Abstract

The Multifactor general knowledge test for the openpsychometrics website was evaluated on multiple dimensions, including its reliability, ability to generate differences in areas where it is known that groups differ, how it should be scored, whether older individuals scored higher, and its dimensionality. The best method to generate the scores was to treat every checkbox as an item and add up the correct and incorrect scores. This generated a highly reliable (rxx = 0.93) test, with a low median completion time (577 seconds), and a high ceiling (IQ = 149). One set of items (internet abbreviations) were found to have very low g-loadings, so we recommend removing them. The test also had age, national, and gender differences which replicate previous findings in the field.

The test was clearly biased against non-Anglos, especially in the sections of aesthetic knowledge, cultural knowledge, literary knowledge, and technical knowledge. Computational and international knowledge did not seem to have these biases. We highly recommend using this test to test the general knowledge of native English speakers, and the use of a cultural or linguistic translation for non-English speakers. It is unclear whether norms generated from an online test accurately correspond to those of a nationally representative sample, so these norms should be interpreted with caution.

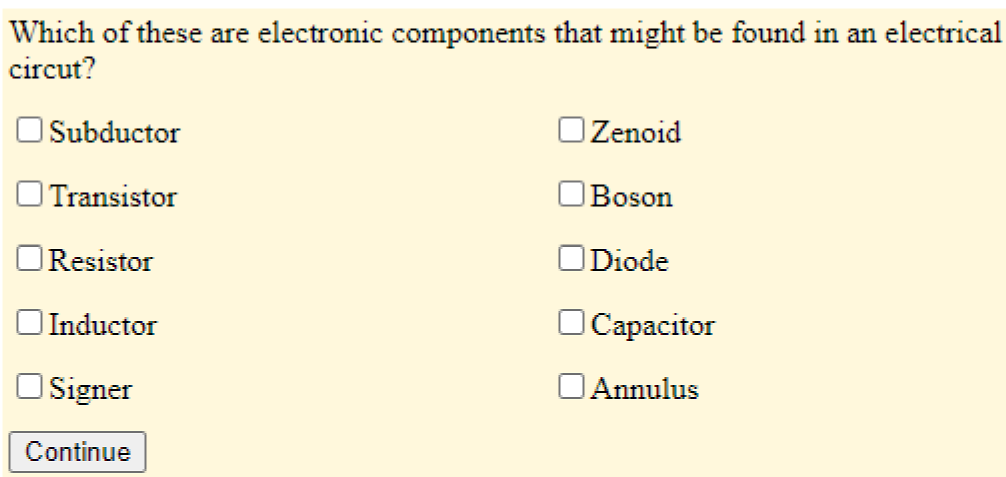
Online tests

Typically, people are skeptical of online tests, as they are unsure whether they are valid measurements of intelligence. Some researchers have attempted to gather samples who take both an online and offline test (Young & Keith, 2020; Logos et al., 2021). Overall, offline and online IQ tests correlate at 0.57 on average, compared to an average correlation of .77 found between two offline tests (Jensen, 1980). Typically, offline tests return lower IQ estimates than online ones - The openpsychometrics FSIQ test underestimated scores by 5.7 points in college students and the VIQ test underestimated scores by 11.5 points in college students.

Data

Data was taken from the openpsychometrics website, which contained a dataset of 19218 individuals who took the Multifactor General Knowledge Test. This test consists of 32 questions where individuals are asked to identify whether 10 items correspond to a criteria asked in a question, with the constraint that there are only 5 correct answers. An example question is displayed in Figure X for clarification.

Figure X. Example item from this test.



Data regarding the individual's gender, age, English proficiency, nationality, screen height, and screen width was also available. The data on screen height and width was then used to infer device type, as some resolutions (e.g. 360x640) are very typical of mobile phones. Data regarding the time taken to complete the test was also collected, with data for time spent on individual items as well.

Gender was coded as 1 = Male, 2 = Female, and 3 = Other. There were several individuals coded as 'zeroes', which are presumably missing data. In the Male-Female comparisons, individuals who are 'zeroes' or were coded as 'other' are excluded from the analysis.

Individuals whose first language was not English were excluded from most of the analysis, as well as those who spent under one second on a question. The data had also come with the removal of individuals who were under 13 and those who said they did not provide accurate answers.

There are several approaches that can be taken to score these items. Listed, they are:

1. Treating every individual checkbox as an item, which leads to a test of 320 items. Then, a numeric score out of 320 is calculated. (summed scores)
2. Treating every individual checkbox as an item, then doing an IRT analysis on the distractors and correct answers separately, then adding up the two IRT scores. The reason the IRT analysis is done on the distractors and correct answers separately is that IRT will falsely assume that the distractors are correct answers, no matter what direction they are coded in as. (160 + 160 IRT). One problem with this method is that it violates the local independence assumption, as answering one item from a question correctly corresponds to an increased likelihood in doing this for all items in the question.
3. Adding up all of the correct answers to the individual questions, then doing a graded IRT analysis of all 32 questions to generate one general score. (32 IRT)
4. Adding up all of the correct answers to the individual questions, then calculating the first general factor from the 32 questions. (32 FA)
5. Adding up all of the correct answers to the individual questions, then calculating the first principal component from the 32 questions. (32 PC)

In approach 2, 4 different approaches were taken when evaluating the IRT items themselves. Three of them involve the inclusion of various levels of logistic parameters, with one model having 2, one having 3, and another having 4. The other method involved using the best method to evaluate the answers (4PL) and distractors (splines) separately.

These 5 methods will be graded on 4 criteria:

1. Reliability. This is the most important criteria for the test to abide by, as a more reliable test result will lead to an inherently better understanding of the world. For the methods where there is not a convenient way to measure reliability, the odd and even items were correlated and then the spearman-brown formula was applied to calculate the estimated reliability.
2. Correlation with other scoring methods. Better scoring methods will correlate more with other scoring methods as they are measuring more signal and less noise.
3. Sex bias. This is an unconventional criteria, given that researchers generally try to avoid biased tests. However, because men typically have more general knowledge than women (d = 0.53) (Tran et al., 2014), a more valid measurement of it would have a difference closer to that mean.
4. Age bias. Humans accumulate knowledge as they grow older, so a method that identifies a larger effect of age is also probably more valid.
5. Device bias. Using the screen width and height metrics, it is possible to identify participants who had used a mobile phone to take the test. Individuals who use mobile phones often tend to be less intelligent than those who use other types of devices (Brown et al., 2022; Wilmer et al., 2017), so a method that returns larger differences between mobile phone users and other devices will be more reflective of a true difference.
6. Nationality bias. When data of the mental ability of different nations is collected, some Nations are more intelligent than others on average (Lynn & Becker, 2019). A method that generates greater differences between nationalities is also probably more valid.

Comparison of the 5 methods used to score the MGKT.

Based on the results on Table X, the best method to score the MGKT to use the 160 + 160 IRT method (2PL) or to add up the scores. Due to the simplicity of the method, the summed scores method will be used for most of this study. However, when evaluating bias in the test, the 160 + 160 IRT (2PL) method will be used, as it is more convenient to evaluate it using DIF.

Table X. Comparison of the seven methods used to calculate general knowledge.

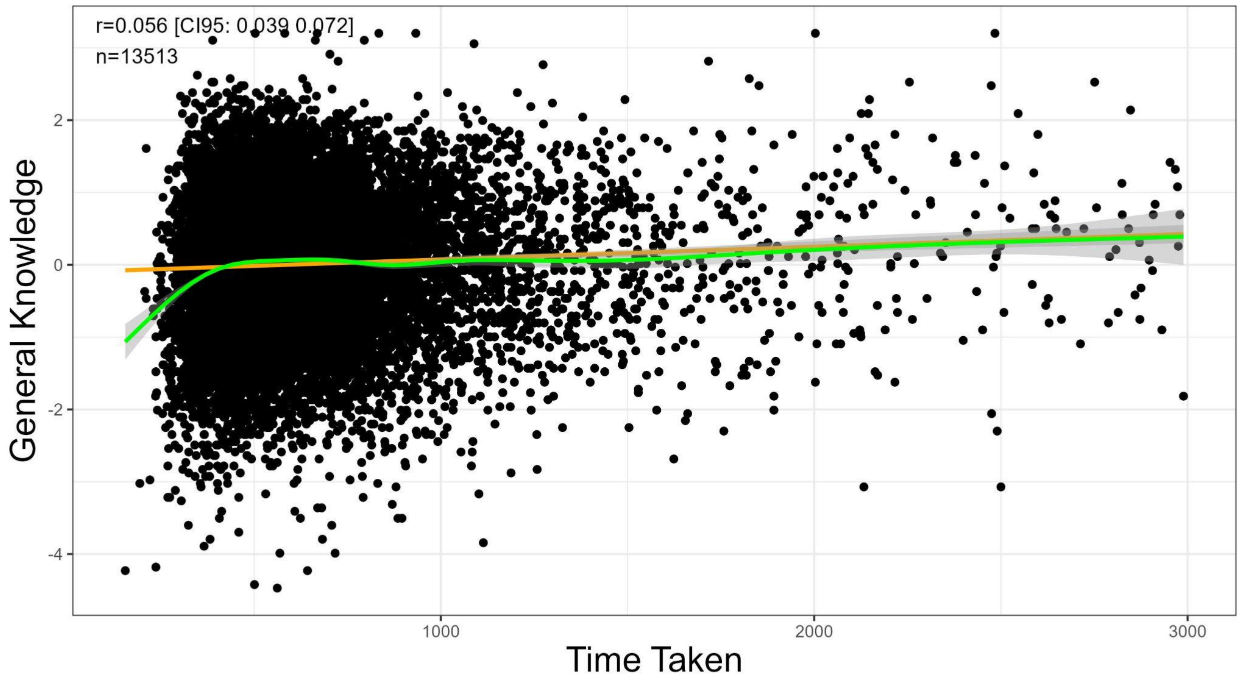
Method	Reliability	Loading on the general factor	Sex difference	Age correlation †	Desktop advantage	National differences (averaged)
Summed Scores	0.93	0.989	-0.43	0.396	0.22	0.534
160 + 160 IRT (4PL)	0.91	0.94	-0.49	0.375	0.25	0.505
160 + 160 IRT (3PL)	0.93	0.963	-0.41	0.392	0.22	0.511
160 + 160 IRT (2PL)	0.93	0.958	-0.45	0.386	0.24	0.496
160 + 160 IRT (optimal)	0.91	0.918	-0.45	0.371	0.22	0.505
32 IRT	0.89	0.983	-0.4	0.398	0.22	0.485
32 FA	0.88	0.991	-0.38	0.406	0.21	0.536
32 PCA	0.88	0.992	-0.38	0.407	0.21	0.531

† - only within those under the age of 25

Test score and time elapsed

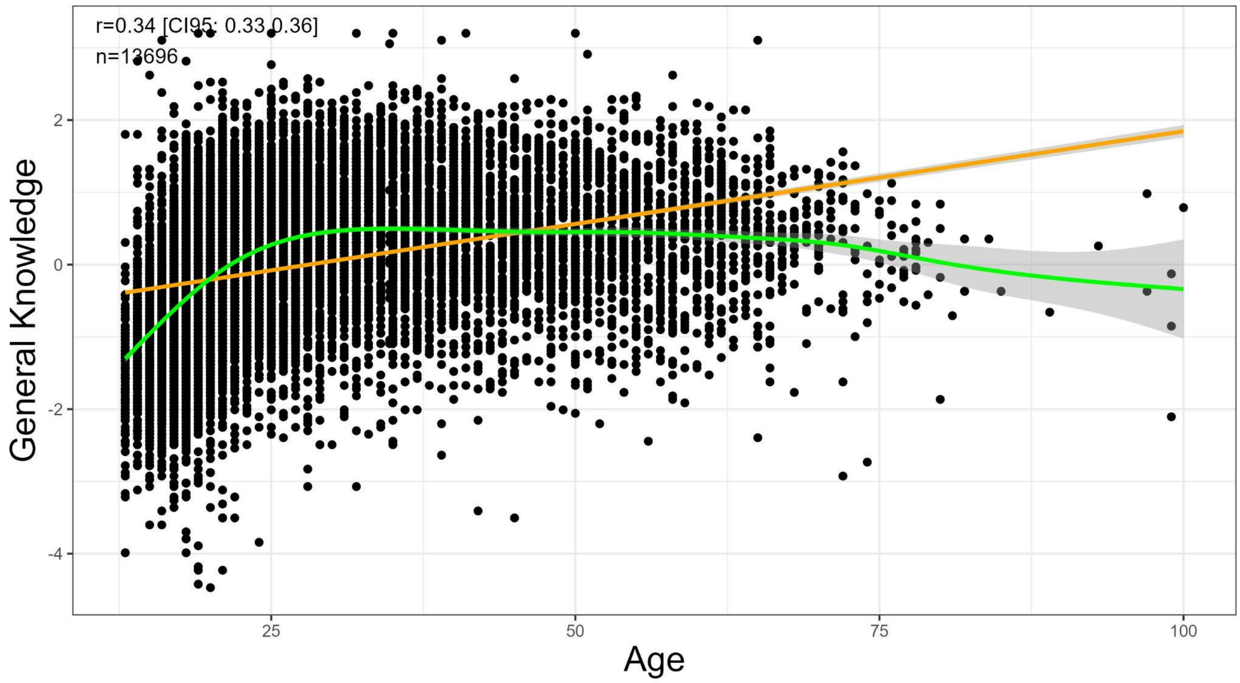
There was a small correlation between general knowledge and time taken to finish the test ($r = .049$, $p < .001$). This effect was largely due to people who took less than 6 minutes to take the test, based on the fit from the restricted curved spline, which is displayed in Figure X.

Figure X. Relationship between time taken to complete the test and general knowledge. Modeled with loess smoothing



Age had a non-monotonic relationship with general knowledge. Individuals gradually increased their general knowledge until their mid-30s, and after that there was a slow decline in observed scores, as shown in Figure X. This is consistent with data from other researchers, who find that crystalized ability gradually rises until it peaks in the mid 30s, after which it gradually starts to stagnate (Rohwedder & Willis, 2010).

Figure X. Relationship between General Knowledge by age, modeled with a restricted cubic spline (ages of above 100 excluded in the analysis).



Sex bias

Differential item functioning testing was used to assess whether certain items had sex biases, that is, whether certain items were answered correctly by one gender independent of general ability. Based on the results, the test contains a large amount of gender bias, where most items have a sex bias. Out of the distractors, 37 out of the 180 items displayed a pro-male bias, while 32 of the items had a pro-female bias. Within the answers, 48 of the 180 items had a pro-male bias, while 57 of the 180 items had a pro-female bias. Items with a pro-female bias typically were associated with cultural knowledge, while items associated with a pro-male bias were typically associated with technological or international knowledge. The item probability functions by gender where ability is calculated using the LOO method are available in Figures X and X.

Figure X. Item Probability Functions of the distractors by gender.

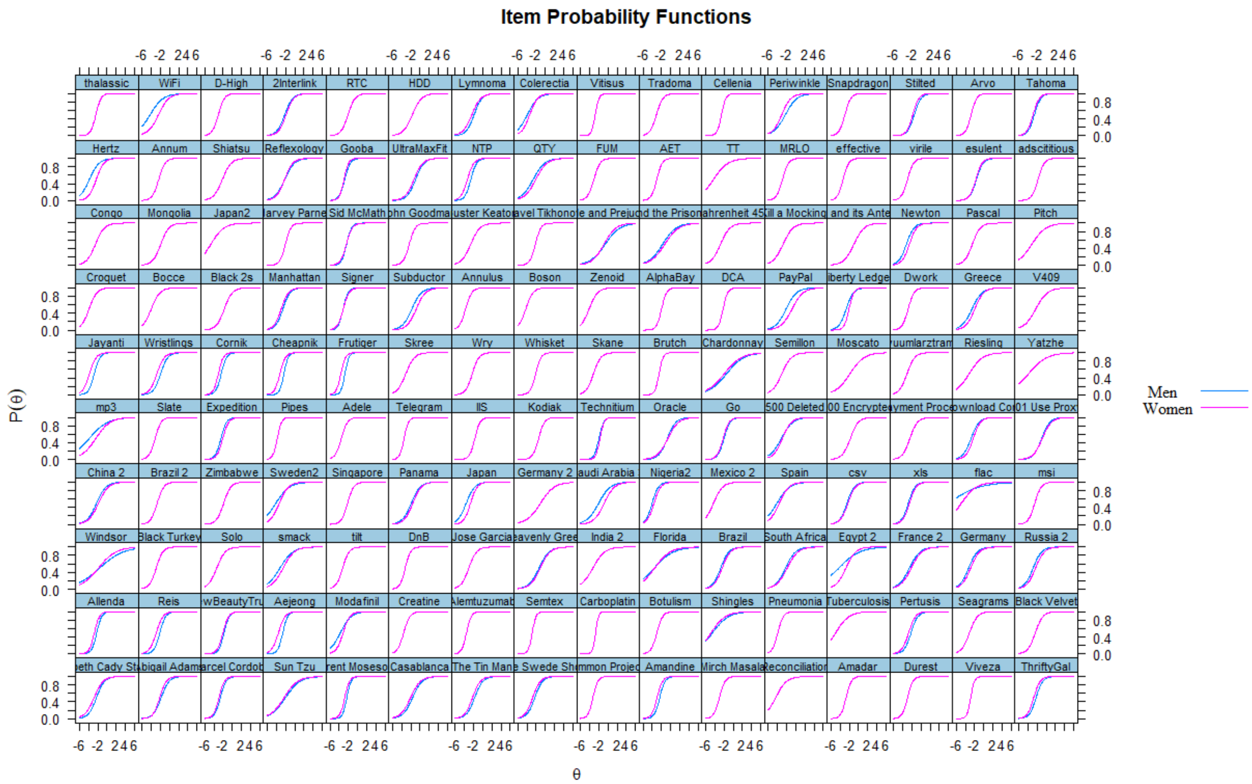
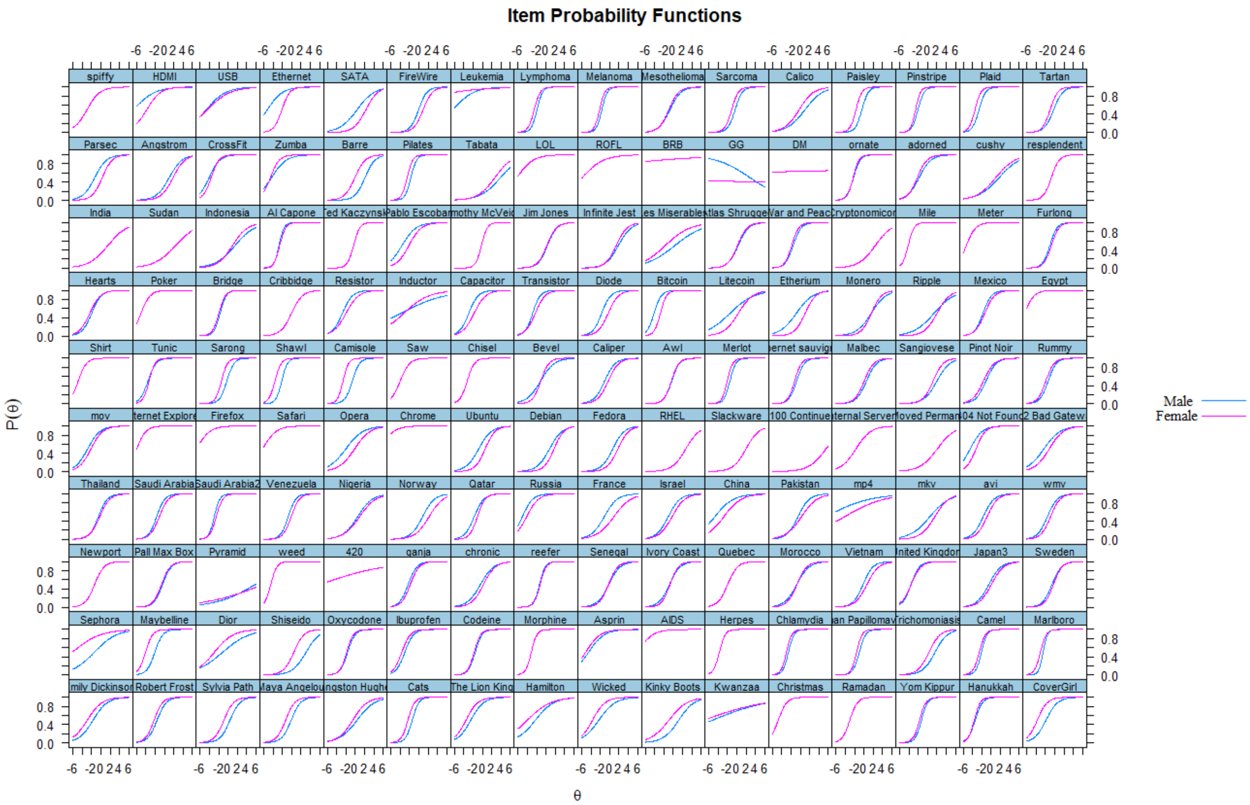


Figure X. Item Probability Functions of the answers by gender.



The bias-adjusted sex difference in general knowledge (d = 0.4683) was hardly different from the difference before adjustment after adjustment (d = 0.4689), after adjusting for reliability as well. This leads me to believe that, while the amount of sex bias in the test is fairly large, this is not leading to a significant bias in favor of either gender.

Factor structure

The factor structure of the test can be assessed with two methods. The first is to build an intuitive model of the test using confirmatory factor analysis, and the second is to use factor analysis to extract additional factors from the data. To facilitate the analysis, the questions were scored and then subjected to factor analysis to avoid having to do an analysis for the correct answers and distractors separately.

To evaluate the number of factors necessary to model general knowledge, parallel analysis was used. The number of factors that are necessary to evaluate general knowledge was judged to be 7. The results of the parallel analysis are available in Figure X., and the results of an oblimin rotated factor analysis with 7 factors is available in Table X. While using rotation methods can undermine the size of the general factor in the data, this can be ameliorated by using it as a basis to form a hierarchical model.

Figure X. Parallel analysis of the 32 questions in the dataset.

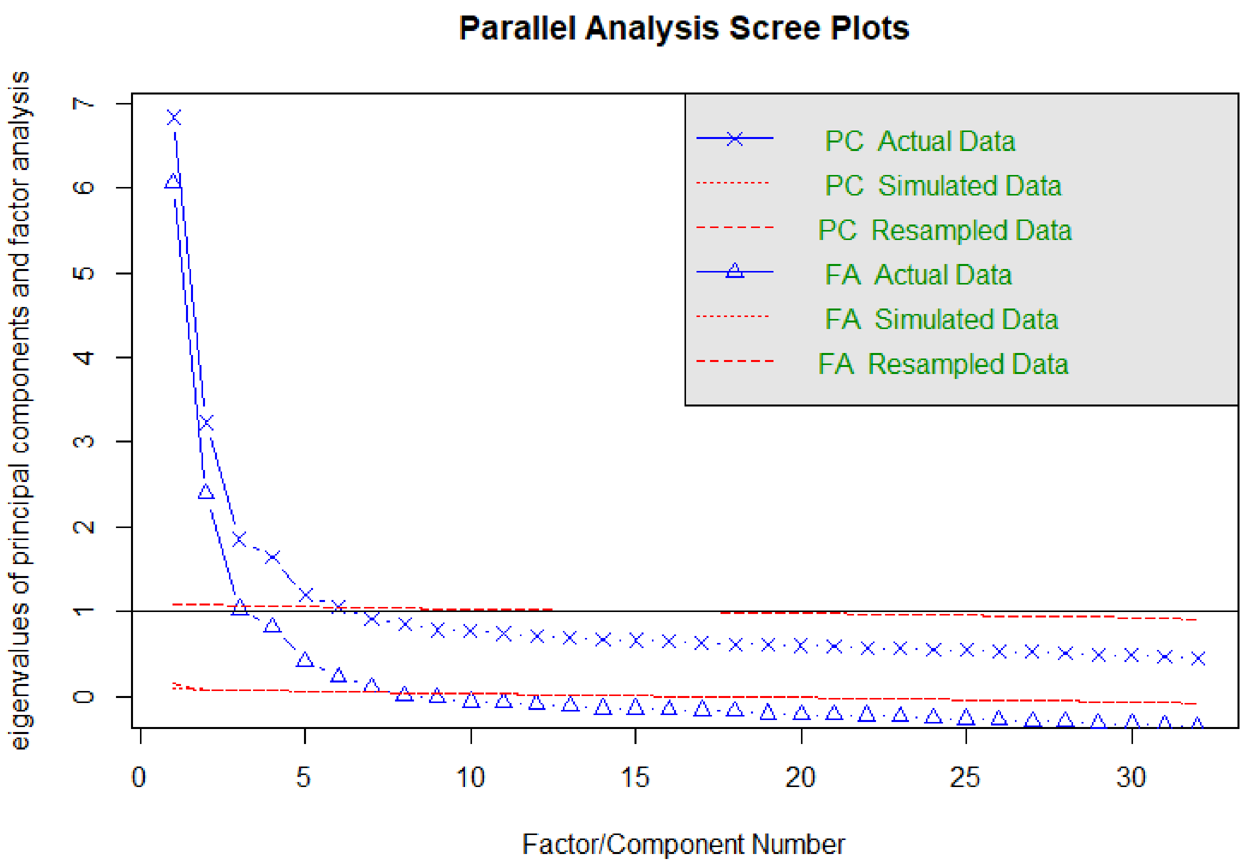


Table X. Oblimin rotated factor analysis of the 32 questions.

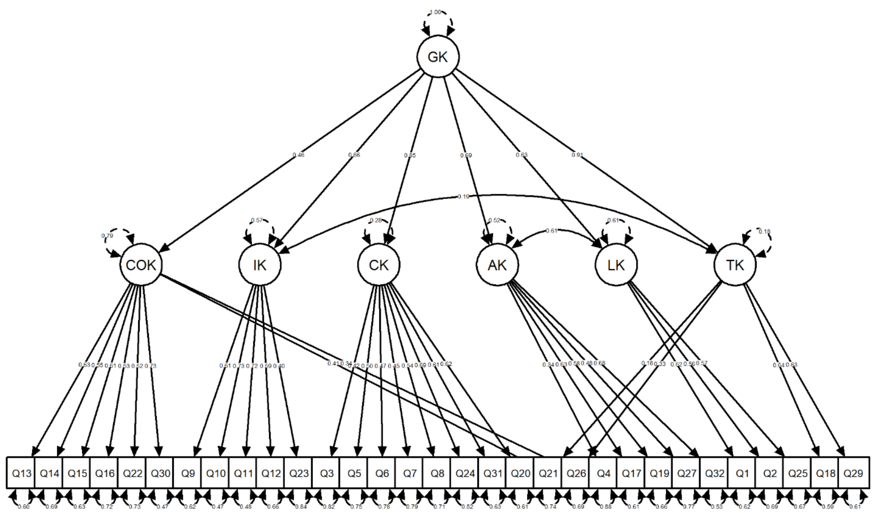
Questions	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Loadings	Cumulative
Q1	-0.13	0.05	0.24	0.11	0.47	0.02	0.06	0.42	1.9
Q2	-0.03	0.09	-0.03	0.31	0.44	-0.09	0.06	0.42	2.1
Q3	-0.02	-0.02	0.3	0	0.24	0.14	0.19	0.25	3.2
Q4	-0.02	-0.04	0.12	0.5	0.04	-0.21	0.19	0.36	1.8
Q5	-0.06	0.05	0.46	0.17	-0.1	0.15	0.14	0.35	1.9
Q6	-0.07	0.05	0.38	0.21	-0.05	0.08	0.13	0.29	2.1

Q7	0	-0.09	0.65	-0.06	0.1	0.03	-0.08	0.42	1.1
Q8	0.24	0.01	0.59	0	0.01	-0.1	0.01	0.43	1.4
Q9	-0.06	0.6	-0.03	0.08	0.08	-0.01	0.06	0.38	1.1
Q10	0.02	0.75	-0.1	0.04	0.06	0.02	0.03	0.58	1.1
Q11	0.05	0.67	0.08	-0.01	-0.03	0	-0.05	0.51	1.1
Q12	0.06	0.61	0.06	-0.12	-0.05	0.04	-0.08	0.43	1.2
Q13	0.6	0.05	0	0.05	-0.05	0.04	0.09	0.42	1.1
Q14	0.56	0.04	-0.06	0.03	0.03	0.01	0.11	0.36	1.1
Q15	0.61	0.07	-0.02	-0.03	0.03	0.03	-0.1	0.41	1.1
Q16	0.51	0.01	0	0.03	0.07	0.02	0.11	0.31	1.1
Q17	0.02	-0.01	-0.05	0.68	0.06	0.13	-0.05	0.53	1.1
Q18	0.11	0.06	0.15	0.17	0.03	0.42	-0.07	0.42	1.9
Q19	0.09	0.22	0.14	0.41	-0.04	-0.12	-0.07	0.3	2.3
Q20	0.07	0.02	0.27	0.2	0.14	0.23	-0.2	0.4	4.5
Q21	0.28	0.13	-0.01	-0.01	-0.12	0.42	0.04	0.4	2.2
Q22	0.41	0.24	0.06	-0.12	-0.12	0.02	0.14	0.35	2.4
Q23	-0.04	0.32	0.09	-0.09	0.11	0.07	0.05	0.15	1.8
Q24	0.02	0.3	0.49	0	0.08	0.03	-0.12	0.48	1.9
Q25	0.09	0.19	-0.02	0.02	0.46	0.03	-0.03	0.32	1.5
Q26	0.24	0.23	-0.05	-0.03	0.12	0.33	0	0.38	3.1
Q27	0.17	-0.04	0.11	0.4	0.16	-0.16	0.05	0.3	2.3
Q28	0.36	-0.11	-0.07	-0.17	0.21	-0.01	0.38	0.39	3.3
Q29	0.09	0.06	0.08	0.21	0.24	0.27	0	0.36	3.5
Q30	0.64	-0.02	0.15	0.06	-0.04	0.05	-0.12	0.49	1.2
Q31	-0.07	0.09	0.37	0.28	-0.05	0.21	0.15	0.42	3.2
Q32	-0.01	0.05	0.01	0.53	0.16	0.17	-0.09	0.48	1.5

Given that factor 7 was mostly associated with the internet abbreviations question, it was ignored in the confirmatory factor analysis. Internet abbreviations also has a very low g-loading as a question, so it was also excluded from the norms that were provided later on in the test

A confirmatory factor analysis was conducted based on these results, which was somewhat successful, yielding a CFI of .93 and a RMSEA of 0.055. The loadings for the items and latent factors are available in Figure X. The list of questions that each factor was associated with is available in the Appendix.

Figure X. Confirmatory factor analysis of the Multifactor General Knowledge test.



The gender differences in each specific ability were calculated. Women tended to score higher in facets related to cultural knowledge and aesthetic knowledge, while Men scored higher in facets related to computational knowledge and international knowledge. Medical knowledge showed a small difference in favor of men, though it was fairly negligible in size. Individuals whose gender identity was missing or classified as ‘other’ tended to follow a feminine knowledge profile. The results of this analysis are available in Table X.

Table X. Gender differences in knowledge by facet of knowledge. Reference group is men. COK - Computational knowledge, TK - Technical knowledge, IK - International

Knowledge, AK - Aesthetic knowledge, LK - Literary Knowledge, CK - Cultural knowledge, GK - General knowledge. * = p < .05, ** = p < .01, *** = p < .001.

Gender	COK	TK	IK	AK	LK	CK	GK
Female	-1.11***	-0.64***	-0.73***	0.65***	0.34***	-0.14***	-0.43***
Other	-0.47***	-0.28***	-0.5***	0.37***	0.51***	-0.22***	-0.16**
Missing	-0.64***	-0.22	-0.15	0.35**	0.31*	-0.06	-0.17

This is largely consistent with previous research on sex differences in knowledge (Tran et al., 2014b). Men tend to score higher in fields related to science and geography, while women tend to know more about fashion and cultural works. This is also evidence against the hypothesis that this test has a sex bias, as many different facets of knowledge are tested where there are sex differences in both directions. Even when technological knowledge is not considered, the gender difference in general knowledge is still present (d = -0.18, p < .001).

The latent differences generated using a bifactor model were similar to the raw differences observed, though the coefficients were slightly different. For instance, the gender difference in practical knowledge decreased, but the gender difference in aesthetic knowledge increased.

Table X. Latent differences in knowledge by sex and facet of knowledge. Reference group is men. COK - Computational knowledge, TK - Technical knowledge, IK - International Knowledge, AK - Aesthetic knowledge, LK - Literary knowledge, CK - Cultural Knowledge, GK - General knowledge. * = p < .05, ** = p < .01, *** = p < .001.

Gender	COK	TK	IK	AK	LK	CK	GK
Female	-1.05***	-0.418***	-0.8***	0.78***	0.48***	-0.128***	-0.42***
CFI	0.94	0.95	0.95	0.87	0.9	0.9	0.52
RMSEA	0.067	0.08	0.08	0.12	0.14	0.077	0.095
SRMR	0.039	0.037	0.037	0.062	0.052	0.048	0.1

One possible reason why there is a gender difference in total knowledge is because there are gender differences in intelligence (Lynn & Kanazawa, 2011; Nyborg, 2005; Hunt, 2010), and general knowledge correlates with intelligence at about .8 . While some studies find no sex difference or a sex difference in favor of women, this is an artifact of the fact that the male advantage only emerges after children fully develop (Alexopoulos, 1996; Lynn & Kanazawa, 2011). The likely causal factor behind this difference is brain size, which correlates with intelligence at about .28 (Cox et al., 2019). Given that the sex difference in brain size is about d = 0.84 (Nyborg, 2005), the predicted male-female standardized difference in intelligence is 0.24. This is roughly the same as the sex difference that is found in tests of intelligence, supporting the theory that brain size mediates the sex difference.

National differences

While non-English speakers had been excluded from this analysis until now, they have been reincluded into the analysis for the sole purpose of assessing national differences. This is because English speakers within foreign countries are not representative of their host nations, and doing so generates a larger sample of them. While the test will be undeniably biased in favor of those within Anglophone countries or who interact with Anglo culture, this can be ameliorated by assessing test bias using DIF. To avoid small sample sizes from damaging the analysis, countries with less than 50 observations were ignored.

To facilitate country comparisons, countries were grouped into the following categories:

- Anglo
- Latin American
- Germanic
- Northern European
- Eastern European
- Balkan

- Caucasus
- MENA
- South Asian
- African
- East Asian
- South East Asian

When comparing Anglos and Germans, the unadjusted difference in general knowledge (generated with the 160 + 160 scoring method) was -0.46, while the adjusted difference was -0.54. Given that the IQ of German speaking countries (99.5) is almost equivalent to those of Anglo ones (98), this indicates that DIF failed to evaluate the bias in the test properly. This is probably because most of the items in the test were Anglo-favored, resulting in the unbiased items being improperly flagged as pro-German.

Instead, an alternative approach was considered, where regions were compared based on their specific abilities. Based on the results in Table X., it appears that foreigners score better than Anglos on items of computational knowledge and international knowledge, probably due to a collider bias where taking the test is a product of a self-selection process where individuals are selected based on their fluency in English and their general knowledge. Out of all of the facets, Anglos score the highest on cultural knowledge, which is unsurprising, as lots of the knowledge that was asked for (e.g. famous criminals, cigarette brands) are specific to Anglo and particularly American culture. In contrast, computational terms tend to be language invariant, so the test is less biased against non-English speakers.

Table X. Differences by specific ability by region. Reference group is anglos. COK - Computational knowledge, TK - Technical knowledge, IK - International Knowledge, AK - Aesthetic knowledge, CK - Cultural Knowledge, LK - Literary knowledge, GK - General knowledge.

Cultural category	COK	TK	IK	AK	LK	CK	GK
German (n = 521)	0.48***	-0.57***	0.62***	-0.75***	-0.72***	-0.87***	-0.35***
Latin American (n = 628)	-0.1**	-0.84***	-0.2***	-1.04***	-0.83***	-1.32***	-1.05***
Northern European (n = 814)	0.38***	-0.56***	0.52***	-0.59***	-0.8***	-0.81***	-0.36***
Southern European (n = 587)	0.16***	-0.68***	0.44***	-0.64***	-0.66***	-0.97***	-0.54***
Eastern European (n = 742)	0.42***	-0.76***	0.3***	-0.89***	-0.96***	-1.04***	-0.64***
Balkans (n = 199)	0.11	-0.97***	0.2**	-0.87***	-0.98***	-0.88***	-0.73***
Caucasus (n = 84)	0.18	-0.98***	0.19	-1.37***	-1.02***	-1.57***	-1.05***
MENA (n = 138)	-0.2*	-0.92***	0.17*	-1.25***	-1.07***	-1.4***	-1.1***
South Asian (n = 256)	0.35***	-0.36***	-0.12	-1.24***	-0.98***	-1.63***	-0.96***
East Asian (n = 354)	0.2***	-0.33***	0.28***	-0.38***	-0.59***	-1.18***	-0.47***
South East Asian (n = 413)	-0.36***	-0.97***	-0.57***	-1.15***	-1.19***	-1.9***	-1.52***
African (n = 66)	0.1	-0.37**	0.37**	-0.81***	-1.1***	-1.09***	-0.71***

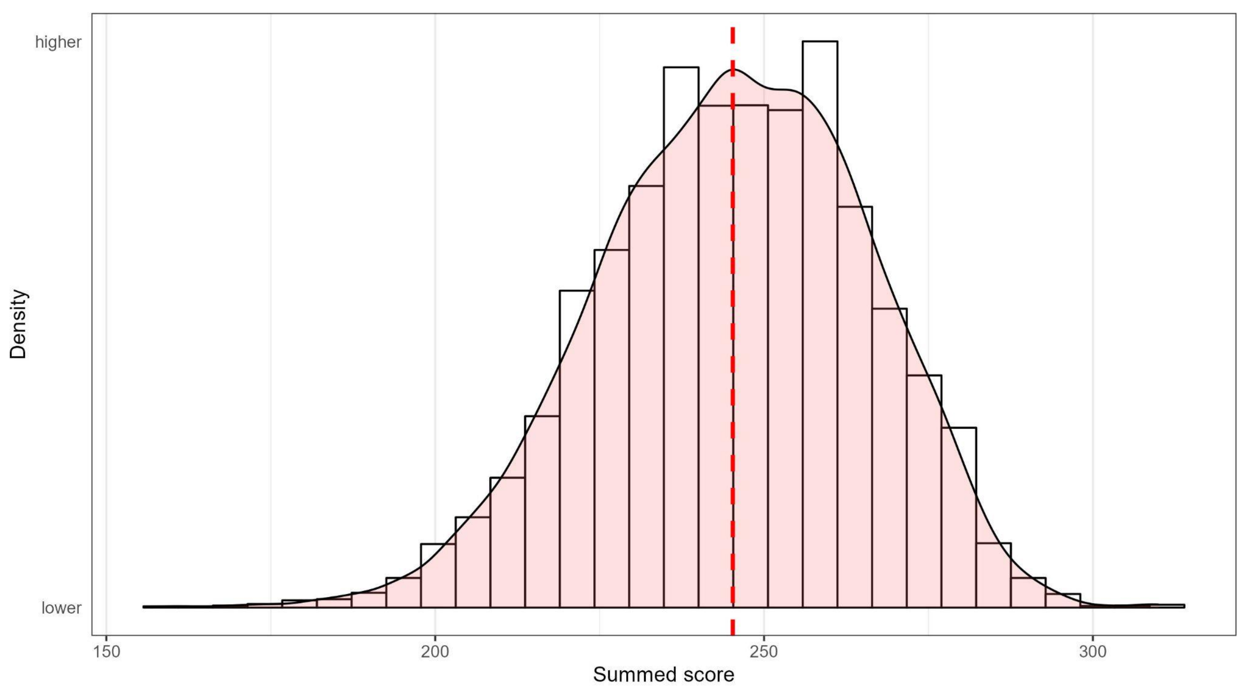
After restricting the sample to countries with over 50 participants, national IQs taken from Becker's latest version of the NIQ dataset (V1.3.3) correlate at .61 with the averaged general knowledge score ($p < .001$), .34 with averaged computational knowledge ($p < .05$), .49 with averaged cultural knowledge ($p < .01$), .41 with averaged literary knowledge ($p < .05$), .58 with averaged aesthetic knowledge ($p < .001$), .55 with averaged international knowledge ($p < .001$), and .26 with averaged technical knowledge ($p = .13$). While the test is clearly biased, this bias doesn't seem to be affecting the rank order of the respective nations very much.

Norming

There are three ways to norm an IQ test - calculate the raw percentage of people who the individual scored higher than, use a linear regression model which predicts the converted IQ score based on the summed score, or calculate the z-score based on the mean and the standard deviation. The first method works well when you have a very large sample size and there are departures from normality within the test. The 2nd and 3rd methods work well with a small sample size, but are sensitive to departures from normality within the scores of the test.

Given that the distribution of raw scores was almost identical to a normal distribution, based on the plot in Figure X, and that the sample size of English speakers was very large (n = 13696), all methods are acceptable ways to calculate norms. While there were small inconsistencies between the different methods at the tails of the test, all three methods of calculating IQ-based scores resulted in almost identical norms.

Figure X. Density plot of the summed scores (internet abbreviations question excluded).



Summed score	Percentile-based IQ	Linear regression-based IQ	z-score based IQ	Averaged estimate
180	56.2	52.1	51.9	53.4

181	56.4	52.9	52.7	54.0
182	56.9	53.6	53.4	54.6
183	58.4	54.4	54.2	55.6
184	58.7	55.1	54.9	56.2
185	58.9	55.9	55.6	56.8
186	59.4	56.6	56.4	57.5
187	59.9	57.4	57.1	58.1
188	60.6	58.1	57.8	58.9
189	61.2	58.9	58.6	59.6
190	62.0	59.6	59.3	60.3
191	62.2	60.4	60.0	60.9
192	62.5	61.1	60.8	61.5
193	63.1	61.9	61.5	62.2
194	63.8	62.6	62.3	62.9
195	64.5	63.4	63.0	63.6
196	65.1	64.1	63.7	64.3
197	65.7	64.9	64.5	65.0
198	66.3	65.6	65.2	65.7
199	66.9	66.4	65.9	66.4
200	67.4	67.1	66.7	67.1
201	67.9	67.9	67.4	67.7
202	68.8	68.6	68.1	68.5
203	69.6	69.4	68.9	69.3
204	70.3	70.1	69.6	70.0
205	70.9	70.9	70.4	70.7
206	71.6	71.6	71.1	71.4
207	72.4	72.4	71.8	72.2
208	73.1	73.1	72.6	72.9

209	73.8	73.9	73.3	73.7
210	74.5	74.7	74.0	74.4
211	75.1	75.4	74.8	75.1
212	75.7	76.2	75.5	75.8
213	76.4	76.9	76.2	76.5
214	77.2	77.7	77.0	77.3
215	78.0	78.4	77.7	78.0
216	78.5	79.2	78.5	78.7
217	79.3	79.9	79.2	79.5
218	79.9	80.7	79.9	80.2
219	80.7	81.4	80.7	80.9
220	81.4	82.2	81.4	81.7
221	82.1	82.9	82.1	82.4
222	82.8	83.7	82.9	83.1
223	83.5	84.4	83.6	83.8
224	84.2	85.2	84.4	84.6
225	84.9	85.9	85.1	85.3
226	85.6	86.7	85.8	86.0
227	86.3	87.4	86.6	86.8
228	87.1	88.2	87.3	87.5
229	87.9	88.9	88.0	88.3
230	88.5	89.7	88.8	89.0
231	89.3	90.4	89.5	89.7
232	90.0	91.2	90.2	90.5
233	90.7	91.9	91.0	91.2
234	91.4	92.7	91.7	91.9
235	92.1	93.4	92.5	92.7
236	92.8	94.2	93.2	93.4

237	93.4	94.9	93.9	94.1
238	94.1	95.7	94.7	94.8
239	94.8	96.4	95.4	95.5
240	95.5	97.2	96.1	96.3
241	96.1	97.9	96.9	97.0
242	96.8	98.7	97.6	97.7
243	97.5	99.4	98.3	98.4
244	98.2	100.2	99.1	99.2
245	98.9	100.9	99.8	99.9
246	99.6	101.7	100.6	100.6
247	100.4	102.4	101.3	101.4
248	101.1	103.2	102.0	102.1
249	101.8	103.9	102.8	102.8
250	102.4	104.7	103.5	103.5
251	103.1	105.5	104.2	104.3
252	103.8	106.2	105.0	105.0
253	104.5	107.0	105.7	105.7
254	105.1	107.7	106.4	106.4
255	106.0	108.5	107.2	107.2
256	106.7	109.2	107.9	107.9
257	107.5	110.0	108.7	108.7
258	108.2	110.7	109.4	109.4
259	109.0	111.5	110.1	110.2
260	109.7	112.2	110.9	110.9
261	110.5	113.0	111.6	111.7
262	111.4	113.7	112.3	112.5
263	112.2	114.5	113.1	113.2
264	112.9	115.2	113.8	114.0

265	113.8	116.0	114.5	114.8
266	114.6	116.7	115.3	115.5
267	115.5	117.5	116.0	116.3
268	116.2	118.2	116.8	117.1
269	116.9	119.0	117.5	117.8
270	117.9	119.7	118.2	118.6
271	118.8	120.5	119.0	119.4
272	119.6	121.2	119.7	120.2
273	120.4	122.0	120.4	120.9
274	121.2	122.7	121.2	121.7
275	122.2	123.5	121.9	122.5
276	123.1	124.2	122.6	123.3
277	124.2	125.0	123.4	124.2
278	125.1	125.7	124.1	125.0
279	126.2	126.5	124.9	125.8
280	127.3	127.2	125.6	126.7
281	128.4	128.0	126.3	127.6
282	129.4	128.7	127.1	128.4
283	130.6	129.5	127.8	129.3
284	131.5	130.2	128.5	130.1
285	132.6	131.0	129.3	131.0
286	133.6	131.7	130.0	131.8
287	134.5	132.5	130.7	132.6
288	135.5	133.2	131.5	133.4
289	136.2	134.0	132.2	134.1
290	137.4	134.8	133.0	135.0
291	138.3	135.5	133.7	135.8
292	139.3	136.3	134.4	136.7

293	140.2	137.0	135.2	137.5
294	141.3	137.8	135.9	138.3
295	142.1	138.5	136.6	139.1
296	143.2	139.3	137.4	139.9
297	144.6	140.0	138.1	140.9
298	145.4	140.8	138.8	141.7
299	145.7	141.5	139.6	142.3
300	145.7	142.3	140.3	142.8
301	145.7	143.0	141.1	143.3
302	145.9	143.8	141.8	143.8
303	146.9	144.5	142.5	144.6
304	146.9	145.3	143.3	145.1
305	147.3	146.0	144.0	145.8
306	147.4	146.8	144.7	146.3
307	147.3	147.5	145.5	146.8
308	147.7	148.3	146.2	147.4
309	149.3	149.0	146.9	148.4
310	149.3	149.8	147.7	148.9

For the age based norms, the method using the mean and the standard deviation was judged to be more appropriate, as the sample sizes within the age cohorts are much smaller. Age norms were generated for specific ages from 18-30, and then for the age categories of 31-50 and 51-70. The predicted average score for every cohort was calculated using the restricted cubic splines. The predicted average standard deviation was also calculated, as the standard deviation is lower when the test takers are younger, also based on a restricted cubic splines method.

Table X. Norms of the MGKT by age group.

Score sum	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31-50	51-70
180	66.5	63.6	60.8	58.0	55.4	53.0	50.9	48.9	46.9	45.1	43.6	42.3	41.1	40.2	39.4	38.8	38.3	37.9	34.5	30.8
181	67.4	64.5	61.7	58.9	56.3	53.9	51.7	49.8	47.7	46.0	44.4	43.1	42.0	41.0	40.3	39.6	39.1	38.7	35.3	31.7
182	68.3	65.4	62.6	59.8	57.2	54.8	52.6	50.6	48.6	46.8	45.3	43.9	42.8	41.9	41.1	40.5	40.0	39.6	36.2	32.6
183	69.2	66.3	63.4	60.7	58.0	55.6	53.4	51.5	49.4	47.6	46.1	44.8	43.7	42.7	41.9	41.3	40.8	40.4	37.1	33.5
184	70.1	67.2	64.3	61.5	58.9	56.5	54.3	52.3	50.3	48.5	46.9	45.6	44.5	43.6	42.8	42.2	41.6	41.2	37.9	34.5
185	71.0	68.1	65.2	62.4	59.8	57.3	55.1	53.1	51.1	49.3	47.8	46.5	45.3	44.4	43.6	43.0	42.5	42.1	38.8	35.4
186	71.9	69.0	66.1	63.3	60.6	58.2	55.9	54.0	51.9	50.2	48.6	47.3	46.2	45.2	44.5	43.8	43.3	42.9	39.7	36.3
187	72.8	69.9	67.0	64.2	61.5	59.0	56.8	54.8	52.8	51.0	49.5	48.1	47.0	46.1	45.3	44.7	44.2	43.8	40.5	37.2
188	73.7	70.8	67.9	65.0	62.3	59.9	57.6	55.7	53.6	51.8	50.3	49.0	47.9	46.9	46.1	45.5	45.0	44.6	41.4	38.1
189	74.7	71.7	68.7	65.9	63.2	60.7	58.5	56.5	54.5	52.7	51.1	49.8	48.7	47.8	47.0	46.3	45.8	45.4	42.3	39.0
190	75.6	72.6	69.6	66.8	64.1	61.6	59.3	57.3	55.3	53.5	52.0	50.6	49.5	48.6	47.8	47.2	46.7	46.3	43.2	40.0
191	76.5	73.5	70.5	67.7	64.9	62.4	60.2	58.2	56.1	54.3	52.8	51.5	50.4	49.4	48.7	48.0	47.5	47.1	44.0	40.9
192	77.4	74.3	71.4	68.5	65.8	63.3	61.0	59.0	57.0	55.2	53.6	52.3	51.2	50.3	49.5	48.9	48.4	47.9	44.9	41.8
193	78.3	75.2	72.3	69.4	66.7	64.1	61.9	59.8	57.8	56.0	54.5	53.2	52.0	51.1	50.3	49.7	49.2	48.8	45.8	42.7
194	79.2	76.1	73.2	70.3	67.5	65.0	62.7	60.7	58.6	56.9	55.3	54.0	52.9	51.9	51.2	50.5	50.0	49.6	46.6	43.6
195	80.1	77.0	74.0	71.2	68.4	65.9	63.6	61.5	59.5	57.7	56.2	54.8	53.7	52.8	52.0	51.4	50.9	50.5	47.5	44.6
196	81.0	77.9	74.9	72.0	69.3	66.7	64.4	62.4	60.3	58.5	57.0	55.7	54.6	53.6	52.8	52.2	51.7	51.3	48.4	45.5
197	81.9	78.8	75.8	72.9	70.1	67.6	65.2	63.2	61.2	59.4	57.8	56.5	55.4	54.5	53.7	53.1	52.5	52.1	49.2	46.4
198	82.8	79.7	76.7	73.8	71.0	68.4	66.1	64.0	62.0	60.2	58.7	57.4	56.2	55.3	54.5	53.9	53.4	53.0	50.1	47.3
199	83.7	80.6	77.6	74.6	71.8	69.3	66.9	64.9	62.8	61.1	59.5	58.2	57.1	56.1	55.4	54.7	54.2	53.8	51.0	48.2
200	84.6	81.5	78.5	75.5	72.7	70.1	67.8	65.7	63.7	61.9	60.4	59.0	57.9	57.0	56.2	55.6	55.1	54.7	51.8	49.1
201	85.5	82.4	79.4	76.4	73.6	71.0	68.6	66.6	64.5	62.7	61.2	59.9	58.8	57.8	57.0	56.4	55.9	55.5	52.7	50.1
202	86.4	83.3	80.2	77.3	74.4	71.8	69.5	67.4	65.4	63.6	62.0	60.7	59.6	58.7	57.9	57.2	56.7	56.3	53.6	51.0
203	87.3	84.2	81.1	78.1	75.3	72.7	70.3	68.2	66.2	64.4	62.9	61.6	60.4	59.5	58.7	58.1	57.6	57.2	54.5	51.9
204	88.2	85.1	82.0	79.0	76.2	73.5	71.2	69.1	67.0	65.3	63.7	62.4	61.3	60.3	59.6	58.9	58.4	58.0	55.3	52.8
205	89.1	86.0	82.9	79.9	77.0	74.4	72.0	69.9	67.9	66.1	64.6	63.2	62.1	61.2	60.4	59.8	59.3	58.8	56.2	53.7
206	90.0	86.9	83.8	80.8	77.9	75.3	72.9	70.8	68.7	66.9	65.4	64.1	63.0	62.0	61.2	60.6	60.1	59.7	57.1	54.6
207	90.9	87.8	84.7	81.6	78.8	76.1	73.7	71.6	69.6	67.8	66.2	64.9	63.8	62.9	62.1	61.4	60.9	60.5	57.9	55.6
208	91.8	88.7	85.5	82.5	79.6	77.0	74.6	72.4	70.4	68.6	67.1	65.7	64.6	63.7	62.9	62.3	61.8	61.4	58.8	56.5

209	92.7	89.5	86.4	83.4	80.5	77.8	75.4	73.3	71.2	69.4	67.9	66.6	65.5	64.5	63.8	63.1	62.6	62.2	59.7	57.4
210	93.6	90.4	87.3	84.3	81.4	78.7	76.2	74.1	72.1	70.3	68.7	67.4	66.3	65.4	64.6	64.0	63.4	63.0	60.5	58.3
211	94.5	91.3	88.2	85.1	82.2	79.5	77.1	74.9	72.9	71.1	69.6	68.3	67.1	66.2	65.4	64.8	64.3	63.9	61.4	59.2
212	95.5	92.2	89.1	86.0	83.1	80.4	77.9	75.8	73.7	72.0	70.4	69.1	68.0	67.0	66.3	65.6	65.1	64.7	62.3	60.1
213	96.4	93.1	90.0	86.9	83.9	81.2	78.8	76.6	74.6	72.8	71.3	69.9	68.8	67.9	67.1	66.5	66.0	65.6	63.1	61.1
214	97.3	94.0	90.8	87.7	84.8	82.1	79.6	77.5	75.4	73.6	72.1	70.8	69.7	68.7	67.9	67.3	66.8	66.4	64.0	62.0
215	98.2	94.9	91.7	88.6	85.7	82.9	80.5	78.3	76.3	74.5	72.9	71.6	70.5	69.6	68.8	68.2	67.6	67.2	64.9	62.9
216	99.1	95.8	92.6	89.5	86.5	83.8	81.3	79.1	77.1	75.3	73.8	72.5	71.3	70.4	69.6	69.0	68.5	68.1	65.8	63.8
217	100.0	96.7	93.5	90.4	87.4	84.6	82.2	80.0	77.9	76.2	74.6	73.3	72.2	71.2	70.5	69.8	69.3	68.9	66.6	64.7
218	100.9	97.6	94.4	91.2	88.3	85.5	83.0	80.8	78.8	77.0	75.5	74.1	73.0	72.1	71.3	70.7	70.2	69.8	67.5	65.6
219	101.8	98.5	95.3	92.1	89.1	86.4	83.9	81.7	79.6	77.8	76.3	75.0	73.9	72.9	72.1	71.5	71.0	70.6	68.4	66.6
220	102.7	99.4	96.1	93.0	90.0	87.2	84.7	82.5	80.5	78.7	77.1	75.8	74.7	73.8	73.0	72.3	71.8	71.4	69.2	67.5
221	103.6	100.3	97.0	93.9	90.9	88.1	85.5	83.3	81.3	79.5	78.0	76.7	75.5	74.6	73.8	73.2	72.7	72.3	70.1	68.4
222	104.5	101.2	97.9	94.7	91.7	88.9	86.4	84.2	82.1	80.4	78.8	77.5	76.4	75.4	74.7	74.0	73.5	73.1	71.0	69.3
223	105.4	102.1	98.8	95.6	92.6	89.8	87.2	85.0	83.0	81.2	79.6	78.3	77.2	76.3	75.5	74.9	74.4	73.9	71.8	70.2
224	106.3	103.0	99.7	96.5	93.4	90.6	88.1	85.9	83.8	82.0	80.5	79.2	78.0	77.1	76.3	75.7	75.2	74.8	72.7	71.1
225	107.2	103.8	100.6	97.4	94.3	91.5	88.9	86.7	84.7	82.9	81.3	80.0	78.9	77.9	77.2	76.5	76.0	75.6	73.6	72.1
226	108.1	104.7	101.4	98.2	95.2	92.3	89.8	87.5	85.5	83.7	82.2	80.8	79.7	78.8	78.0	77.4	76.9	76.5	74.4	73.0
227	109.0	105.6	102.3	99.1	96.0	93.2	90.6	88.4	86.3	84.5	83.0	81.7	80.6	79.6	78.9	78.2	77.7	77.3	75.3	73.9
228	109.9	106.5	103.2	100.0	96.9	94.0	91.5	89.2	87.2	85.4	83.8	82.5	81.4	80.5	79.7	79.1	78.5	78.1	76.2	74.8
229	110.8	107.4	104.1	100.9	97.8	94.9	92.3	90.0	88.0	86.2	84.7	83.4	82.2	81.3	80.5	79.9	79.4	79.0	77.1	75.7
230	111.7	108.3	105.0	101.7	98.6	95.8	93.2	90.9	88.8	87.1	85.5	84.2	83.1	82.1	81.4	80.7	80.2	79.8	77.9	76.6
231	112.6	109.2	105.9	102.6	99.5	96.6	94.0	91.7	89.7	87.9	86.4	85.0	83.9	83.0	82.2	81.6	81.1	80.7	78.8	77.6
232	113.5	110.1	106.7	103.5	100.4	97.5	94.9	92.6	90.5	88.7	87.2	85.9	84.8	83.8	83.0	82.4	81.9	81.5	79.7	78.5
233	114.4	111.0	107.6	104.3	101.2	98.3	95.7	93.4	91.4	89.6	88.0	86.7	85.6	84.7	83.9	83.3	82.7	82.3	80.5	79.4
234	115.4	111.9	108.5	105.2	102.1	99.2	96.5	94.2	92.2	90.4	88.9	87.6	86.4	85.5	84.7	84.1	83.6	83.2	81.4	80.3
235	116.3	112.8	109.4	106.1	102.9	100.0	97.4	95.1	93.0	91.3	89.7	88.4	87.3	86.3	85.6	84.9	84.4	84.0	82.3	81.2
236	117.2	113.7	110.3	107.0	103.8	100.9	98.2	95.9	93.9	92.1	90.6	89.2	88.1	87.2	86.4	85.8	85.3	84.9	83.1	82.1
237	118.1	114.6	111.2	107.8	104.7	101.7	99.1	96.8	94.7	92.9	91.4	90.1	89.0	88.0	87.2	86.6	86.1	85.7	84.0	83.1
238	119.0	115.5	112.0	108.7	105.5	102.6	99.9	97.6	95.6	93.8	92.2	90.9	89.8	88.9	88.1	87.4	86.9	86.5	84.9	84.0
239	119.9	116.4	112.9	109.6	106.4	103.4	100.8	98.4	96.4	94.6	93.1	91.7	90.6	89.7	88.9	88.3	87.8	87.4	85.7	84.9
240	120.8	117.3	113.8	110.5	107.3	104.3	101.6	99.3	97.2	95.4	93.9	92.6	91.5	90.5	89.8	89.1	88.6	88.2	86.6	85.8
241	121.7	118.1	114.7	111.3	108.1	105.2	102.5	100.1	98.1	96.3	94.7	93.4	92.3	91.4	90.6	90.0	89.5	89.0	87.5	86.7

242	122.6	119.0	115.6	112.2	109.0	106.0	103.3	101.0	98.9	97.1	95.6	94.3	93.1	92.2	91.4	90.8	90.3	89.9	88.4	87.6
243	123.5	119.9	116.5	113.1	109.9	106.9	104.2	101.8	99.7	98.0	96.4	95.1	94.0	93.0	92.3	91.6	91.1	90.7	89.2	88.6
244	124.4	120.8	117.3	114.0	110.7	107.7	105.0	102.6	100.6	98.8	97.3	95.9	94.8	93.9	93.1	92.5	92.0	91.6	90.1	89.5
245	125.3	121.7	118.2	114.8	111.6	108.6	105.8	103.5	101.4	99.6	98.1	96.8	95.7	94.7	93.9	93.3	92.8	92.4	91.0	90.4
246	126.2	122.6	119.1	115.7	112.4	109.4	106.7	104.3	102.3	100.5	98.9	97.6	96.5	95.6	94.8	94.2	93.6	93.2	91.8	91.3
247	127.1	123.5	120.0	116.6	113.3	110.3	107.5	105.1	103.1	101.3	99.8	98.5	97.3	96.4	95.6	95.0	94.5	94.1	92.7	92.2
248	128.0	124.4	120.9	117.5	114.2	111.1	108.4	106.0	103.9	102.2	100.6	99.3	98.2	97.2	96.5	95.8	95.3	94.9	93.6	93.2
249	128.9	125.3	121.8	118.3	115.0	112.0	109.2	106.8	104.8	103.0	101.5	100.1	99.0	98.1	97.3	96.7	96.2	95.8	94.4	94.1
250	129.8	126.2	122.7	119.2	115.9	112.8	110.1	107.7	105.6	103.8	102.3	101.0	99.9	98.9	98.1	97.5	97.0	96.6	95.3	95.0
251	130.7	127.1	123.5	120.1	116.8	113.7	110.9	108.5	106.5	104.7	103.1	101.8	100.7	99.8	99.0	98.3	97.8	97.4	96.2	95.9
252	131.6	128.0	124.4	120.9	117.6	114.5	111.8	109.3	107.3	105.5	104.0	102.7	101.5	100.6	99.8	99.2	98.7	98.3	97.0	96.8
253	132.5	128.9	125.3	121.8	118.5	115.4	112.6	110.2	108.1	106.4	104.8	103.5	102.4	101.4	100.7	100.0	99.5	99.1	97.9	97.7
254	133.4	129.8	126.2	122.7	119.4	116.3	113.5	111.0	109.0	107.2	105.7	104.3	103.2	102.3	101.5	100.9	100.4	99.9	98.8	98.7
255	134.3	130.7	127.1	123.6	120.2	117.1	114.3	111.9	109.8	108.0	106.5	105.2	104.1	103.1	102.3	101.7	101.2	100.8	99.7	99.6
256	135.2	131.6	128.0	124.4	121.1	118.0	115.1	112.7	110.7	108.9	107.3	106.0	104.9	104.0	103.2	102.5	102.0	101.6	100.5	100.5
257	136.2	132.5	128.8	125.3	122.0	118.8	116.0	113.5	111.5	109.7	108.2	106.8	105.7	104.8	104.0	103.4	102.9	102.5	101.4	101.4
258	137.1	133.3	129.7	126.2	122.8	119.7	116.8	114.4	112.3	110.5	109.0	107.7	106.6	105.6	104.9	104.2	103.7	103.3	102.3	102.3
259	138.0	134.2	130.6	127.1	123.7	120.5	117.7	115.2	113.2	111.4	109.8	108.5	107.4	106.5	105.7	105.1	104.5	104.1	103.1	103.2
260	138.9	135.1	131.5	127.9	124.5	121.4	118.5	116.1	114.0	112.2	110.7	109.4	108.2	107.3	106.5	105.9	105.4	105.0	104.0	104.2
261	139.8	136.0	132.4	128.8	125.4	122.2	119.4	116.9	114.8	113.1	111.5	110.2	109.1	108.1	107.4	106.7	106.2	105.8	104.9	105.1
262	140.7	136.9	133.3	129.7	126.3	123.1	120.2	117.7	115.7	113.9	112.4	111.0	109.9	109.0	108.2	107.6	107.1	106.7	105.7	106.0
263	141.6	137.8	134.1	130.6	127.1	123.9	121.1	118.6	116.5	114.7	113.2	111.9	110.8	109.8	109.0	108.4	107.9	107.5	106.6	106.9
264	142.5	138.7	135.0	131.4	128.0	124.8	121.9	119.4	117.4	115.6	114.0	112.7	111.6	110.7	109.9	109.3	108.7	108.3	107.5	107.8
265	143.4	139.6	135.9	132.3	128.9	125.7	122.8	120.3	118.2	116.4	114.9	113.6	112.4	111.5	110.7	110.1	109.6	109.2	108.3	108.7
266	144.3	140.5	136.8	133.2	129.7	126.5	123.6	121.1	119.0	117.3	115.7	114.4	113.3	112.3	111.6	110.9	110.4	110.0	109.2	109.7
267	145.2	141.4	137.7	134.1	130.6	127.4	124.5	121.9	119.9	118.1	116.6	115.2	114.1	113.2	112.4	111.8	111.3	110.9	110.1	110.6
268	146.1	142.3	138.6	134.9	131.5	128.2	125.3	122.8	120.7	118.9	117.4	116.1	115.0	114.0	113.2	112.6	112.1	111.7	111.0	111.5
269	147.0	143.2	139.4	135.8	132.3	129.1	126.1	123.6	121.6	119.8	118.2	116.9	115.8	114.9	114.1	113.4	112.9	112.5	111.8	112.4
270	147.9	144.1	140.3	136.7	133.2	129.9	127.0	124.4	122.4	120.6	119.1	117.8	116.6	115.7	114.9	114.3	113.8	113.4	112.7	113.3
271	148.8	145.0	141.2	137.5	134.0	130.8	127.8	125.3	123.2	121.5	119.9	118.6	117.5	116.5	115.8	115.1	114.6	114.2	113.6	114.2
272	149.7	145.9	142.1	138.4	134.9	131.6	128.7	126.1	124.1	122.3	120.7	119.4	118.3	117.4	116.6	116.0	115.5	115.0	114.4	115.2
273	150.6	146.8	143.0	139.3	135.8	132.5	129.5	127.0	124.9	123.1	121.6	120.3	119.1	118.2	117.4	116.8	116.3	115.9	115.3	116.1
274	151.5	147.6	143.9	140.2	136.6	133.3	130.4	127.8	125.8	124.0	122.4	121.1	120.0	119.0	118.3	117.6	117.1	116.7	116.2	117.0

275	152.4	148.5	144.7	141.0	137.5	134.2	131.2	128.6	126.6	124.8	123.3	121.9	120.8	119.9	119.1	118.5	118.0	117.6	117.0	117.9
276	153.3	149.4	145.6	141.9	138.4	135.0	132.1	129.5	127.4	125.6	124.1	122.8	121.7	120.7	120.0	119.3	118.8	118.4	117.9	118.8
277	154.2	150.3	146.5	142.8	139.2	135.9	132.9	130.3	128.3	126.5	124.9	123.6	122.5	121.6	120.8	120.2	119.6	119.2	118.8	119.7
278	155.1	151.2	147.4	143.7	140.1	136.8	133.8	131.2	129.1	127.3	125.8	124.5	123.3	122.4	121.6	121.0	120.5	120.1	119.6	120.7
279	156.0	152.1	148.3	144.5	141.0	137.6	134.6	132.0	129.9	128.2	126.6	125.3	124.2	123.2	122.5	121.8	121.3	120.9	120.5	121.6
280	157.0	153.0	149.2	145.4	141.8	138.5	135.4	132.8	130.8	129.0	127.5	126.1	125.0	124.1	123.3	122.7	122.2	121.8	121.4	122.5
281	157.9	153.9	150.0	146.3	142.7	139.3	136.3	133.7	131.6	129.8	128.3	127.0	125.9	124.9	124.1	123.5	123.0	122.6	122.3	123.4
282	158.8	154.8	150.9	147.2	143.5	140.2	137.1	134.5	132.5	130.7	129.1	127.8	126.7	125.8	125.0	124.4	123.8	123.4	123.1	124.3
283	159.7	155.7	151.8	148.0	144.4	141.0	138.0	135.4	133.3	131.5	130.0	128.7	127.5	126.6	125.8	125.2	124.7	124.3	124.0	125.2
284	160.6	156.6	152.7	148.9	145.3	141.9	138.8	136.2	134.1	132.4	130.8	129.5	128.4	127.4	126.7	126.0	125.5	125.1	124.9	126.2
285	161.5	157.5	153.6	149.8	146.1	142.7	139.7	137.0	135.0	133.2	131.7	130.3	129.2	128.3	127.5	126.9	126.4	126.0	125.7	127.1
286	162.4	158.4	154.5	150.6	147.0	143.6	140.5	137.9	135.8	134.0	132.5	131.2	130.1	129.1	128.3	127.7	127.2	126.8	126.6	128.0
287	163.3	159.3	155.3	151.5	147.9	144.4	141.4	138.7	136.7	134.9	133.3	132.0	130.9	130.0	129.2	128.5	128.0	127.6	127.5	128.9
288	164.2	160.2	156.2	152.4	148.7	145.3	142.2	139.5	137.5	135.7	134.2	132.8	131.7	130.8	130.0	129.4	128.9	128.5	128.3	129.8
289	165.1	161.1	157.1	153.3	149.6	146.2	143.1	140.4	138.3	136.5	135.0	133.7	132.6	131.6	130.9	130.2	129.7	129.3	129.2	130.7
290	166.0	161.9	158.0	154.1	150.5	147.0	143.9	141.2	139.2	137.4	135.8	134.5	133.4	132.5	131.7	131.1	130.6	130.1	130.1	131.7
291	166.9	162.8	158.9	155.0	151.3	147.9	144.8	142.1	140.0	138.2	136.7	135.4	134.2	133.3	132.5	131.9	131.4	131.0	130.9	132.6
292	167.8	163.7	159.8	155.9	152.2	148.7	145.6	142.9	140.8	139.1	137.5	136.2	135.1	134.1	133.4	132.7	132.2	131.8	131.8	133.5
293	168.7	164.6	160.6	156.8	153.0	149.6	146.4	143.7	141.7	139.9	138.4	137.0	135.9	135.0	134.2	133.6	133.1	132.7	132.7	134.4
294	169.6	165.5	161.5	157.6	153.9	150.4	147.3	144.6	142.5	140.7	139.2	137.9	136.8	135.8	135.0	134.4	133.9	133.5	133.6	135.3
295	170.5	166.4	162.4	158.5	154.8	151.3	148.1	145.4	143.4	141.6	140.0	138.7	137.6	136.7	135.9	135.3	134.7	134.3	134.4	136.2
296	171.4	167.3	163.3	159.4	155.6	152.1	149.0	146.3	144.2	142.4	140.9	139.6	138.4	137.5	136.7	136.1	135.6	135.2	135.3	137.2
297	172.3	168.2	164.2	160.3	156.5	153.0	149.8	147.1	145.0	143.3	141.7	140.4	139.3	138.3	137.6	136.9	136.4	136.0	136.2	138.1
298	173.2	169.1	165.1	161.1	157.4	153.8	150.7	147.9	145.9	144.1	142.6	141.2	140.1	139.2	138.4	137.8	137.3	136.9	137.0	139.0
299	174.1	170.0	165.9	162.0	158.2	154.7	151.5	148.8	146.7	144.9	143.4	142.1	141.0	140.0	139.2	138.6	138.1	137.7	137.9	139.9
300	175.0	170.9	166.8	162.9	159.1	155.5	152.4	149.6	147.6	145.8	144.2	142.9	141.8	140.9	140.1	139.4	138.9	138.5	138.8	140.8
301	175.9	171.8	167.7	163.8	160.0	156.4	153.2	150.5	148.4	146.6	145.1	143.8	142.6	141.7	140.9	140.3	139.8	139.4	139.6	141.8
302	176.8	172.7	168.6	164.6	160.8	157.3	154.1	151.3	149.2	147.5	145.9	144.6	143.5	142.5	141.8	141.1	140.6	140.2	140.5	142.7
303	177.8	173.6	169.5	165.5	161.7	158.1	154.9	152.1	150.1	148.3	146.8	145.4	144.3	143.4	142.6	142.0	141.5	141.0	141.4	143.6
304	178.7	174.5	170.4	166.4	162.6	159.0	155.7	153.0	150.9	149.1	147.6	146.3	145.2	144.2	143.4	142.8	142.3	141.9	142.2	144.5
305	179.6	175.4	171.3	167.2	163.4	159.8	156.6	153.8	151.8	150.0	148.4	147.1	146.0	145.1	144.3	143.6	143.1	142.7	143.1	145.4
306	180.5	176.3	172.1	168.1	164.3	160.7	157.4	154.6	152.6	150.8	149.3	147.9	146.8	145.9	145.1	144.5	144.0	143.6	144.0	146.3
307	181.4	177.1	173.0	169.0	165.1	161.5	158.3	155.5	153.4	151.6	150.1	148.8	147.7	146.7	146.0	145.3	144.8	144.4	144.9	147.3

308	182.3	178.0	173.9	169.9	166.0	162.4	159.1	156.3	154.3	152.5	150.9	149.6	148.5	147.6	146.8	146.2	145.6	145.2	145.7	148.2
309	183.2	178.9	174.8	170.7	166.9	163.2	160.0	157.2	155.1	153.3	151.8	150.5	149.3	148.4	147.6	147.0	146.5	146.1	146.6	149.1
310	184.1	179.8	175.7	171.6	167.7	164.1	160.8	158.0	155.9	154.2	152.6	151.3	150.2	149.2	148.5	147.8	147.3	146.9	147.5	150.0

It should be noted that IQ scores at the extremes of the distribution are not reliable. This is because there are too few extreme scorers within a dataset to accurately capture the distribution at the tails and they tend to regress to the mean (Lohman & Korb, 2006). Because of this, we recommend winsorizing scores below 60 or above 140 by half, that is, somebody who scores 180 should be assigned a score of 160 instead.

Appendix

Table Ax. Associated factor by question (CFA model).

Questions	Associated factor
Poets	Literary Knowledge
Musicals	Literary Knowledge
Holidays	Cultural Knowledge
Makeup	Aesthetic Knowledge
Painkillers	Cultural Knowledge
STDs	Cultural Knowledge
Cigarette brands	Cultural Knowledge
Weed slang	Cultural Knowledge
Colonies of france	International Knowledge
Monarchies	International Knowledge
Oil producers	International Knowledge
Nuclear powers	International Knowledge
Video file types	Computational Knowledge
Web browsers	Computational Knowledge
Linux OSs	Computational Knowledge
HTTP status codes	Computational Knowledge
Garments	Aesthetic Knowledge

Craftsman's tools	Technical Knowledge
Red wines	Aesthetic Knowledge
Card games	Cultural Knowledge
Electronic components	Technical Knowledge
Cryptocurrencies	Computational Knowledge
Countries with pyramids	International Knowledge
Famous criminals	Cultural Knowledge
1000 page books	Literary Knowledge
Units of distance	Technical Knowledge
Exercise programs	Aesthetic Knowledge
Synonyms of fancy	Technical Knowledge
Computer cables	Computational Knowledge
Cancers	Cultural Knowledge
Fabric patterns	Aesthetic Knowledge

Table AX. General Knowledge by country (no bias adjustment)

Country	General Knowledge	Sample Size
Austria	95.8	55
Australia	97.2	810
Belgium	93.7	81
Brazil	88.8	176
Canada	100.3	1333
Switzerland	96.5	83
Czechia	94.6	68
Germany	93.9	383
Denmark	92.8	71
Spain	91.8	84
Finland	93.9	123
France	93.5	194
United Kingdom	96.9	1657
Greece	87.6	98
Croatia	92.3	78
Indonesia	84.6	143
Ireland	100.4	137
India	85.7	232
Italy	92.8	137
Japan	97.0	55
Mexico	90.9	83
Malaysia	79.4	139
Netherlands	94.1	221
Norway	94.8	95
New Zealand	98.6	202
Philippines	75.0	236
Poland	91.2	193
Portugal	89.8	66
Romania	86.0	112

Serbia	87.9	78
Russia	90.7	90
Sweden	94.9	203
Singapore	90.0	141
Turkey	85.6	65
United States	100.0	9494
South Africa	93.2	117

Fragment AX. Countries listed by regional category:

- Anglo: US, UK, Canada, New Zealand, Australia, Ireland, South Africa
- Latin American: Mexico, Nicaragua, Panama, Peru, Philippines, Puerto Rico, Paraguay, El Salvador, Uruguay, Argentina, Bolivia, Brazil, Belize, Chile, Columbia, Costa Rica, Cuba, Ecuador, Guatemala, Honduras, Guyana
- German: Germany, Switzerland, Austria
- Northern European: Norway, Sweden, Finland, Belgium, Denmark, Netherlands, Iceland, Luxembourg
- Southern European: Portugal, Spain, France, Andorra, Italy, Greece, Malta
- Eastern European: Estonia, Latvia, Lithuania, Russia, Belarus, Ukraine, Poland, Czechia, Slovakia, Moldova, Hungary, Romania, Slovenia,
- Balkan: Serbia, Macedonia, Albania, Micronesia, Bosnia, Montenegro, Croatia
- Caucasus: Turkey, Georgia, Azerbaijan, Armenia, Kazakhstan, Cyprus
- MENA: Afghanistan, Algeria, Iran, Israel, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Tunisia, Egypt
- South Asian: India, Bangladesh, Maldives, Nepal, Bahrain
- East Asian: Hong Kong, Singapore, Japan, China, South Korea, Taiwan, North Korea, Mongolia
- South East Asian: Laos, Malaysia, Thailand, Vietnam, Philippines, Cambodia
- African: Kenya, Sri Lanka, Madagascar, Mauritius, Malawi, Maldives, Nigeria, Mozambique, Seychelles, Sudan, Somalia, South Sudan, Tanizia, Ugandan, Zambia, Zimbabwe, Ethiopia, Ghana, Rwanda
-

Figure AX. Bias in Germans vs Anglos in the distractors

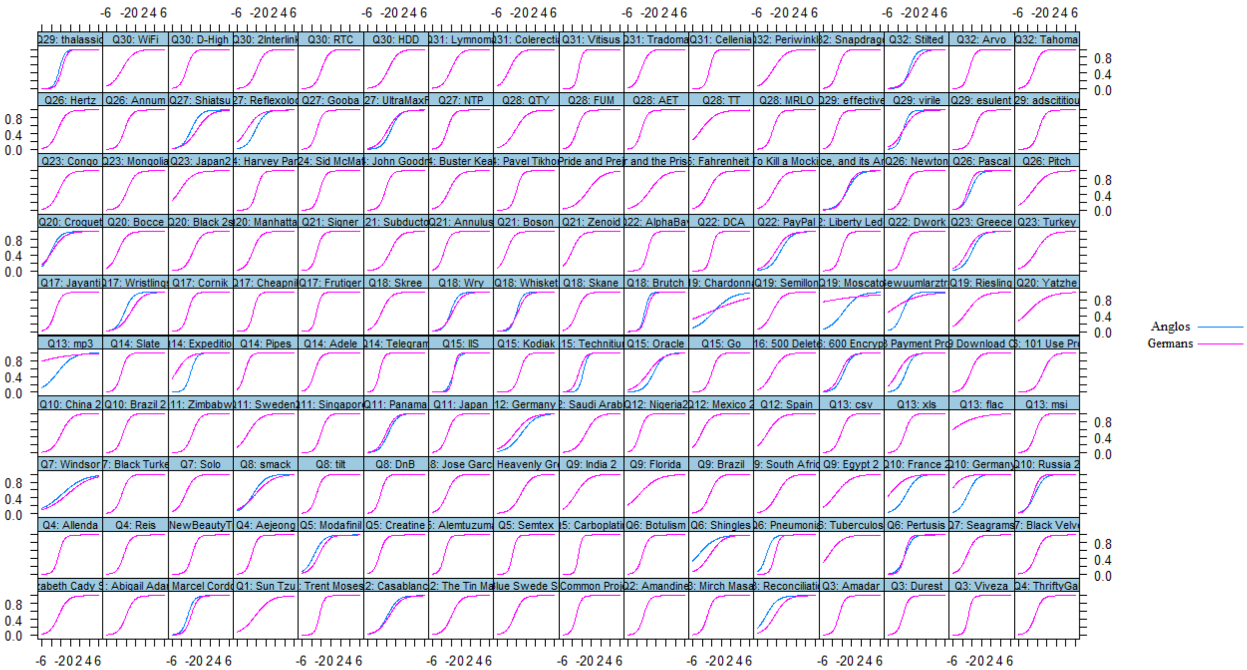


Figure AX. Bias in Germans vs Anglos in the answers