Modern women match men on Raven’s Progressive Matrices

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Thank you for your assistance.
Modern women match men on Raven's Progressive Matrices

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ABSTRACT

Raven's Progressive Matrices data of high quality from five advanced nations show that females matched males both below and above the age of 14. This counts against hypotheses that genetic factors cause general intelligence differences between the genders. Evidence unfriendly to gender parity at mature ages is based on suspect samples. At ages 15–18, more males than females are school dropouts. At ages 18–24, female deficits among university students may be caused by an IQ/academic achievement gap.

1. Introduction

Lynn and Irving (2004) conclude that males begin to show a significant advantage on Raven's Progressive Matrices at age 15, which escalates to about five IQ points by maturity. The best data nation-by-nation shed light on the question of greatest interest: whether there is a male advantage that suggests genetic superiority.

2. University samples

2.1. Gender parity hypothesis

In the general population of 17–22 year olds, males and females have the same mean (100) and standard deviation (15). But the university IQ threshold for males is 100 and for females 95. If so, male university students would have a mean IQ of 111.97 (the bottom half of the curve gone) and an SD of 9.04 (60% of the full curve's SD). Females would have a mean of 108.99 (the bottom 37% of the curve gone) and an SD of 9.97. Therefore, the male mean would be 2.98 points higher; and the female SD would be 110% of the male (9.97/9.04).

2.2. Male advantage hypothesis

In the general population, males have a mean IQ of 100, females a mean of 95, and both a SD of 15. But the IQ threshold for males and females is the same at 100. If so, male university students would still have a mean of 111.97 and an SD of 9.04. Females would have a mean of 110.30; the bottom 63% of the curve gone would raise the mean of the remainder by 1.02 SDs; and 1.02 × 15 = 15.30, which plus 95 = 110.30. Females would have an SD of 8.18 (with the bottom 63% gone). Therefore, the male mean would be 1.67 points higher; and the female SD would be just over 90% of the male SD (8.18/9.04).

Table 1 is based on Irving and Lynn (2005). Our thesis of gender parity applies to the current generation in nations or groups where women enjoy modernity. Therefore, we set aside the data from 1964 to 1986 in favor of that from 1998 to 2004, all data from developing nations, and one set in which the nature of the Raven's test was not specified. The data remaining cover 6230 subjects from four nations. The male SD was used to calculate the gender gap in mean IQ because it is constant between the two hypotheses. As an example, the first row shows a male advantage of 0.4826 male SDs. That is inflated by the fact that the within sample SD is only 0.6 of the population SD, so 0.4826/0.6 = 0.8043 SDs; and that 0.8043/15 = 4.34 IQ points.

The total results confirm the gender parity hypothesis: males have an IQ advantage of 2.73 points (predicted 2.98); the female SD is 106% of the male (predicted 110). We suspect that the latter shortfall is because females do not quite have SD parity in the general population.

In any event, the results are far from those predicted by the male advantage hypothesis, namely, a 1.67-point male advantage and a female SD at only 90% of male. The fact that the within sample female SD is so much larger than the male is devastating. How could the female SD soar above the male SD among university students except due to a lower IQ threshold, one that allowed a larger
80 proportion of females into university? The alternative would be to assume that the general population SD for females was huge. If they have a mean IQ of 95 and only the top 37% qualify for university, the university sample SD would be only 0.5453 of the population SD. Yet it is 1.06 times the male SD. The latter is the equivalent of 9 IQ point; so the female within-sample SD is 9.54 points (1.06 × 9); and that divided by 0.5453 = 17.5 points.

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3. Students at a magnet school

Duckworth and Seligman (2006) studied 198 students (age 13.4 years) who had qualified (3 years earlier) for admission to a magnet school on the basis of grades and standardized tests. On the Otis-Lennon, girls had a mean IQ of 106.94, which implies a threshold of 91.1 (the bottom 46.8% missing). So for admission to this school, the female threshold was 7.7 IQ points lower.

Girls had a Grade Point Average (GPA) 0.6 male SDs higher than boys. However, the within sample SD is attenuated and should be corrected: 0.6 × 0.62 = 0.372 population SDs or the equivalent of 5.6 IQ points. In other words, girls could spot boys 4.27 IQ points and outperform them by over 5 points. Using delay of gratification measures and estimates of self-control, Duckworth and Seligman concluded that the girls had more self-discipline.

On a standardized academic achievement test, girls scored only 1.3 points above boys. Because universities emphasize SAT (Scholastic Aptitude Test) scores for admission, we would expect a lower female IQ threshold for university students of over 5 points.

1.3 + 4.27 = 5.57.

4. Students in general

Between 1990 and 2000, female high school graduates in America had a GPA well above boys (Coates & Draves, 2006). The only values given for a GPA show that the female mean would be 0.342–0.402 SDs above the male. Gurian (2001) estimates that boys get 70% of the Ds, and Fs and girls get 60% of the As. About 80% of high school dropouts are boys. Coates and Draves find a similar pattern in the United Kingdom, Ireland, Scandinavia, Australia, New Zealand, and Canada.

The Organization for Economic Co-operation and Development (OECD) compared 15-year olds on a test of reading proficiency. In 57 nations, high school girls outperformed boys. Table 2 gives results for Western European nations plus the US and Canada; and for five nations of particularly interest.

The overall female reading advantage is 0.385 SDs. For each nation, we multiply the female SD advantage by 15 to make it analogous to IQ points. We put the correlation between reading proficiency and IQ at 0.50. Multiplying the female reading advantage by 0.50 gives how many IQ points a female would be below a male of the same reading proficiency. Jensen (1980, p. 325) gives 0.58 but warns that the value is lower for lower SES subjects. The next to last column of Table 2 estimates how far the female IQ threshold for university would be below the male threshold. It should be noted that males do marginally better than females for mathematics (PISA, 2006, Table 6.2c). We assume that reading and good grades bolster confidence to go to university; and that lacking mathematics proficiency discourages few students. Rather they choose a non-science major.

The difference in the IQ threshold of two groups is greater than the resulting mean IQ difference. Therefore, in the final column in Table 2, we multiply the threshold difference by 0.68. This is the value if one-third of males attend university, and would differ nation by nation. Even if male and female IQ were identical in the general population, nations herein would show a female threshold for university 3 points below the male, and a 2-point IQ deficit for female university students. US data were not available from the OECD, but the Nation's Report Card shows that the median for girls' reading proficiency was at the 67th percentile of the boys' curve, which means that US gender gap is typical.

We state what we think a judicious conclusion: until the possibility of different gender IQ thresholds is investigated, university samples are suspect.

5. Argentina

The Universidad Nacional de La Plata standardized Raven's points for 1996 and 2000 on 1695 students, 13–30 years of age.
Table 2
Female university IQ deficit: Predicted by female reading advantage at age 15.

<table>
<thead>
<tr>
<th>Nation/s</th>
<th>F-M raw score</th>
<th>SD</th>
<th>Female raw advantage</th>
<th>Female raw advantage (SD = 15)</th>
<th>Female IQ threshold</th>
<th>Female IQ deficit mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>OECD</td>
<td>38</td>
<td>98.7</td>
<td>.3850</td>
<td>5.78</td>
<td>2.89</td>
<td>1.97</td>
</tr>
<tr>
<td>Austria</td>
<td>45</td>
<td>98.7</td>
<td>.4559</td>
<td>6.84</td>
<td>3.42</td>
<td>2.33</td>
</tr>
<tr>
<td>Belgium</td>
<td>40</td>
<td>98.7</td>
<td>.4053</td>
<td>6.08</td>
<td>3.04</td>
<td>2.07</td>
</tr>
<tr>
<td>Canada</td>
<td>32</td>
<td>98.7</td>
<td>.3242</td>
<td>4.86</td>
<td>2.43</td>
<td>1.65</td>
</tr>
<tr>
<td>Denmark</td>
<td>30</td>
<td>98.7</td>
<td>.3040</td>
<td>4.56</td>
<td>2.28</td>
<td>1.55</td>
</tr>
<tr>
<td>Finland</td>
<td>51</td>
<td>98.7</td>
<td>.5167</td>
<td>7.75</td>
<td>3.88</td>
<td>2.64</td>
</tr>
<tr>
<td>France</td>
<td>35</td>
<td>98.7</td>
<td>.3546</td>
<td>5.32</td>
<td>2.66</td>
<td>1.81</td>
</tr>
<tr>
<td>Germany</td>
<td>42</td>
<td>98.7</td>
<td>.4255</td>
<td>6.38</td>
<td>3.19</td>
<td>2.17</td>
</tr>
<tr>
<td>Iceland</td>
<td>48</td>
<td>98.7</td>
<td>.4863</td>
<td>7.29</td>
<td>3.65</td>
<td>2.48</td>
</tr>
<tr>
<td>Ireland</td>
<td>34</td>
<td>98.7</td>
<td>.3445</td>
<td>5.17</td>
<td>2.58</td>
<td>1.75</td>
</tr>
<tr>
<td>Italy</td>
<td>41</td>
<td>98.7</td>
<td>.4154</td>
<td>6.23</td>
<td>3.12</td>
<td>2.12</td>
</tr>
<tr>
<td>Netherlands</td>
<td>24</td>
<td>98.7</td>
<td>.2433</td>
<td>3.65</td>
<td>1.82</td>
<td>1.24</td>
</tr>
<tr>
<td>Norway</td>
<td>46</td>
<td>98.7</td>
<td>.4661</td>
<td>6.99</td>
<td>3.50</td>
<td>2.38</td>
</tr>
<tr>
<td>Spain</td>
<td>35</td>
<td>98.7</td>
<td>.3546</td>
<td>5.32</td>
<td>2.66</td>
<td>1.81</td>
</tr>
<tr>
<td>Sweden</td>
<td>40</td>
<td>98.7</td>
<td>.4053</td>
<td>6.08</td>
<td>3.04</td>
<td>2.07</td>
</tr>
<tr>
<td>Switzerland</td>
<td>31</td>
<td>98.7</td>
<td>.3141</td>
<td>4.71</td>
<td>2.36</td>
<td>1.60</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>29</td>
<td>98.7</td>
<td>.2938</td>
<td>4.41</td>
<td>2.20</td>
<td>1.50</td>
</tr>
<tr>
<td>USA</td>
<td>–</td>
<td>–</td>
<td>.4400</td>
<td>6.60</td>
<td>3.30</td>
<td>2.24</td>
</tr>
<tr>
<td>Argentina</td>
<td>54</td>
<td>128.4</td>
<td>.4266</td>
<td>6.31</td>
<td>3.15</td>
<td>2.14</td>
</tr>
<tr>
<td>Australia</td>
<td>37</td>
<td>93.5</td>
<td>.3957</td>
<td>5.94</td>
<td>2.97</td>
<td>2.02</td>
</tr>
<tr>
<td>Estonia</td>
<td>46</td>
<td>83.1</td>
<td>.5534</td>
<td>8.30</td>
<td>4.15</td>
<td>2.82</td>
</tr>
<tr>
<td>Israel</td>
<td>42</td>
<td>126.2</td>
<td>.3329</td>
<td>4.99</td>
<td>2.50</td>
<td>1.70</td>
</tr>
<tr>
<td>New Zealand</td>
<td>37</td>
<td>105.4</td>
<td>.3511</td>
<td>5.27</td>
<td>2.63</td>
<td>1.79</td>
</tr>
</tbody>
</table>

Notes:
(1) For an account of the computations, see text.
(2) For the nations from Austria to the United Kingdom, the SD for the OECD as a whole has been used to provide a common metric.
(3) For the nations from Argentina to New Zealand, SDs specific to each nation have been used as these are of special interest.
(4) For the US, the fact that the female median is at the 67th percentile of the male curve, which implies an advantage of .4400 SDs, was used to get an estimate.

Sources:
(1) USA: USDE (2003) (2) All others: PISA (2006), Table 6.1c.

Table 3
La Plata: the 1998 standardization of Raven's and gender.

<table>
<thead>
<tr>
<th>Ages</th>
<th>Male</th>
<th>Raw score</th>
<th>Female</th>
<th>IQ</th>
<th>IQ adj</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raw score</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13–14</td>
<td>46.82</td>
<td>100.00</td>
<td>46.87</td>
<td>100.12</td>
<td></td>
</tr>
<tr>
<td>15–19</td>
<td>49.29</td>
<td>100.00</td>
<td>49.36</td>
<td>100.17</td>
<td>100.79</td>
</tr>
<tr>
<td>20–24</td>
<td>51.18</td>
<td>100.00</td>
<td>51.16</td>
<td>99.95</td>
<td>100.39</td>
</tr>
<tr>
<td>25–29</td>
<td>51.03</td>
<td>100.00</td>
<td>51.08</td>
<td>100.13</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>49.80</td>
<td>100.00</td>
<td>49.93</td>
<td>100.31</td>
<td></td>
</tr>
<tr>
<td>33–30</td>
<td>48.86</td>
<td>100.00</td>
<td>49.92</td>
<td>100.14</td>
<td>100.39</td>
</tr>
<tr>
<td>35–44</td>
<td>50.26</td>
<td>100.00</td>
<td>50.28</td>
<td>100.06</td>
<td>100.59</td>
</tr>
<tr>
<td>45–54</td>
<td>49.29</td>
<td>100.00</td>
<td>49.36</td>
<td>100.17</td>
<td>100.79</td>
</tr>
</tbody>
</table>

Examples of calculations ages 15–19. See Appendix for description and further data. Female IQ (1) 49.36 = 49.29 + (M = 0.07; (2) 0.07/6.26 (SD: males 13–14) = 0.0112 SDU; (3) 0.0112 × 15 = 0.167.

Adjusted female IQ: (1) Male percentage in school or graduates = 70.63%; (2) Bottom 29.37% of normal curve missing raises mean by 0.488 SDs; (3) Female percentage in school or graduate = 76.26%; (4) Bottom 23.74% of normal curve missing raises mean by 0.405 SDs; (5) Male advantage 0.488–0.405 = 0.083 SDs; (6) Correlation between not in school and IQ = .50 – see text; (7) 0.083 × .50 = 0.0415 SDs × 15 = 0.62 IQ points as male bias; (8) 100.17 + 0.62 = 100.79 as adjusted female IQ. The adjusted female IQ for ages 20–24 are less reliable; adjustment for ages 13–14, 25–29, and 30 would be inappropriate. See text.

and staying in high school to get a diploma. Having no value for Argentina, we used 0.50 as a conservative estimate. Because almost all Argentine children are still in school at ages 13–14, we selected the largest SD for those ages (the male SD of 6.26) as an estimate of unattenuated SD.

Adjusting for ages 15–19 is straightforward. Census data provide the numbers in secondary or tertiary institutions or with a secondary or tertiary qualification: 76.26% females and 70.63% males (Karmona, 2003). Table 3 shows how we adjusted for this difference. The same method was used at ages 20–24 where the percentage of male dropouts was 48 and female 44.

As Table 3 shows, the La Plata university age group is atypical in that it shows no female deficit for IQ. There were peculiar local conditions. High unemployment put secondary school graduates under great pressure to continue their education. The percentage of those in tertiary education is extraordinary, about 54%, midway between the secondary levels and the tertiary levels that prevail elsewhere. At ages 25–29, we did not attempt to compensate for those absent from the in-school sample. By then, the reasons for being absent would be legion.

The La Plata unadjusted values show that the largest female deficit at any of the seven age categories is 0.19 IQ points. Adjusted values put female IQ at 100.39 for ages 13–30, 100.59 at 15–24, and 100.79 at 15–19.

6. New Zealand, Australia, and South Africa

Australian (1986) and New Zealand data (1984) are from standardization samples (de Lemos, 1988; Reid & Gilmore, 1988).

In New Zealand, Table 4 shows that for ages 15–16, girls had a mean IQ of 101.37 (boys = 100). Efforts to locate gender in-school data for 1984 failed. In Australia (circa 1986), the percentage of girls in school was 1.04 times that of boys (Lamb, 2003). If New Zealand were similar, a value corrected for bias would be about 101.70. The Australians administered Raven's both timed and untimed.

un timed (all other administrations herein were untimed). At ages 14.5–16.5, timed gave females 99.78 rising to 100.11 (corrected) and untimed 99.41 rising to 99.74.


Table 4 shows, at age 15, the female IQs for white South Africans are 100.38 unadjusted and 100.80 adjusted. Since age 15 begins the ages of supposed female IQ decline, this might seem of little interest. It gains significance from the values for non-white ethnic groups in South Africa. Going from whites to Indian and Coloured to Blacks, Females’ IQ declines from almost 101 to 95. Females lose ground going from a group like the population of advanced nations to groups in which their status is subordinate.

7. Estonia

In 2000, Raven’s was standardized in 27 Estonian-speaking schools (Lynn, Allik, Pullman, & Laidra, 2002b) on students aged 12–18 (1250 males and 1441 females). The samples for ages 16–18 show radically reduced SDs thanks to the elite character of those tested at those ages. Using a proper value for SD (6.71) shows that males aged 16–18 outscored females by 1.05 IQ points. Initially, the data seemed too flawed to use, for example, they showed girls aged 13 with a lower raw score than those aged 12, something that could not be true of the general population. However, we perceived sources of sample bias that accounted for such anomalies and devised corrections.

First, the standardization included only students in academic secondary schools (grades 10–12), that is, gymnasium and “keskko- ols” (schools just as academic as gymnasium). This means that the sample omits Estonian youth who drop out of the academic stream after the age of 15, youths we will call the “the non-academic group”. A majority of this group are not dropouts in the literal sense: almost 50–60% of them are in vocational high schools. Nonetheless the non-academic group includes many genuine dropouts and more males than females.

Second, they tested grades 6, 8, 10, and 12 rather than all grades. This affected sample quality from age to age. If most 12-year-olds come from grade 6, you lose the slow students who are in grades 5 and below — and get mean IQ inflation for that age. If most 13-year-olds also come from grade 6, you lose the quick students who are in grade 7 — and get mean IQ deflation for that age. This can affect gender comparisons from age to age because girls go through school faster than boys. In this case, the method of sampling happened to favor girls at age 13 and boys at ages 16 and 18. To estimate the biases, we constructed 14 normal curves: one for each sex at each age from 12 to 18. The Appendix gives detail.

Table 5 corrects sample bias. The second column(s) show the effects of higher male percentages among those who have dropped out of the academic stream. The third column(s) show the effects of testing every other grade, namely, further distortions reflecting what percentiles happened to be sampled from age to age. It reveals why girls appeared to fall behind boys at age 16. By testing grade 8, they captured a few among the very slowest girls (those two years behind their normal grade of 10) or percentiles 45–78. By omitting grade 11, they missed most of the atypical females, that is, those who were one year ahead of their normal grade. By comparing the genders for percentiles captured at age 16, we see just how much the sampling disadvantaged females.

The final column of Table 5 shows that when female IQ is adjusted for bias, females match or outscore males at all ages. There is a large female advantage of almost 7 IQ points at age 12. This looks simply eccentric: the male sample underperformed in a way for which sample quality provides no explanation. Age 13 was atypically good for females, putting them at about 103; but age 15 is equally good. At ages 16 to 18, females have a steady advantage that averages at 100.48. This is close to their mean of 100.76 at age 14. See Appendix for detail and a bonus: Raven’s performance and speed of progress through school correlate at about 0.70.

297 performed worse on Raven’s; or that women in developing nations
296 ing herein denies that women born prior to the current generation
295 ously unless we evidence gender equality for IQ thresholds. Noth-
293 have to go far beyond Raven’s scores. Moreover, age 17 edges into
292 ronment that favors women, but the supporting evidence would
291 gence. It is possible that these two nations foster a cognitive envi-
288 16 or 17. This would render inconclusive all data except those from
286 has been consistent in naming 15 as the age at which males forge
282 fathers until passed onto their husbands. The female deficit is due to the fact that
280 Eastern European origin. They were sheltered from modernity, that
278 ated them may persist. The female deficit is due to the fact that
277 clearly from a past generation, but the circumstances that gener-
275 took a shortened version of Raven’s from 1976 to 1984. Men out-
273
8. Israel
274 Flynn (1998) reports results from Israel for 17-year olds who
275 took a shortened version of Raven’s from 1976 to 1984. Men out-
273

Table 5
Correction of the Estonian gender comparisons.

<table>
<thead>
<tr>
<th>Age</th>
<th>Percentiles of age cohort in academic cohort</th>
<th>Percentiles of age cohort in sample (with sample percentages)*</th>
<th>Male bias in IQ points</th>
<th>F IQ</th>
<th>F IQ (adjusted)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F M</td>
<td>F M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>2–100</td>
<td>2–100</td>
<td>43–90 (100%)</td>
<td>37–93 (100%)</td>
<td>–0.48</td>
</tr>
<tr>
<td>13</td>
<td>2–100</td>
<td>2–100</td>
<td>7–42 (90%)</td>
<td>10–40 (97%)</td>
<td>Nil</td>
</tr>
<tr>
<td>14</td>
<td>3–100</td>
<td>4–100</td>
<td>4–7 (3%)</td>
<td>6–7 (7%)</td>
<td>–1.27</td>
</tr>
<tr>
<td>15</td>
<td>6–100</td>
<td>9–100</td>
<td>41–85 (97%)</td>
<td>45–89 (92%)</td>
<td>+0.31</td>
</tr>
<tr>
<td>16</td>
<td>13–100</td>
<td>21–100</td>
<td>12–40 (71%)</td>
<td>23–50 (83%)</td>
<td>+0.38</td>
</tr>
<tr>
<td>17</td>
<td>22–100</td>
<td>39–100</td>
<td>15–19 (2%)</td>
<td>27–36 (8%)</td>
<td>–0.11</td>
</tr>
<tr>
<td>18</td>
<td>36–100</td>
<td>56–100</td>
<td>45–78 (98%)</td>
<td>64–87 (91%)</td>
<td>+1.78</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>53–65 (47%)</td>
<td>53–65 (47%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>86–100 (49%)</td>
<td>86–100 (49%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>55–80 (99%)</td>
<td>72–87 (98%)</td>
<td>+1.22</td>
</tr>
</tbody>
</table>

* The sample percentages do not quite add up to 100% because only the principal percentiles selected by the samples are given. For example, the male sample for age 16 was: 8.22% from grade 8 (percentiles 27–36); 91.32% from grade 10 (percentiles 64–87); and 0.46% from grade 12. See Appendix for calculation of male bias.

8. Israel

Flynn (1998) reports results from Israel for 17-year olds who took a shortened version of Raven’s from 1976 to 1984. Men outscored women by the equivalent of 1.4 IQ points. The data are clearly from a past generation, but the circumstances that generated them may persist. The female deficit is due to the fact that about 20% of the women were primarily from orthodox homes of Eastern European origin. They were sheltered from modernity, that is, either married at age 17 and a half, or were wards of their fathers until passed onto their husbands.

9. Men and women and genes

Five advanced nations show gender parity on Raven’s beyond age 14. Lynn (1994), Lynn (1999) and Lynn and Irwing (2004) has been consistent in naming 15 as the age at which males forge ahead, but this does not debar a hypothesis that the age of onset is 16 or 17. This would render inconclusive all data except those from Argentina and Estonia. But even two nations put a heavy burden on any hypothesis that women have inferior genes for general intelligence. It is possible that these two nations foster a cognitive environment that favors women, but the supporting evidence would have to go far beyond Raven’s scores. Moreover, age 17 edges into the university age range, and university data cannot be taken seriously unless we evidence gender equality for IQ thresholds. Nothing herein denies that women born prior to the current generation performed worse on Raven’s; or that women in developing nations still do so. The full effect of modernity on women may have been crucial.

10. Uncited references


Appendix A. Supplementary data


References


