# Gender Differences in Means and Variance on the Standard Progressive Matrices in Pakistan

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A standardization of the Standard Progressive Matrices in Pakistan for the ages 12 through 18 years and 18 through 45 years was analysed for gender differences in means and variance. The results show no significant differences in means and generally greater variance in females, contrary to the frequent assertion that males have greater variance than females.

**Key Words:** Progressive Matrices; Pakistan; Gender differences; Variance.

The Progressive Matrices is one of the most widely used tests of reasoning ability, general intelligence and Spearman's *g* (Jensen, 1998; Raven, Raven & Court, 2000). The test was constructed in Britain in the 1930s by John Raven (1939) and numerous studies have been published on it during the last seventy years. Two of the issues that have been discussed and researched are whether there are any sex differences in mean scores obtained on the test, and whether there is a sex difference in variability.

The issue of whether there are any sex differences in mean scores obtained on the Progressive Matrices has been discussed since the test was first published. Raven (1939) reported in his initial study of children up to the age of 14 that there was no difference in the average scores obtained by boys and girls. This conclusion was affirmed for adults as well as children in a review of numerous studies by Court (1983) and later by Mackintosh (1996). These conclusions have been disputed by Lynn & Irwing (2004) in a meta-analysis of sex differences on the Progressive Matrices that showed no sex difference in children, but a slightly higher mean for boys at the age of 16 years, increasing in size into adulthood where it reaches about 5 IQ points.

The second question of whether there is a sex difference in

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variability has been discussed in connection with the claim that males have greater variability of intelligence than females, i.e. that there are more males with high and low intelligence, while females cluster around the mean. This contention has been asserted since the early years of the twentieth century, when it was proposed by Havelock Ellis (1904), Thorndike (1910) and Terman (1916). These early writers proposed that a difference in variability explains why men are greatly overrepresented among geniuses, when there is apparently no average sex difference in intelligence. The theory that there is greater variability among males entailing more males among those with very high intelligence (as well as more males with very low intelligence) seemed to provide a solution to this problem.

Thorndike (1910) put the theory as follows: "The trivial difference between the central tendency of men and that of women which is a common finding of psychological tests and school experience may seem at variance with the patent fact that in the great achievements of the world in science, art, invention, and management, women have been by far excelled by men. One who accepts the equality of typical representatives of the two sexes must assume the burden of explaining this great difference in the high ranges of achievement. The probably true explanation is to be sought in the greater variability within the male". Thorndike examined test data on variability and concluded that men are about five percent more variable than women.

The theory that males have greater variability of intelligence than females has been frequently re-asserted. For instance, "the consistent story has been that men and women have nearly identical IQs but that men have a broader distribution…the larger variation among men means that there are more men than women at either extreme of the IQ distribution" (Herrnstein & Murray, 1994, p. 275); "males are more variable than females" (Lehrke, 1997, p.140); "males' scores are more variable on most tests than are those of females" (Jensen, 1998, p.537); and "sex differences exhibit greater male than female variance. Females are much of a muchness, clustering round the mean. But among males, the difference between the best and the worst can be vast. So, when it comes to science, more men than women will be dunces but more will be geniuses – although the means are close" (Cronin, 2005, p.17).

Some studies have confirmed this thesis (e.g. Hedges & Nowell, 1995; Deary, Irwing, Der & Bates, 2007). Other studies, however, have failed to confirm the theory. For instance, a meta-analysis of 22 studies of sex differences on the Progressive Matrices among university students found no difference in variability (Irwing & Lynn, 2005).

Most of the studies of sex differences in means and variability have been carried out in the United States and Europe. It is useful to examine how far the results in these countries are present in other locations and cultures. To contribute to this question we present some results from Pakistan.

**Method**

The Standard Progressive Matrices test (SPM) (Raven, Raven & Court, 2000) was standardized in Pakistan in 2004 through 2006. The standardization sample consisted of adolescents aged 12 to 19 years and adults aged 18-45. The adolescents (N=1,662) were selected from representative schools in the four provinces into which Pakistan is divided (North West Frontier, Baluchistan, Sindh and Punjab) and were tested in groups. The adult sample consisted of 2,016 subjects (1,019 females and 997 males). The mean age was 31.7 years (females: 31.4 yrs; males: 32.1 yrs). The sample was drawn from the city of Karachi and comprised volunteers obtained from a variety of different organizations. These were tested in groups or individually. Both samples were matched to the general population for socio-economic status. For both samples the test was administered without any time restriction.

The split-half reliability was found to be .891. The validity study of SPM was examined by administering the Draw-a-Person test (Goodenough, 1926) together with the SPM to a sample of 200 school children aged 6.0 years to 12.0 years. The correlation coefficient between the two tests was found to be .256. This is quite a low correlation probably because the Goodenough test is not an especially good test of general intelligence. Harris (1963) has reviewed studies of the correlations between the Goodenough and Wechsler and Stanford-Binet tests of general intelligence and reported a wide range of results ranging between 0·38 and 0·77 with the WISC (the Wechsler children's test), and between 0·26 and 0·92 with the Stanford-Binet.

**Table 1.**
*Gender Means for the Standard Progressive Matrices in Pakistan*

| Age (years) | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 18-45 |
|---|---|---|---|---|---|---|---|---|
| **Males** | | | | | | | | |
| Number | 108 | 143 | 144 | 142 | 103 | 90 | 123 | 997 |
| Mean | 32.69 | 32.34 | 37.00 | 38.38 | 41.76 | 41.99 | 41.30 | 45.61 |
| S.D | 10.13 | 10.29 | 10.51 | 9.46 | 9.89 | 10.04 | 10.31 | 7.61 |
| **Females** | | | | | | | | |
| Number | 111 | 103 | 113 | 116 | 135 | 107 | 124 | 1019 |
| Mean | 31.12 | 32.43 | 36.39 | 37.22 | 39.50 | 39.53 | 41.31 | 45.30 |
| S.D | 10.43 | 11.67 | 10.95 | 10.08 | 10.59 | 9.25 | 10.63 | 7.60 |
| *d* | .15 | .00 | .06 | .11 | .22 | .26 | .00 | .04 |
| t | 1.135 | -0.065 | 0.459 | 0.949 | 1.679 | 1.786 | -0.010 | 0.905 |
| Significance | .258 | .948 | .647 | .344 | .095 | .076 | .992 | .366 |
| Variance ratio | .94 | .79 | .92 | .88 | .87 | 1.18 | .94 | .00 |

**Table 2.**
*Standard Progressive Matrices Means for the Provinces of Pakistan*

| Provinces | N | Mean | St dev | Brit Pc |
|---|---|---|---|---|
| Sindh | 453 | 40.9 | 9.0 | 22.0 |
| Baluchistan | 389 | 39.5 | 11.0 | 13.5 |
| Punjab | 410 | 35.6 | 10.5 | 7.5 |
| NWFP | 410 | 33.9 | 10.5 | 5.0 |

**Results**

Table 1 gives the data from the study consisting of the numbers, mean scores and standard deviations for males and females. These are followed by the differences between the means of the males and females expressed in standard deviation units *d*, obtained by dividing the difference between the means by the pooled standard deviation (the average of the two standard deviations). The next two rows give the values of t and the statistical significance of the gender difference, and show that none of the differences are statistical significant. The last row gives the variance ratios (VR, obtained by dividing the male variance by the female variance). Variance ratios greater than 1.0 indicate that males have greater variance than females, while variance ratios lower than 1.0 indicate that females have greater variance than males.

The mean scores of the 12-19 year olds (mean age 15.5) in each of the four provinces are given in Table 2. The percentile equivalents in the British 1979 standardization sample are given in the right hand column. We see that the highest mean was obtained in Sindh in the south. The mean score of 40.9 corresponds to the British 22$^{nd}$ percentile and a British IQ of approximately 88.4. The next highest mean was obtained in Baluchistan, which lies to the west and borders Iran and Afghanistan. A somewhat lower mean was obtained in Punjab, which lies to the north-east. The lowest mean was obtained in the North West Frontier Province, which lies to the north and where the mean score of 33.9 corresponds to the British 5th percentile and a British IQ of approximately 75.4.

**Discussion**

The results show slightly higher means for males than females in adolescents aged 12, 14, 15, 16 and 17 years and among adults, but none of these differences are statistically significant. At ages 13 and 18 years there were no differences in the means. The results as a whole suggest that there are only negligible gender differences in the mean performance on the Standard Progressive Matrices in Pakistan. It is interesting to note that in this traditional society, girls and women perform just as well as boys and men on this test. It is sometimes suggested that females are handicapped in traditional societies and this impairs their intellectual development, and that as

females become more emancipated and gain greater equality, their cognitive abilities improve. This theory receives no support from the present results.

The gender differences in variability given in the last row of the table show that at ages 12 through 16 and at age 18 years, girls have greater variability than boys (the VRs are less than 1.0). Only at age 17 do boys have greater variability than girls (VR = 1.18), while among adults there is no gender difference in variability. These results are inconsistent with the frequent assertion that males have greater variability of intelligence than females. This theory also receives no support from the present results.

The mean scores obtained by the sample are lower than those obtained by standardization samples in Britain and the United States. For the four age groups 12-15 the percentile equivalent of the mean scores on the British 1979 standardization samples is 10.5, and this is equivalent to an IQ of 81.3. For the age groups 16 and 18, the American 1993 standardization percentile equivalent of the mean scores of the two age groups is 13.5, and this is equivalent to an IQ of 83.5 (Raven, Raven & Court, 2000, p.18) . For the adults, the American 1993 standardization percentile equivalent of the mean scores of the five adult age groups is 18.4, and this is equivalent to an IQ of 86.4. These IQ equivalents do not take account of possible Flynn effects, i.e. secular increases in IQ. These IQs are typical of those reported in a number of countries in the Middle East reported in Lynn (2006). It will be seen in Table 2 that there is quite a considerable range of average IQs in the four provinces. The mean IQ is highest in the most prosperous southern province of Sindh, which contains the major city of Karachi, and lowest in the poorer North West Frontier Province, much of which lies in the foothills of the Himalayas. Thus in the provinces of Pakistan there is a positive relationship between regional IQs and prosperity of the same kind as holds in the British Isles and France (Lynn, 1979, 1980) and on a global scale (Lynn & Vanhanen, 2006).

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