in Means and Variance of Intelligence: Some data for Spain

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It has been very widely asserted that there is no sex difference in average general intelligence but that males have greater variability than females. We examine these propositions in a sample of 258 adults tested with the Progressive Matrices in Spain and find that both of them are incorrect.

Key Words: Intelligence; Progressive Matrices; Spain; Gestalt continuation; Verbal-analytical reasoning; Visuospatial ability; Sex differences.

From the early years of the twentieth century it has been consistently asserted that there is no sex difference in average general intelligence but that males have greater variability than females. In the first half of the twentieth century the absence of a sex difference in average intelligence was asserted by Burt & Moore (1912), Terman (1916) and Spearman (1923). In the second half of the century this conclusion was reaffirmed by Cattell (1971, p. 131), Brody (1992, p. 323), Mackintosh (1996, p. 567), Jensen (1998, p. 531), Halpern (2000, p. 218), Bartholomew (2004, p. 91), Anderson (2004, p. 829), Hines (2007, p. 103), Haier (2007), Halpern (2007, p. 123), and Speke (2007, p. 65) – "Men and women have equal cognitive capacity."

It has also been consistently asserted for approximately a century that while males and females have the same *average* intelligence, males have greater *variability* of intelligence than females. An early statement of this proposition was made by Havelock Ellis (1904, p. 425): "It is

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undoubtedly true that the greater variational tendency in the male is a psychic as well as a physical fact". This sex difference in variability has been repeatedly reaffirmed by numerous authorities including Thorndike (1910), Penrose (1963, p. 186), Herrnstein & Murray (1994, p. 275), Lehrke (1997, p. 140), Jensen (1998, p. 537), Ceci & Williams (2007, p. 223), and Deary et al. (2010) – "Males have a slight but consistently wider distribution than females at both ends of the range."

Thus the consensus on sex differences in intelligence for the last century was summed up by Eysenck (1981, p. 42) as follows: "While men and women average pretty much the same IQ score, men have always shown more variability in intelligence. In other words, there are more males than females with very high IQs and very low IQs."

Both these assertions have been challenged by Lynn (1994, 1999), who contended that while there is no sex difference in mean IQ up to the age of 15 years, from the age of 16 years males begin to show greater intelligence than females, reaching an advantage of 3 to 5 IQ points in adults. In subsequent studies Lynn & Irwing (2004) carried out a meta-analysis of sex differences on the Progressive Matrices and found that there was no sex difference up to the age of 15 years, but from the age of 16 years males obtained higher means and in adults men obtain a higher mean IQ than women by an average of 5 IQ points. This conclusion was confirmed in a further meta-analysis of sex differences on the Progressive Matrices among college students that found a male advantage of 4.6 IQ points (Irwing & Lynn, 2005).

Lynn's contention that from the age of 16 years males begin to show greater intelligence than females reaching an advantage of 3 to 5 IQ points in adults has been confirmed for a Spanish sample by Colom & Lynn (2004), who report a male advantage at age 18 of 4.3 IQ points on the Differential Aptitude Test. This conclusion has been further confirmed by Meisenberg (2009), who reports a male advantage of 2.8 IQ points among 22-3 year old whites in the United States on the ASVAB (Armed Services Vocational Aptitude Battery). This difference, however, was not present among blacks. In this study intelligence was

also measured as *g*, and for this there was no significant sex difference among 15 year olds among either blacks or whites. Among whites a significant male advantage of 4 IQ points was present among 16 year olds, and this increased to an advantage of 6.5 points among 22-3 year olds. For blacks a male advantage of 1 IQ point at age 16 increased to an advantage of 2.15 points at age 22-3.

Sex Differences in Variance

The assertion that males have greater variability of intelligence than females has also been disputed by Lynn and his colleagues. Irwing & Lynn (2005) reported that there was no sex difference in variability in their meta-analysis of 22 studies of sex differences on the Progressive Matrices among university students. Lynn and several of his colleagues have reported a further nine studies of sex difference in variability on the Progressive Matrices and the results of these are summarized in Table 1. These results are for the Standard Progressive Matrices except for Libya and the United Arab Emirates, where they are for the Colored Progressive Matrices. This gives the country, the numbers of males and females, the number of age groups in which males have greater variance than females, the number of age groups in which females have greater variance than males, and number of age groups in which there was no sex difference in variance. It can be seen that males have greater variability than females in 36 of the samples, females have greater variability than males in 35 of the samples, and there is no sex difference in variability in 3 of the samples. It is evident that these results bring into serious question the assertion that males have greater variability than females. As Abdel-Khalek & Lynn (2009, p.112) observed in their study of 13 samples in Saudi Arabia: "The greater variance of males is not a universal phenomenon".

Reservations about the greater variability of males have also been expressed by Meisenberg (2009, p.148), who notes that in his own study males had greater variability but that "not all studies find higher male variance." He cites Harnqvist (1997) and Reynolds et al. (2008) as among the studies that failed to find this.

Table 1

Sex differences in variability on the Progressive Matrices. VR, variance ratio, defined as male variance squared divided by female variance squared.

Country	N male	N female	Variance M>F	Variance F>M	Variance M=F	Reference
Bosnia	310	295	2	0	0	Djapo & Lynn, 2010
Kuwait	3278	3251	6	2	0	Abdel-Khalek & Lynn, 2006
Libya	250	250	2	4	0	Lynn et al., 2008
Pakistan	1850	1828	1	6	1	Ahmad et al., 2008
Saudi Arabia	2935	1724	7	6	0	Abdel-Khalek & Lynn, 2009
Sudan	3135	3067	7	5	0	Khaleefa et al, 2008
Syria	1739	1750	7	4	0	Khaleefa & Lynn, 2008a
United Arab Emirates	2601	1895	4	6	2	Khaleefa & Lynn, 2008b
Yemen	672	314	0	2	0	Khaleefa & Lynn, 2008c
Total	16770	14374	36	35	3	

Method

We now report some data from Spain on the contentions that there is no sex difference in average intelligence and that males have greater variability than females. In this study the Raven Standard Progressive Matrices test (SPM) (Raven et al., 1996, 2001) was administered to a sample of 258 adults. The sample

consisted of 101 men (mean age 27.01, SD=9.90) and 157 women (mean age 23.98, SD=7.87). The sample was obtained from the University of Valencia halls of residence, and consisted of students studying a wide range of subjects, and the staff of the halls of residences including administrative staff, cleaners, waiters and cooks. When these samples had performed the test, we obtained further subjects through the social network of these initial subjects. The test was administered without time limits. Answering the test was voluntary and anonymous, and no reward was given for performing the test.

Table 2

Performance of males and females on the Standard Progressive Matrices (SPM) test. Sample size N, mean, standard deviation SD, Student's t, two-tailed significance level p, Cronbach's α, and variance ratio (VR) are shown.

Test	N	Mean	SD	t	p	α	VR
Total score	101 (♂) 157 (♀)	52.64 51.31	6.88 7.08	1.50	.135	.90	0.94
Gestalt continuation	101 (♂) 157 (♀)	17.68 17.54	1.25 0.89	1.11	.267	.69	1.97
Verbal analytic reasoning	101 (♂) 157 (♀)	6.33 5.91	2.72 2.51	1.26	.210	76	1.17
Visuospatial ability	101 (♂) 157 (♀)	20.90 19.70	2.81 3.36	1.19	.237	.94	0.70

Results

The test was scored for the total scores and for the scores on the three sub-factors of gestalt continuation, verbal-analytical reasoning and visuospatial ability identified in the Standard Progressive Matrices by Lynn et al. (2004). The means and standard deviations of the men and women on the total scores and the scores on the three subfactors are shown in Table 2. Reading from left to right, this gives the means and standard deviations for men and women on

the total score and on the three sub-factors of gestalt continuation, verbal-analytic reasoning, and visuospatial ability. Shown next are the values of two-tailed t tests of the statistical significance of the differences between men and women. Shown next are the reliabilities of the tests as defined by Cronbach's α, all of which are satisfactory for the four factors. The final column headed VR gives the variance ratios obtained by dividing the squared standard deviation of the men by the squared standard deviation of the women.

Discussion

We first examine how far the sample is representative of the Spanish population. The mean score of the sample weighting both sexes equally is 52.0. This is at the 42nd percentile of the 1992 British standardization sample given in Raven et al. (1996, p. 62) and is equivalent to an IQ of 97. No adjustment is made for a Flynn effect in Britain because there has been no increase in SPM scores in Britain among those aged 13+ years from 1979 to 2008 (Lynn, 2009). The IQ of 97 for the sample is virtually identical to the IQ of 98 for Spain given by Lynn & Vanhanen (2006, p.308) based on the median of three studies. It appears therefore that the sample is representative of the Spanish population

The objective of this study has been to examine the propositions that have been consistently advanced for approximately a century that there is no sex difference in average general intelligence but that males have greater variability than females. Our results show that neither proposition was confirmed in this sample. In fact the reverse was found. Men had higher average general intelligence than women, but women had greater variability than men.

The difference between the mean scores obtained by the men and women expressed as an IQ can be estimated as follows. The men obtained a mean score of 52.64 (sd = 6.88) and the women obtained a mean score of 51.31 (sd = 7.08). The difference in standard deviation units (d) is obtained by dividing the difference in the scores by the average of the sds = 0.19d. This difference can be

converted to a conventional IQ by multiplying by 15 = 2.85 IQ points. This is lower than the average male advantage of 5 IQ points among adults obtained by Lynn & Irwing (2004) in their meta-analysis of sex differences on the Progressive Matrices, but is virtually identical to the 2.8 point IQ advantage for men among 22-3 year old whites in the United States reported by Meisenberg (2009).

The 2.85 IQ point advantage of men obtained in this study is not statistically significant when tested with a two-tailed t test, as shown in Table 2 ($t = 1.5$, $p <= .135$). However, we believe that in view of Lynn & Irwing's (2004) meta-analysis of sex differences on the Progressive Matrices finding that men have a significantly higher IQ, the present result could have been predicted and therefore that a one-tailed t test can be used. For this, the value of t for the total score (1.50) is statistically significant at $p < 0.10$, i.e. the sex difference would be expected to appear by chance fewer than one time in 10. We believe therefore that the sex difference in the present study can be taken as further support for the conclusion reached by Lynn & Irwing (2004) in their meta-analysis of sex differences on the Progressive Matrices that men have a higher average IQ than women on the Progressive Matrices test.

We note further that the male advantage is present to about the same extent in the three subfactors of gestalt continuation, verbal-analytical reasoning and visuospatial ability identified in the Standard Progressive Matrices by Lynn et al. (2004).

Finally, the greater variability of women in the present results adds further confirmation to a number of the studies summarized in Table 1. It is apparent that the assertion that men have greater variability of intelligence than women, which has been so consistently asserted for more than a century, is not nearly so soundly based as many scholars have contended, at least not when intelligence is measured with Raven's Progressive Matrices.

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