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# IQ gains in Argentina between 1964 and 1998

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ABSTRACT

The literature on IQ gains in Latin America is sparse. We estimate gains on Raven's Progressive Matrices in the city of La Plata (Argentina) between 1964 and 1998. The gains are robust at the top of the curve as well as at the bottom. Therefore, they are contrary to the hypothesis that nutrition played a major role in recent Argentine IQ gains. This does not imply that nutrition was marginal elsewhere, for example, Spain. The magnitude of the gain, about 21.35 points over 34 years, is typical of Raven's gains during their peak period but high for schoolchildren. We provide comprehensive international data on Raven's gains for purposes of comparison. Argentina appears to be unlike Norway where Raven's gains have either diminished or ceased. Although economic trends in La Plata resemble those in Argentina as a whole, nation-wide data are desirable.



## 1. Introduction

Massive IQ gains from one generation to another have occurred in at least 31 nations. But only two are from Latin America: Brazil and Dominica (Flynn, 2009a, 2009b, 2009c). This paper reports Raven's data from the city of La Plata in Argentina.

They cover the 34 years between 1964 and 1998. A city can undergo drastic and atypical change over such a period. Some Northern European cities have experienced unusual economic decline. Liverpool lost almost half of its population between 1930 and 2001 (Belchem, 2006). After its coalmines closed between 1965 and 1975, Heerlen in the Netherlands began a precipitous decline that continues to this day (CIA, 2011). Might La Plata's gains be specific to that locale and unrepresentative of Argentina as a whole?

If La Plata had been relatively depressed in 1964 and relatively prosperous by 1998, this would engender IQ gains that were atypically large. Or if its unemployment increased, and that of Argentina decreased, a lot of the bottom half of its population would have deteriorated atypically. Therefore, a national trend toward IQ gains primarily in the bottom half of the curve would be obscured because of peculiar local conditions.

Table 1 compares the local economy of La Plata with larger trends between 1964 and 1998. The percentage of its population employed was an almost perfect match for Argentina as a whole during the entire period. La Plata's median family income began and ended at exactly 103% of that of Argentina as a whole. There was a decade between 1979 and 1989 during which it enjoyed unusual prosperity but after 1989, it quickly dropped to its initial level (by 1994).

## 2. Samples and data collection

The Universidad Nacional is the state university of La Plata, which today has a population of about 600,000. The university standardized Raven's Progressive Matrices both in 1964 and between 1996 and 2000 (mid-point 1998). The content of the test was unaltered between those years. The 1998 sampling procedures were designed to be identical to those of 1964 (Rossi-Casé, 2000). Thanks to the growth of the school population, the 1998 sample had 1390 subjects aged 13 to 24 years, as compared to the 1964 sample of 880 subjects.

To illustrate implementation of the design, we will describe the 1998 selection process. In 1998, La Plata had 100 secondary

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**Table 1**
Comparative data for La Plata, 1964 to 1998.
Source: INDEC (1998). The median income was estimated in October for each year.

| Year | 1964 | 1969 | 1974 | 1979 | 1984 | 1989 | 1994 | 1998 |
|---|---|---|---|---|---|---|---|---|
| | Percentage employed (all ages) | | | | | | | |
| La Plata | 43.1 | 41.9 | 41.3 | 35.2 | 36.4 | 38.5 | 39.0 | 42.7 |
| Argentina | 43.8 | 40.7 | 40.1 | 38.4 | 37.9 | 39.3 | 40.8 | 42.1 |
| | Median family monthly income (US dollars) | | | | | | | |
| La Plata | 76.4 | 73.3 | 220.5 | 324.8 | 183.3 | 166.9 | 535.4 | 596.4 |
| Argentina | 74.2 | 69.5 | 208.2 | 288.7 | 142.1 | 150.4 | 521.2 | 579.1 |
| | La Plata income as percentage of Argentine income | | | | | | | |
| | 103 | 105 | 106 | 112 | 129 | 111 | 103 | 103 |

schools, 48 public (state) and 52 private. Five of each were chosen at random for a total of 10. However, it was considered essential that schools were representative as to location (radiating out from the city's center) and as to type (usual secondary school, or technical, or fine arts). To ensure this, new random choices were made and substituted into the original 10. In La Plata's secondary schools, there is no streaming: students are assigned to classes in alphabetical order. There are five levels of schooling, ranging from the first level (ages 13–14) to the fifth level (ages 17–18) and schools have three or four classes at each level. From each of the 10 schools selected, one class was randomly chosen at each level, giving a total of 50 classes to be tested.

La Plata has a state university (The Universidad Nacional) and a private university, which offer degree courses of five to six years; and 32 tertiary institutes which offer four-year diploma courses conferring teaching qualifications, technical certification, and so forth. All tertiary institutions were sampled in proportion to their share of total tertiary student numbers.

From the Universidad National, a class was selected randomly from each of years one to five. Random individuals were selected from the smaller group doing year six and other individuals to ensure appropriate representation of students from the sciences and computer studies as well as arts. From the small private university, 39 individuals were randomly selected. Four institutes were randomly selected and from each, a class at each of the four years.

The procedures seem to have approached their objective of simulating a random sample of La Plata's total secondary and tertiary school populations. For example, females comprise 50.56% of the sample. Census data show that the true value is 50.81% (Karmona, 2003).

### 2.1. Data and method

Table 2 illustrates the kind of data that were available**.** It would have been desirable to use latent variable analysis to see if items changed properties over time, but item-by-item data was not available for 1964. Thus, we could not determine whether the gains were factor invariant (Wicherts et al., 2004).

Table 3 gives the raw score data from both 1964 and 1998. We used three methods to calculate IQ gains: (1) SD differences based on the fact that a certain raw score (say 48) was at the 90th percentile in 1964 but only at the 50th percentile in 1998 (which implies a gain of 1.282 SDs); (2) Median score differences; and (3) Mean score differences.

The first is unique in that it does not require a contentious choice as to what SD to use to convert raw score points into IQ points. Virtually all of the distributions have attenuated SDs due to ceiling effects and using these would inflate gains over time. Paradoxically, although the first method treats the data as a normal distribution, and in fact the distributions have a negative skew, it registers the effects of the skew by sampling at various levels. Loehlin, Lindzey, and Spuhler (1975) introduced it into the literature and Flynn (1987) adopted it.

The second (using medians) assumes a symmetrical distribution above and below the median. Thanks to the skew, this is not quite the case. It requires an un-attenuated raw-score SD and we chose the best one we could find. The third (using means) also requires a posited SD. It also takes the skew into account. But it can be argued that the extent to which the 1998 distributions are less skewed than the 1964 distributions "artificially" lowers the 1964 mean and that the median would be fairer.

## 3. The methods applied

The first method compares the percentiles that attained a certain raw score in 1964 and 1998 respectively. Take ages 13 to14. A Raven's score of 48 was the 90th percentile in 1964: so it was 1.282 SDs above the 1964 mean. That same score was the 50th percentile in 1998: so it was right on the 1998 mean. Therefore, at that level, the IQ-gain estimate is 1.282 SDs. The same comparison was made for other raw scores and their percentile equivalents. Sometimes interpolation was used but the distances were generally small (linear and non-linear gave the same result within one percentile). The average of the values was calculated, namely, 1.305 SDs (or 19.57 IQ points) as the estimated gain for ages 13–14. Not all raw score levels were used. To qualify, they had to meet the following criterion: their percentile equivalent was not above 95 for 1964; if it was as low as 5 for 1998, it had to be at least at 50 for 1964. This eliminates the distorting effect of comparisons that include only a very few subjects.

The second method subtracts the Raven's raw score at the median (50th percentile) for 1964 from that of 1998. The raw score difference is then divided by the raw score SD. No SDs were available from 1964. Therefore, for all ages, we used the largest 1998 SD afforded by the distributions: the male SD at ages 13–14, which was 6.26 raw score points. At that age, over 98% of the age cohort were still in school, so dropouts did not attenuate the SD. Moreover, the SD was the least attenuated by ceiling effects. To illustrate this method, again take ages 13–14. The median score difference was 9 and when divided by 6.26, this gives 1.438 SDs (or 21.57 IQ points) as the estimated gain.

The third method is exactly the same using means rather than medians. There were no means available from 1964. But we used a method that estimates means from the distributions (described at the bottom of Table 2). It gave estimates that virtually matched the actual means from 1998. Therefore we compared these to estimated means from 1964. At ages 13–14, the mean score difference was 9.42 and divided by 6.26, this gives 1.505′ SDs (or 22.57 IQ points). So the three methods vary only from about 19.5 to 22.5 points and we leave the choice to the reader.

**Table 2**
Percentile, median, and mean raw scores on Raven's Progressive Matrices: 1964 and 1998 samples compared.

| Percentiles | Ages | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 13–14 | | 15–16 | | 17–18 | | 19–20 | | 21–22 | | 23–24 | |
| | 1964 | **1998** | 1964 | **1998** | 1964 | **1998** | 1964 | **1998** | 1964 | **1998** | 1964 | **1998** |
| 99 | 50 | **59** | 52 | **59** | 53 | **58** | 53 | **59** | 53 | **59** | 53 | **60** |
| 95 | 49 | **56** | 51 | **56** | 53 | **57** | 53 | **57** | 53 | **58** | 53 | **59** |
| 90 | 48 | **55** | 49 | **55** | 50 | **56** | 51 | **56** | 51 | **57** | 51 | **58** |
| 75 | 44 | **52** | 44 | **52** | 45 | **53** | 45 | **54** | 45 | **54** | 45 | **55** |
| 50 median | 39 | **48** | 41 | **49** | 40 | **50** | 40 | **52** | 40 | **51** | 40 | **53** |
| 25 | 35 | **44** | 36 | **44** | 35 | **46** | 34 | **48** | 34 | **48** | 34 | **49** |
| 10 | 27 | **39** | 28 | **40** | 27 | **43** | 27 | **46** | 27 | **45** | 27 | **44** |
| 5 | 22 | **36** | 23 | **36** | 22 | **40** | 22 | **43** | 22 | **42** | 22 | **42** |
| Mean | – | **46.85** | – | **48.44** | – | **49.50** | – | **51.24** | – | **50.82** | – | **51.36** |
| Estimated Mean | 38.00 | **47.42** | 39.13 | **47.68** | 38.93 | **49.30** | 38.88 | **50.95** | 38.88 | **50.73** | 38.88 | **51.60** |

* The 1964 means were unavailable. They were estimated by a method that gave estimates for the 1998 means that were off by only 0.089 raw score points (averaging both the 6 estimated and actual means). This is equivalent to about 0.21 IQ points.
The method (estimating the mean of the 1998 23–24 years olds):
For each row in the table, multiply the percentage of subjects therein times the mid-point of the scores that bound it. For example, here are the calculations for 23–24 years olds in 1998:

Rows 95–100: 5%×59.5 = 297.5
Rows 90–95: 5%×58.5 = 292.5
Rows 75–90: 15%×56.5 = 847.5
Rows 50–75: 25%×54.0 = 1350
Rows 25–50: 25%×51.0 = 1275.
Rows 10–25: 15%×46.5 = 697.5.
Rows 5–10: 5%×43 = 215.
Rows 0–5: 5%×37 = 185.

Sum of products: 5160 divided by 100 = **51.60.**

## 4. Results

Table 3 equates Raven's raw scores with percentiles from both 1964 and 1998 for all ages from 13 to 14 through 23–24, and gives estimates derived from all three methods. Because they encompass a larger proportion of the population, the school samples (ages 13–18) are the most representative. The SD method gives 20.06 points overall with a variation from 18.62 to 21.99 points by age. The median method gives 21.57 points with a variation from 19.17 to 23.96. The mean method gives 22.63 points with a variation from 20.28 to 24.85. Simply to provide one estimate, we have taken the midpoints of the lowest and highest estimates. This gives a gain of 21.35 points and divided by 34 (the number of years the gains cover) equals 0.628 points per year.

However, the estimate is undoubtedly too low. At ages 15–19, the 1960 census shows that dropouts were 54.15% of the age cohort; the 1991 census puts dropouts at 26.53% (INDEC, 2002). Therefore, the 1964 in-school sample was considerably more elite and this would diminish the difference between their scores and those of the 1998 in-school sample. The census age category does not quite fit our data and no doubt the contrast between dropout rates would be a bit less for ages 13–18. Moreover, in 1964, not having a secondary school diploma did not carry the stigma it does today. Therefore, the correlation between IQ and staying in school would have been somewhat lower. Nonetheless, our estimate of a 21.35-point gain over 34 years is conservative.

The other summary estimate is for ages 19 to 24 or a tertiary sample. The SD method gives 26.57 points overall with a variation from 25.68 to 27.54 points by age. The median method gives 28.75 points with a variation from 26.36 to 31.15. The mean method gives 28.46 points with a variation from 28.08 to 28.92. It is odd that the tertiary gains are larger than the secondary school gains. Fewer attended university 40 years ago and it seems plausible that compared to today's students they would have been highly elite. Perhaps class was the selective mechanism and today's students are selected more by merit.

## 5. Discussion

### 5.1. Nutrition

The 20th century has seen both massive height gains and massive IQ gains. Therefore, many have posited enhanced nutrition as a cause of both (Lynn, 1989, 1990, 1993, 1998, 2009a, 2009b, 2009c; Storfer, 1990). All nations enjoyed significant nutrition gains right up through the Great Depression. The real point of contention is whether nutrition has continued to be an important factor in developed nations since the onset of relative affluence in 1950.

The major argument for nutrition as a persistent factor rests on indirect evidence, namely, the pattern of IQ gains. It is assumed that the more affluent had an adequate diet some 60 years ago and that dietary deficiencies were concentrated mainly in the bottom half of the population. Therefore, enhanced nutrition in recent generations has benefitted primarily the less affluent. Therefore, IQ gains should be larger in the bottom half of the IQ curve than in the top.

Up to now, seven developed nations have provided data that both cover the post-1950 period and give the whole IQ distribution from top to bottom. France, The Netherlands, and the US show relatively uniform gains over the whole curve (Flynn, 1985, p. 240; 1987, Table 3, 2009c; Vroon, 1984; Wechsler, 1992, Table 6.9). British Raven's data are detailed and do not show the IQ gap between the top and bottom halves reducing over time. The difference was large on the eve of the great depression, contracted 1940 to 1942, expanded 1964 to 1971, contacted 1972 to 1977, and has

**Table 3**
La Plata: IQ gains (SD = 15) on Raven's from 1964 to 1998.
Source: Table 2.

| Raven's score | Percentile 1964 | Percentile 1998 | SD difference |
|---|---|---|---|
| *Ages 13–14* | | | |
| 50 | 99.00 | 62.5 | 2.008 |
| 48 | 90.00 | 50.0 | 1.282* |
| 44 | 75.00 | 25.0 | 1.350* |
| 39 | 50.00 | 10.0 | 1.282* |
| 36 | 31.25 | 5.0 | 1.156 |
| SD difference = 1.305 = 19.57 points | | | |
| Median score difference = 9 = 21.57 points | | | |
| Mean score difference = 9.42 = 22.57 points | | | |
| *Ages 15–16* | | | |
| 52 | 99.0 | 75.00 | 1.652 |
| 49 | 90.0 | 50.00 | 1.282* |
| 44 | 75.0 | 25.00 | 1.350* |
| 41 | 50.0 | 13.75 | 1.092* |
| 36 | 25.0 | 5.00 | 0.970 |
| SD difference = 1.241 = 18.62 points | | | |
| Median score difference = 8 = 19.17 points | | | |
| Mean score difference = 8.55 = 20.48 points | | | |
| *Ages 17–18* | | | |
| 53 | 99.00 | 75.0 | 1.652 |
| 50 | 90.00 | 50.0 | 1.282* |
| 46 | 78.75 | 25.0 | 1.472* |
| 40 | 50.00 | 5.0 | 1.645* |
| SD difference = 1.466 = 21.99 points | | | |
| Median score difference = 10 = 23.96 points | | | |
| Mean score difference = 10.37 = 24.85 points | | | |
| *Ages 19–20* | | | |
| 53 | 99.0 | 62.5 | 2.008 |
| 52 | 92.5 | 50.0 | 1.440* |
| 46 | 77.5 | 10.0 | 2.037* |
| 43 | 65.0 | 5.0 | 2.030* |
| SD difference = 1.836 = 27.54 points | | | |
| Median score difference = 12 = 28.75 points | | | |
| Mean score difference = 12.07 = 28.92 points | | | |
| *Ages 21-22* | | | |
| 53 | 99.0 | 66.67 | 1.896 |
| 51 | 90.0 | 50.00 | 1.282* |
| 45 | 75.0 | 10.00 | 1.956* |
| 42 | 60.0 | 5.00 | 1.898* |
| SD difference = 1.712 = 25.68 points | | | |
| Median score difference = 11 = 26.36 points | | | |
| Mean score difference = 11.85 = 28.39 points | | | |
| *Ages 23–24* | | | |
| 53 | 99.0 | 50.0 | 2.327 |
| 51 | 90.0 | 37.5 | 1.601* |
| 45 | 75.0 | 13.0 | 1.798* |
| 42 | 60.0 | 5.00 | 1.898* |
| SD difference = 1.766 = 26.49 points | | | |
| Median score difference = 13 = 31.15 points | | | |
| Mean score difference = 11.72 = 28.08 points | | | |
| Ave IQ gains. Ages 13 to 18: 20.06 (SD); 21.57 (median); 22.63 (mean) | | | |
| Ave IQ gains. Ages 19 to 24: 26.57 (SD); 28.75 (median); 28.46 (mean) | | | |
| Midpoints: Ages 13 to 18: 21.35 points; Ages 19 to 24: 27.66 points | | | |

*Designates SDU values used to calculate IQ gains for each age group (see text).

expanded ever since. No coherent dietary history of England can offer the alteration of feast and famine needed to explain these trends (Flynn, 2009a).

Spain, Denmark and Norway are the only nations in which gains are mainly in the bottom half of the curve (Colom, Lluis Font, & Andres-Pueyo, 2005; Sundet, Barlaug, & Torjussen, 2004; Teasdale & Owen, 1989; Teasdale & Owen, 2000). In fact, Norway is a case in which the nutrition hypothesis is not viable. Although IQ gains have been confined to the lower half of the curve, height gains have been larger in the upper half (Sundet et al., 2004). This combination poses a serious problem. Are there two kinds of enhanced nutrition, one of which raises height more than it does IQ, the other of which raises IQ more than it does height?

The answer lies in the fact that factors other than better nutrition may have been present among the affluent in 1950 and moved down to benefit the less affluent after that date. Good education or modern parenting characterized by a richer parent/child interaction may have spread to the bottom half of the population over the last two generations. Until further data are available, the nutrition hypothesis is suspect in Scandinavia. Spain alone shows a balance of evidence that is favorable.

Table 4 uses the La Plata data to test the viability of the nutrition hypothesis in that locale. It eliminates the extremes of the curve by focusing on the 75th, 50th, and 25th percentiles. The raw score gains at the 75th percentile are large at all ages, ranging from 8 to 9 extra items correct. Given a raw score SD of 6.26 they average at 20 IQ points (8.33/6.26 = 1.33 SDs = 20 points). Where we have secondary school samples (ages 13 to 16), gains above the median are a good match for those below. Where university samples begin to intrude (age 18), gains below the median forge ahead; but not because those above diminish, rather it is because those below soar well above 20 IQ points.

The Argentine diet probably resembles that of developed rather than developing nations. Historically, the Argentine consumption of beef has been high and it reached its present level at least as far back as the 19th century. On the other hand, Calvo and Gnazzo (1990) found that almost half of a sample of children (aged 9 to 24 months) from Buenos Aires had iron deficiencies.

Keeping a balance sheet is, of course, in an important sense simplistic because the potency of nutrition would vary by place and time. In developing nations, there is no doubt that better nutrition is still a cause of IQ gains (Whaley et al., 2003). Even in developed nations, the notion that the Flynn effect will have identical causes should be banished from the literature. Why should nutrition not have been an important post-1950 factor in Spain, and perhaps other Mediterranean nations, but not a factor in America and most of Europe?

We do not question the evidence from interventions that boosted IQ with dietary supplements (Eysenck & Schoenthaler,

**Table 4**
Raw score gains by age at three levels of the IQ curve.
Source: Table 2.

| | Ages | | | | | |
|---|---|---|---|---|---|---|
| | 13–14 | 15–16 | 17–18 | 19–20 | 21–22 | 23–24 |
| 75th percentile | +8 | +8 | +8 | +9 | +9 | +10 |
| 50th percentile | +9 | +8 | +10 | +12 | +11 | +13 |
| 25th percentile | +9 | +8 | +11 | +14 | +14 | +15 |

Explanatory note: At ages 13–14, to score at the 75th percentile, subjects had to get 8 more items correct in 1998 as compared to 1964. The table shows that score gains were robust, no matter whether measured at the top, middle, or bottom of the curve.

1997). The issue is whether post-1950 diets in developing nations have actually mimicked this kind of dietary enhancement. Some argue that junk food has meant a worse diet post-1950. The evidence from the pattern of IQ gains is the best evidence available until someone undertakes the task of a multi-national history of nutrition since 1950.

### 5.2. Magnitude and persistence of IQ gains

Table 5a shows Raven's gains across national or group boundaries for adult subjects in developed nations. Swayed by its presumed nutritional advantages, we have classed La Plata (Argentina) as a developed nation. The La Plata data for ages 19 to 24 give a rate of gain of 0.814 IQ point per year. We set aside the French data as suspect (Flynn, 1987). We set aside the more recent Norwegian data in order to focus on Raven's gains at their peak period. The average rate of gain from all groups and locales is 0.691 points per year. Rates range from a low of 0.540 points to a high of 0.869 points. The La Plata rate of gain falls within this range, although it is above the mid-point between these extremes (0.705 points per year).

Table 5b shows Raven's gains in various locales for school children in developed nations. The La Plata data for ages 13 to 18 give a rate of 0.628 IQ points per year. This is unusually high but the collective data show a wide range of rates and are far inferior to the adult data in sample quality.

The Norwegian data are unique in showing that adult gains on Raven's fade away toward the end of the 20th century. However, its Raven's trends match Scandinavian trends on IQ tests in general: robust gains before 1968, the rate halved between 1968 and 1993, no gains thereafter (Emanuelsson, Reuterberg, & Svensson, 1993; Sundet et al., 2004; Teasdale & Owen, 1989; Teasdale & Owen, 2000).

**Table 5a**
Gains on Raven's progressive matrices or tests composed of Raven's items.

| Samples with adult subjects (developed nations) | | | | |
|---|---|---|---|---|
| Locales/groups | Ages | Gain (SD = 15) | Period | Rate (points/year) |
| France | 18+ | 25.12 | 1949–1974 | (1.005) |
| Belgium Flemish | 18+ | 7.82 | 1958–1967 | 0.869 |
| **La Plata** | **19–24** | **27.66** | **1964–1998** | **0.814** |
| Belgium Walloon | 18+ | 6.47 | 1958–1967 | 0.719 |
| Spain | 18+ | 19.20 | 1963–1991 | 0.686 |
| The Netherlands | 18 | 20.00 | 1952–1982 | 0.667 |
| Israel female | 17.5 | 5.09 | 1976–1984 | 0.637 |
| Israel male | 17.5 | 7.35 | 1971–1984 | 0.565 |
| Great Britain | 18–67 | 27.00 | 1942–1992 | 0.540 |
| Norway | 19–20 | 8.80 | 1954–1968 | 0.629 |
| Norway | 19–20 | 7.90 | 1968–1993 | 0.316 |
| Norway | 19–20 | 0.30 | 1993–2002 | 0.033 |
| Average (excluding France as suspect; excluding Norway post-1968; and with Israel genders merged — see text) | | | | **0.691** |

Sources by locales/groups.
(1) France, Belgium, and The Netherlands: Flynn (1987).
(2) La Plata: Table 4.
(3) Spain: Colom, Andres Pueyo, and Juan-Espinosa (1998).
(4) Norway 1954–1968: Flynn (1987).
(5) Israel: Flynn (1998b).
(6) Britain: Flynn (1998a).
(7) Norway 1968–2002: Sundet et al., 2004.

**Table 5b**
Gains on Raven's progressive matrices or tests composed of Raven's items.

| Samples schoolchildren (developed nations) | | | | |
|---|---|---|---|---|
| Locales | Ages | Gain (SD = 15) | Period | Rate (points/year) |
| Leipzig | 11–16 | 10.00 | 1968–1978 | (1.000) |
| **La Plata** | **13–18** | **21.35** | **1964–1998** | **0.628** |
| Edmonton | 9 | 8.44 | 1956–1977 | 0.402 |
| New Zealand | 15–16 | 9.26 | 1956–1981 | 0.370 |
| Australia | 10–16 | 8.76 | 1950–1976 | 0.337 |
| Great Britain | 5–14 | 6.99 | 1943–1980 | 0.189 |
| Great Britain | 5–15 | 6.23 | 1980–2008 | 0.223 |
| Average (excluding Leipzig as suspect & merging Great Britain) | | | | **0.324** |

Sources by locale.
(1) Leipzig, Edmonton, and Australia: Flynn (1987).
(1) La Plata: Table 4.
(2) New Zealand: Reid and Gilmore (1988).
(3) Great Britain: Flynn (2009a).

Taking 1990 as a benchmark, some data indicate that the Scandinavian decline may as yet be confined to that area. In America, both adults and schoolchildren are still gaining at their historic rate of 0.30 points per year (WAIS 1995–2006; WISC 1989–2002). The current rate for British children is a bit below 0.30, but it was higher from 1980 to 2008 than it was from 1943 to 1980 (Flynn, 2009a, 2009b).

The La Plata results have a recent terminal date but cover a 34-year period. Whether the rate of gain declined approaching the present is unknown. The gains are so large as to suggest that gains could not have ceased very long ago. Assume they ceased in 1990: then adult gains were 27.66 points from 1964 to 1990, a period of 26 years. This gives a rate of gain of 1.064 points per year, larger than any Raven's gain on record (French data for 1949 to 1974 is a virtual match, but Flynn, 1987 labels them low in reliability). Tests analogous to Wechsler tests show that children in urban Brazil (1930–2002), Estonia (1935–1998), and Spain (1970–1999) made gains akin to the US rate. But again, the periods are long enough and gains low enough that they may have diminished approaching the present (Colom, Flores-Mendoza, & Abad, 2007; Colom et al., 2005; Must, Must, & Raudik, 2003).

Table 5c gives Raven's trends from the developing world. Kenya and Dominica appear to have embarked on a period of explosive gains. Sudan has made gains on the WAIS: large fluid gains (on the Performance Scale) were accompanied by a small loss for crystallized intelligence (Daley, Whaley, Sigman, Espinosa, & Neumann, 2003; Khaleefa, Sulman, &

**Table 5c**
Gains on Raven's progressive matrices or tests composed of Raven's items.

| Developing nations | | | | |
|---|---|---|---|---|
| Locales | Ages | Gain (SD = 15) | Period | Rate (points/year) |
| Kenya | 7 | 14.00 | 1984–1998 | 1.000 |
| Dominica | 18–25 | 18.00 | 1969–2004 | 0.514 |
| Saudi Arabia | 8–15 | 11.70 | 1977–2010 | 0.355 |

Sources by nation.
(1) Kenya: Daley et al. (2003).
(2) Dominica: Meisenberg et al. (2005).
(3) Saudi Arabia: Batterjee et al. (in press).

Lynn, 2009; Meisenberg, Lawless, Lambert, & Newton, 2005). Flynn (2009c) speculates that the developing world in general may soon experience the Scandinavian decline. If that occurs, and if developing nations are entering a long period of peak gains, the 21st century will see the IQ gap between those two worlds close.

Latin America is a continent whose nations range from near developed (Argentina, Brazil, Chile, Costa Rico, Mexico, Uruguay) to developing. It may present a microcosm of global trends. It will be fascinating to see if its less developed nations approach the mean IQs of its more developed nations during the 21st century.

## References


Batterjee, A. A., Khaleefa, O., Yousef, K, & Lynn, R. (in press). An increase of intelligence in Saudi Arabia, 1977–2010. Intelligence.

Belchem, J. (Ed.). (2006). *Liverpool 800: Culture, character and history*. Liverpool: Liverpool University Press (200).

Calvo, E. B., & Gnazzo, N. (1990). Prevalence of iron deficiency in children aged 9–24 months from a large urban area of Argentina. *American Journal of Clinical Nutrition*, *52*, 534–540.

CIA (2011). *CIA fact book for The Netherlands.* Washington DC: Government Publications.

Colom, R., Andres Pueyo, A., & Juan-Espinosa, M. (1998). Generational IQ gains: Spanish data. *Personality and Individual Differences*, *25*, 927–935.

Colom, R., Flores-Mendoza, C. E., & Abad, F. J. (2007). Generational changes on the Draw-a-Man Test: A comparison of Brazilian urban and rural children tested in 1930, 2002, and 2004. *Journal of Biosocial Science*, *39*, 79–89.

Colom, R., Lluis Font, J. M., & Andres-Pueyo, A. (2005). The generational intelligence gains are caused by decreasing variance in the lower half of the distribution: Supporting evidence for the nutrition hypothesis. *Intelligence*, *33*, 83–92.

Daley, T. C., Whaley, S. E., Sigman, M. D., Espinosa, M. P., & Neumann, C. (2003). IQ on the rise: The Flynn effect in rural Kenyan children. *Psychological Science*, *4*, 215–219.

Emanuelsson, I., Reuterberg, S. -E., & Svensson, A. (1993). Changing differences in intelligence? Comparisons between groups of thirteen-year-olds tested from 1960 to 1990. *Scandinavian Journal of Educational Research*, *37*, 259–277.

Eysenck, H. J., & Schoenthaler, S. J. (1997). Raising IQ level by vitamin and mineral supplementation. In R. J. Sternberg, & E. L. Grigorenko (Eds.), *Intelligence, heredity and environment* (pp. 363–392). Cambridge: Cambridge University Press.

Flynn, J. R. (1985). Wechsler intelligence tests: Do we really have a criterion of mental retardation? *American Journal of Mental Deficiency*, *90*, 236–244.

Flynn, J. R. (1987). Massive IQ gains in 14 nations: What IQ tests really measure. *Psychological Bulletin*, *101*, 171–191.

Flynn, J. R. (1998a). IQ gains over time: Towards finding the causes. In U. Neisser (Ed.), *The rising curve: Long term gains in IQ and related measures* (pp. 25–66). Washington DC: American Psychological Association.

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

Flynn, J. R. (2009a). Requiem for nutrition as the cause of IQ gains: Raven's gains in Britain 1938 to 2008. *Economics and Human Biology*, *7*, 18–27.

Flynn, J. R. (2009b). The WAIS-III and WAIS-IV: Daubert motions favor the certainly false over the approximately true. *Applied Neuropsychology*, *16*, 1–7.

Flynn, J. R. (2009c). *What is intelligence? Beyond the Flynn Effect.* New York: Cambridge University Press (Enlarged paperback edition).

INDEC (Instituto Nacional de Estaditica y Censos) (1998). Employment and income from the Argentine census. Unpublished.

INDEC (Instituto Nacional de Estaditica y Censos) (2002). School attendance from the Argentine census. Unpublished.

Karmona, A. J. (2003). Censo Nacional de Pob: Departamento La Plata (National Census of Pop: Department La Plata). Unpublished.

Khaleefa, O., Sulman, A., & Lynn, R. (2009). An increase of intelligence in Sudan, 1987–2007. *Journal of Biosocial Science*, *41*, 279–283.

Loehlin, J. C., Lindzey, G., & Spuhler, J. H. (1975). *Race differences in intelligence.* San Francisco: Freeman.

Lynn, R. (1989). Positive correlation between height, heads size, and IQ: A nutrition theory of the secular increases in intelligence. *British Journal of Educational Psychology*, *59*, 372–377.

Lynn, R. (1990). The role of nutrition in secular increases in intelligence. *Personality and Individual Differences*, *11*, 273–275.

Lynn, R. (1993). Nutrition and intelligence. In P. A. Vernon (Ed.), *Biological approaches to the study of intelligence*. Norwood NJ: Ablex.

Lynn, R. (1998). In support of nutrition theory. In U. Neisser (Ed.), *The rising curve: Long term gains in IQ and related measures* (pp. 25–66). Washington DC: APA.

Meisenberg, G., Lawless, E., Lambert, E., & Newton, A. (2005). The Flynn effect in the Caribbean: Generational change in test performance in Dominica. *Mankind Quarterly*, *46*, 29–70.

Must, O., Must, A., & Raudik, V. (2003). The secular rise in IQs: Estonia, the Flynn effect is not a Jensen effect. *Intelligence*, *31*, 461–471.

Reid, N., & Gilmore, A. (1988). The Raven's standard progressive matrices in New Zealand. *Paper presented at the ACER Seminar on Intelligence, Melbourne, 24–26 August 1988*.

Rossi-Casé, L. (2000). *The recent standardization of Raven's Standard Progressive Matrices in La Plata; and Information concerning the 1964 standardization of Raven's Standard Progressive Matrices in La Plata.*

Storfer, M. D. (1990). *Intelligence and giftedness: The contributions of heredity and early environment.* San Francisco: Jossey-Bass.

Sundet, J. M., Barlaug, D. G., & Torjussen, T. M. (2004). The end of the Flynn effect? A study of secular trends in mean intelligence test scores of Norwegian conscripts during half a century. *Intelligence*, *32*, 349–362.

Teasdale, T. W., & Owen, D. R. (1989). Continued secular increases in intelligence and a stable prevalence of high intelligence levels. *Intelligence*, *13*, 255–262.

Teasdale, T. W., & Owen, D. R. (2000). Forty-year secular trends in cognitive abilities. *Intelligence*, *28*, 115–120.

Vroon, P. A. (1984). Raven's score distribution of Dutch draftees. Personal communication, November 5, 1984.

Wechsler, D. (1992). *WISC — Third Edition: Manual (Australian Adaptation)*. San Antonio, TX: The Psychological Corporation.

Whaley, S. E., Sigman, M., Neumann, Ch., Bwibo, N., Guthrie, D., Weiss, R. E., et al. (2003). The impact of dietary intervention on the cognitive development of Kenyan school children. *Journal of Nutrition*, *133*, 3965–3971.

Wicherts, J. M., Dolan, C. V., Hessen, D. J., Oosterveld, P., van Baal, G. C. M., Boomsma, D. I., et al. (2004). Are intelligence tests measurement invariant over time? Investigating the nature of the Flynn effect. *Intelligence*, *32*, 509–537.