Analyses of sex differences in general intelligence *g*

"The best method for determining the sex difference in psychometric *g* is to represent the sex difference on each of the subtests of a battery in terms of a point-biserial correlation and include these correlations with the full matrix of subtest intercorrelations for factor analysis. The result of the analysis will reveal the factor loading of sex on each of the factors that emerge from the analysis, including *g*." ... "This method is preferable to the use of *g* factor scores ... because *g* factor scores are not a pure measure of the *g* factor of the test battery from which is was extracted." (Jensen, 1998, p. 538).

Using this method Nyborg (2003) found no sex difference in general intelligence *g* before age 16, but after this age the point-biserial correlation suggested that sex loads 0.272 on *g* (one-tailed $p = .026$).

Errors

However, there are errors in the above mentioned analysis. The results were accordingly withdrawn, as mentioned on the homepage for the Nyborg 2003 book: *A reanalysis revealed errors in the treatment of data presented in chapter 10: "Sex differences in g" by Helmuth Nyborg. This means that the numbers and graphics in chapter 10 should be disregarded. However, new analyses (to be presented in "Personality and Individual Differences", accepted for publication, pending minor revisions) of more complete data confirm, that the predicted sex difference in g is statistically significant (now at p = 0.014, one-sided, rather than the p = 0.026, one-sided, previously reported in chapter 10).*

The link to the homepage for the book is:
http://www.elsevier.com/wps/find/bookdescription.cws_home/672741/description

Re-analyses

Since then new analyses have been performed on updated and more complete data. The new analyses provide the following results.

Children

First, in contrast to previous findings, sex is now found to load significantly on *g* in children ($r_{pbs} = 0{,}228$; *p* (one-sided) = 0,006, N =119, see table 1.)

Table 1. Hierarchical Schmid-Leiman *g* loadings for 119 un-selected school children (Boys N = 59, age mean 11,1 year, girls N = 60, age mean 11,0 year)

Tests	*g*
RFT Frame dependence (signed error, inv.)	0,545
RFT Response variability (error inv.)	0,289
RFT Field dependence (unsigned error inv.)	0,577
Embedded-Figures test (sec/fig inv.)	0,531
Money left-right discrimination test (Inv.)	0,389
Mental Rotation (Figures found, corrected f. guessing)	0,586
Tapping (Left hand)	0,322
Tapping (Right hand)	0,272
Oral fluency	0,282
WISC Information	0,534
WISC Comprehension	0,485
WISC Arithmetic	0,416
WISC Similarities	0,474
WISC Vocabulary	0,479
WISC Digit Span	0,354
WISC Picture Completion	0,455
WISC Picture Arrangement	0,381
WISC Block Design	0,679
WISC Object Assembly	0,560
WISC Coding	0,254
WISC Mazes	0,384
Co-factorized point-biserial correlation r_{pbs}	0,228

* *p* (one-sided) = 0,006.
Factor structure congruence coefficient r_c = 0,90.

The high congruence coefficient suggests practical identity in the factor structures for girls and boys.

Adults

Second, in line with previous findings, sex loads significantly on *g* in adults (r_{pbs} = 0,280; *p* (one-sided) = 0,014, N = 62, see table 2.)

Table 2. Hierarchical Schmid-Leiman *g* loadings for 62 un-selected adults (Males N = 31, age mean 17,4 year, females N = 31, age mean 17,3 year)

Tests	*g*
RFT Frame dependence (signed error, inv.)	0,373
RFT Response variability (error inv.)	0,465
RFT Field dependence (unsigned error inv.)	0,413
Embedded-Figures test (sec/fig inv.)	0,530
Money left-right discrimination test (Inv.)	0,612
Mental Rotation (Figures found, corrected f. guessing)	0,460
Tapping (Left hand)	0,313
Tapping (Right hand)	0,346
Oral fluency	0,227
WISC Information	0,546
WISC Comprehension	0,386
WISC Arithmetic	0,465
WISC Similarities	0,458
WISC Vocabulary	0,226
WISC Digit Span	0,474
WISC Picture Completion	0,004
WISC Picture Arrangement	0,404
WISC Block Design	0,595
WISC Object Assembly	0,351
WISC Coding	0,460
Co-factorized point-biserial correlation r_{pbs}*	0,280

* *p* (one-sided) = 0,014.

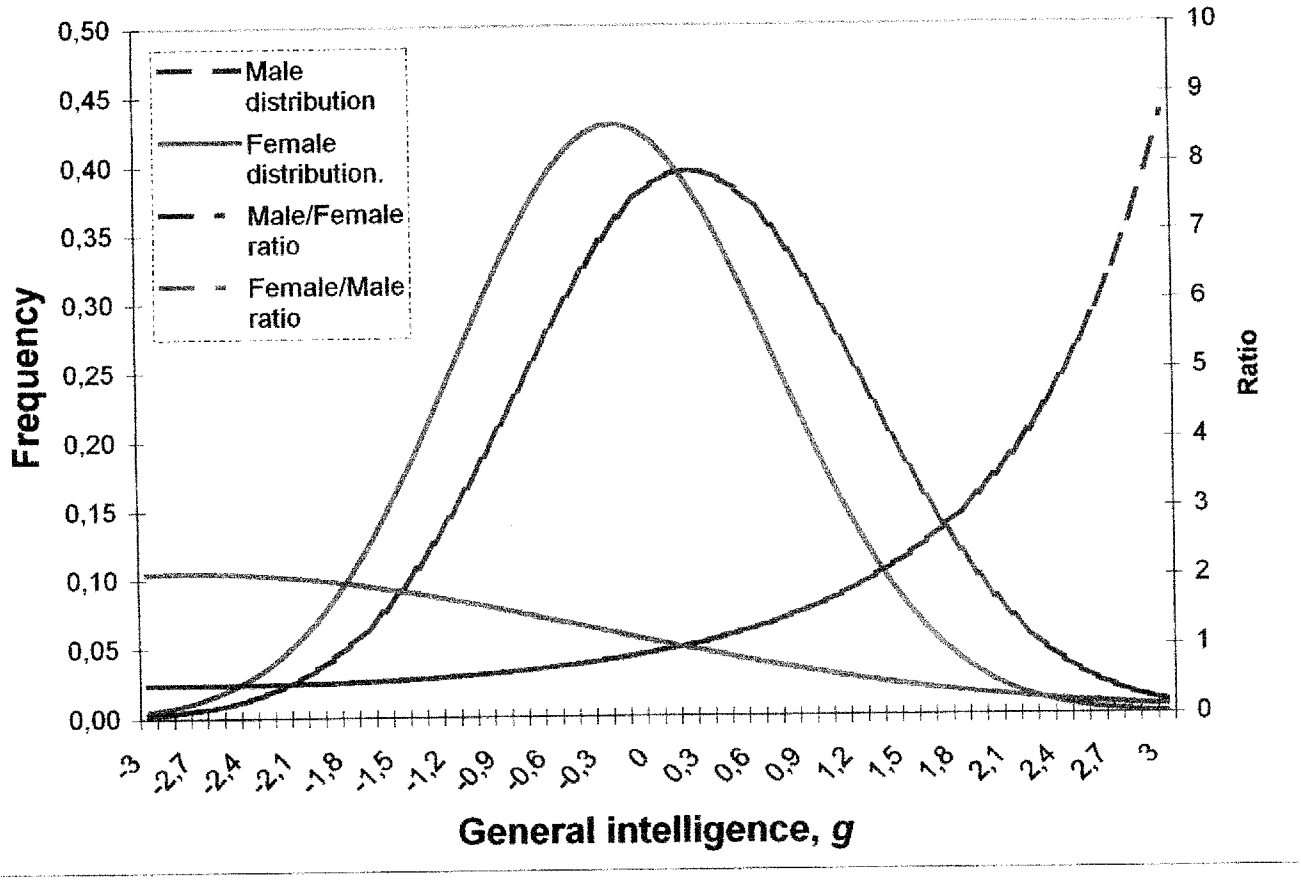
Factor structure incongruence coefficient r_c = 0,92.

Combined child-adult hierarchical Schmid-Leiman g factor scores

Third, as can be seen from tables 1 and 2, the male-female congruence coefficients are very high in both the child and adult sample. Moreover, the combined young-adult sample congruence coefficient amounts to .96. This similarity in factor structures over sex and age permits pooling the Schmid-Leiman general intelligence factor score *g* for the young and the adult sub-samples into a total sample of *g* factor scores, as illustrated in figure 1.

Figure 1 presents graphically the *g* factor scores for this total sample in terms of normal distribution frequencies and sex ratios (see figure 1 below).

Figure 1. Combined male and female hierarchical general intelligence *g* (Schmid-Leiman, 1957) distributions and ratios as a function of male *g* = .23 (sd 1.01) and female *g* = -.23 (sd .93); N_{males} = 90, mean age 13,0; $N_{females}$ = 91, mean age 12,8). (Nyborg, PAID, accepted for publication pending minor revisions).



The graphical data suggests that at above *g* = 0,3 sd (IQ equivalent 105) the ratio of males to females increases exponentially. At *g* = 3 sd (IQ 145) there will be close to 9 males for each female.

A more complete report on these observations has been accepted for publication in *Personality and Individual Differences*, pending minor revisions, and a link to the article will be established from this homepage (and from the Nyborg, 2003, book homepage), at the time of publication.

References

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

Nyborg, H. (2003) Sex differences in g. In H. Nyborg (ed.) *The scientific study of general intelligence: Tribute to Arthur R. Jensen* (pp. 187-222). Oxford: Pergamon.