

Psychometrics: the big bad g-factor

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What are IQ / SAT / GRE ?

Operational perspective: who cares, as long as they have predictive power!

What are IQ / SAT / GRE ?

By construction:

I. Choose a battery of n "cognitive" tests, e.g.,

(1) digit recall (short term memory)

(2) vocabulary

(3) math puzzles

(4) spatial rotations

...

($n-1$) reaction time

(n) pitch recognition (music)

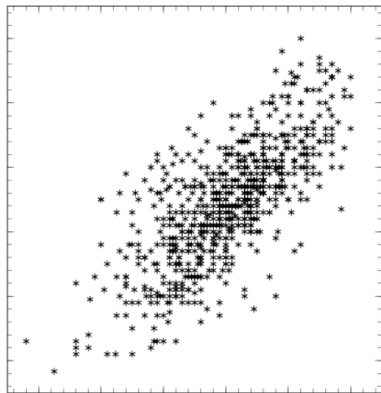
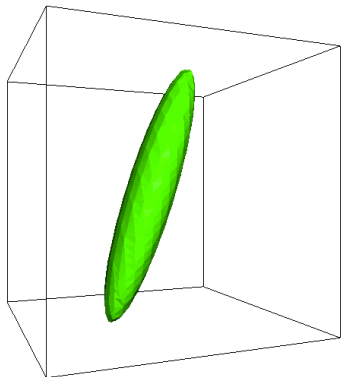
II. Test a lot of people.

{individual} \rightarrow n vector \rightarrow scalar (single number)

(LOSSY) **COMPRESSION!**

Results

- All "cognitive" observables seem to be *positively* correlated
- Use factor analysis or principal components to isolate direction of largest variation in the n-dimensional space



General factor of intelligence

Largest principal component of variation:

g factor = general factor of intelligence \approx IQ \approx SAT \approx GRE
 \approx overall goodness of cognitive functioning?

- Note these are *population level* correlations – compression may not work for a particular individual: value of g may not predict individual components of n-vector very well. But works for “typical” individuals.
- SAT, GRE heavily g-loaded: high correlation with g or IQ; “SAT is an IQ test”

IQ: mean 100, SD 15 (normally distributed)

SAT (M+V): mean 1000, SD 150 (beware 1995 “recentering”)

What good is it?

PRO: Most impressive quantitative results in all of psychology.
Results are stable after late adolescence (reliability).
Results are predictive (validity).
It's heritable (twin studies). **Gulp!**

CON: Only explains small fraction of variance in life outcomes.

College outcomes: two factor working model

Factor 1: SAT (cognitive ability)

Factor 2: Conscientiousness, work ethic, motivation ...

These factors are only weakly correlated with each other.

To what extent can Factor 2 compensate for Factor 1? For fixed values of SAT, what is the range of outcomes in college performance?

Are there *cognitive thresholds* for certain subjects, such that mastery is very unlikely below a certain SAT threshold (i.e., no matter how dedicated or hard working the student)?