

DECISION MAKING REDEFINES HUMAN INTELLIGENCE

A COMPREHENSIVE MODEL OF THE ROLE OF DECISION MAKING IN THE STRUCTURE OF HUMAN COGNITIVE ABILITIES

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INTELLIGENCE & DECISION MAKING

- For 150 years, theory has assumed that innate differences in intelligence cause differences in decision quality and life outcomes (i.e., health, wealth, happiness).
- Previous analyses of cognitive abilities have not included broad tests of decision making skills and processes (e.g., risky decision making, heuristics and biases).
- Specific relations between fluid intelligence (e.g., Raven's Matrices) and decision making ability tend to be small compared to factors like numeracy and risk literacy.

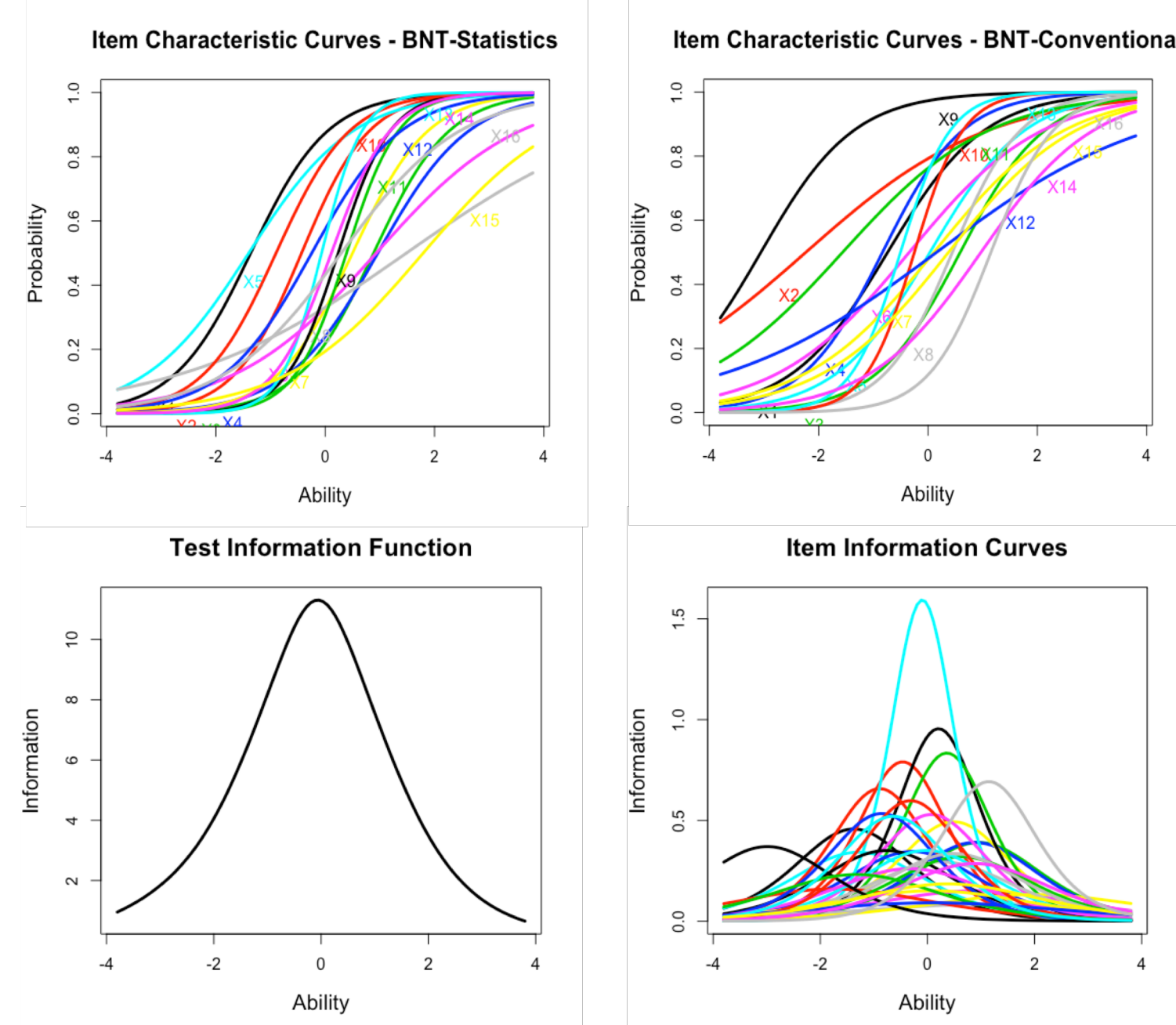
What is the relationship between general cognitive abilities and decision making skill?

RISK LITERACY & NUMERACY

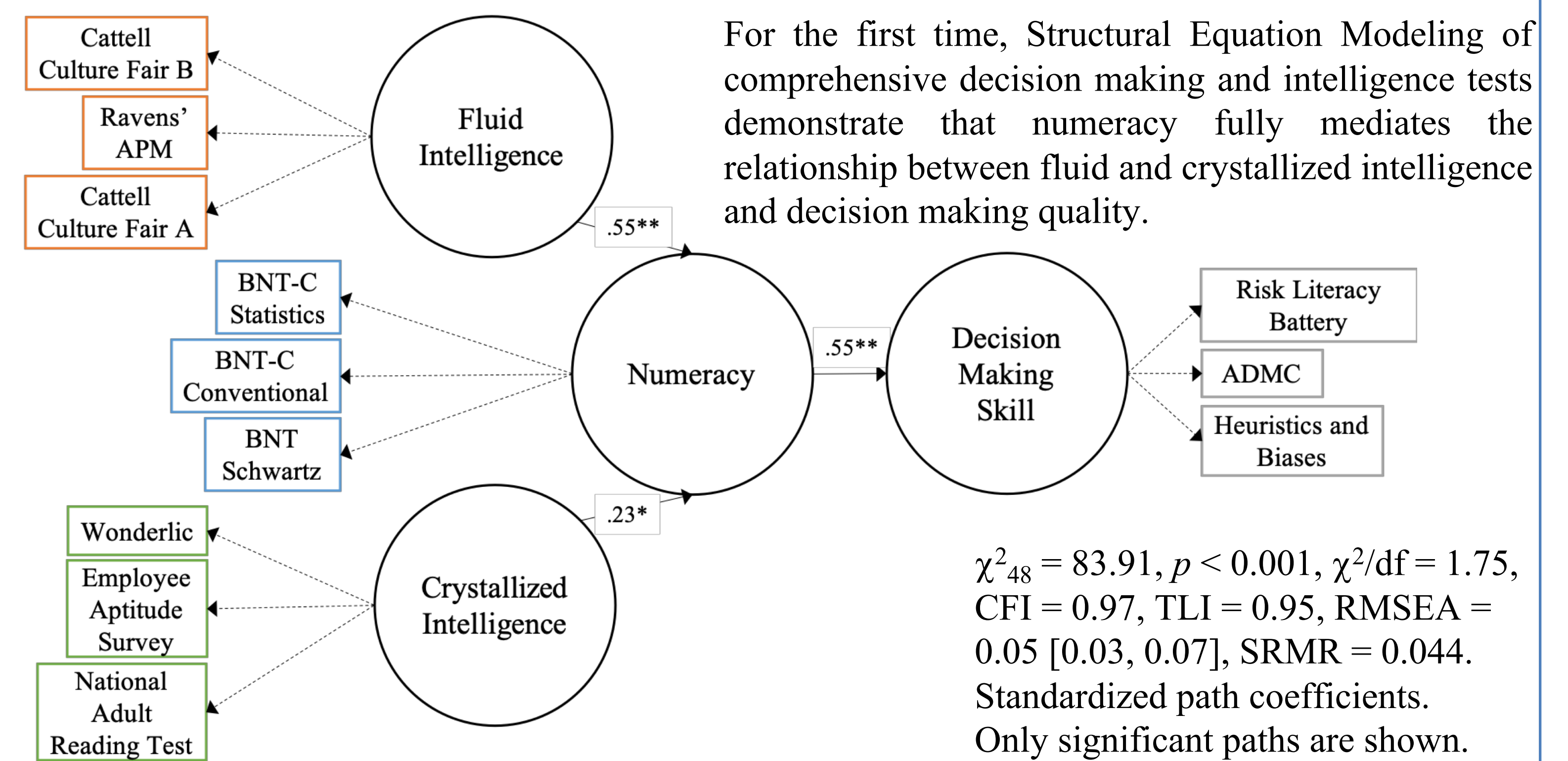
- Risk literacy is defined as the ability to evaluate and understand risk, in the service of skilled and informed decision making (www.RiskLiteracy.org)
- Brief instruments like the Berlin Numeracy Test (BNT) are powerful predictors of decision vulnerability and risky decision making.
 - Brief (3-7 item; 3 min.) **numeracy tests are often the single best predictors of generally superior decision making among diverse individuals from industrialized countries.**
 - Statistical numeracy predicts informed decision making and better outcomes across a wide-range of real-world and paradigmatic domains (e.g., health, wealth, relationships, happiness, etc.).

METHODS

- Study 2 of the 5 year Risk Literacy Components Study (see RiskLiteracy.org)
- 309 students recruited from a university sample completed a five hour assessment battery over the course of 5-12 weeks.
- 112 (36.2%) male and 197 (63.7%) female participants. 97% were under the age of 25.
- The comprehensive battery included numerous intelligence (fluid and crystallized) tests, standard decision making batteries (e.g., Adult Decision Making Competence), and component numeracy measures (e.g., Berlin Numeracy Test)
- For the first time, IRT Optimized Component Numeracy scales made it possible to include measures of statistical and conventional numeracy, broad decision quality assessments, and general intelligence tests in the structural modeling of human cognitive abilities.

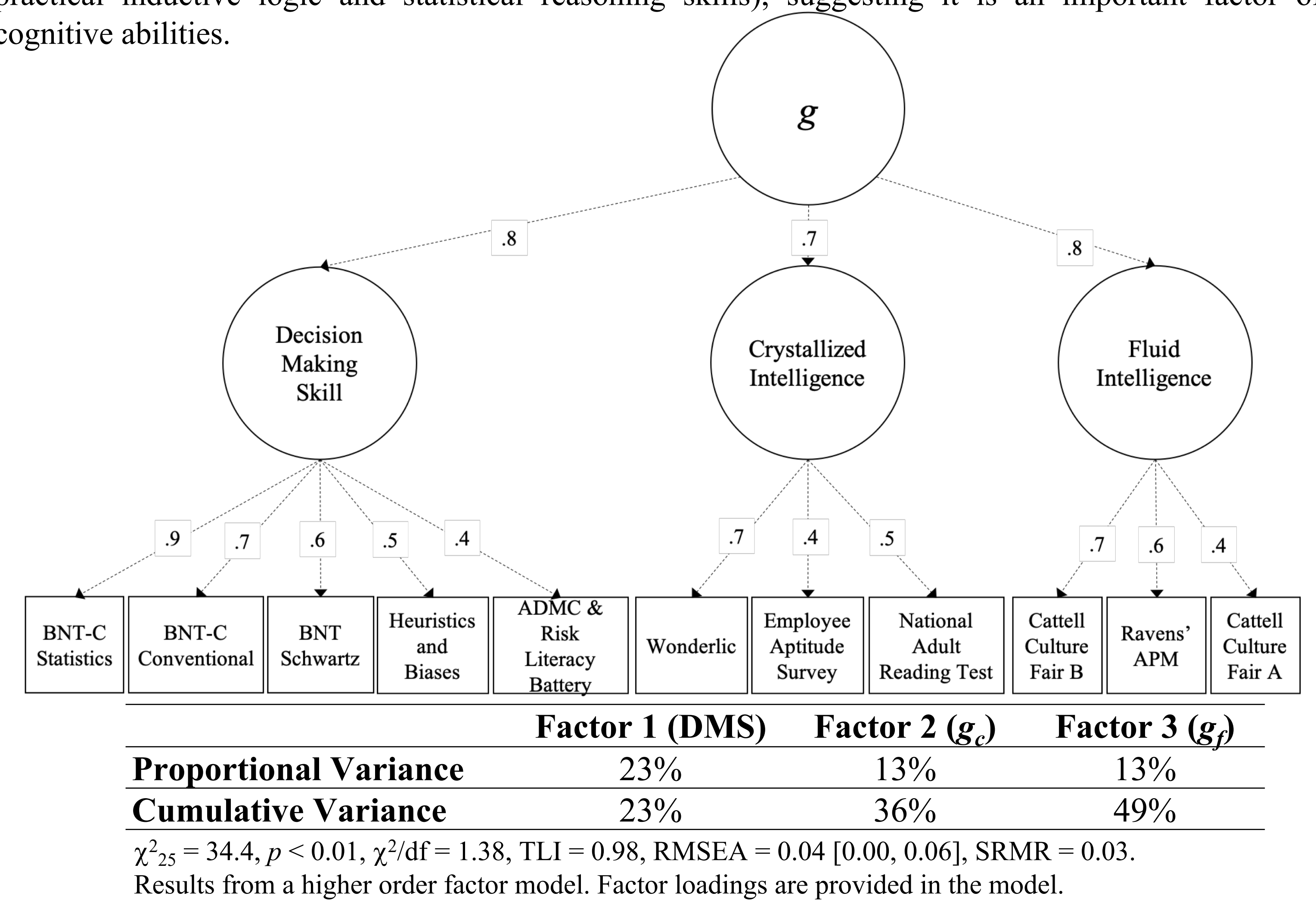


MODELING DECISION MAKING SKILL



ABILITY FACTOR ANALYSIS

A restructuring of Carroll's (1993) model emerges when statistical numeracy and general decision making skill are broadly represented, resulting in a new first factor, *Decision Making Skill* (e.g., practical inductive logic and statistical reasoning skills), suggesting it is an important factor of cognitive abilities.



DISCUSSION

- **Previous studies of intelligence have failed to adequately measure decision making.**
 - Previous models of cognitive abilities (including Carroll, 1993) have largely failed to incorporate decision making tasks, finding that g was predominately Fluid Intelligence, Crystallized Intelligence, and General Memory and Learning.
- **Numeracy is the strongest predictor of superior decision making skill.**
 - Helps explain why quantitative skills are the most influential educational variable associated with economic prosperity in industrialized countries (Hanushek & Woessmann, 2010).
- **General decision making skill does not require high levels of basic cognitive capacities (i.e., fluid intelligence).**
 - Crystallized intelligence (i.e., acquired knowledge) independently out-predicts fluid intelligence.
 - Helps explain why nearly anyone with proper training and access to resources can make informed decisions, in accord with their beliefs, values, and goals.

REFERENCES

Bruine de Bruin, W., Parker, A. M., & Fischhoff, B. (2007). Individual differences in adult decision-making competence. *Journal of personality and social psychology, 92*(5), 938.

Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies*. Cambridge University Press.

Cokely, E. T., Feltz, A., Ghazal, S., Allan, J. N., Petrova, D., & Garcia-Retamero, R. (2018). Skilled Decision Theory: From intelligence to numeracy and expertise. In K. A. Ericsson, R. R. Hoffman, A. Kozbelt, & A. M. Williams (2nd Eds.), *Cambridge Handbook of Expertise and Expert Performance*. New York, NY: Cambridge University Press.

Cokely, E. T., Galesic, M., Schulz, E., Ghazal, S., & Garcia-Retamero, R. (2012). Measuring Risk Literacy: The Berlin Numeracy Test. *Judgment & Decision Making, 7*(1).

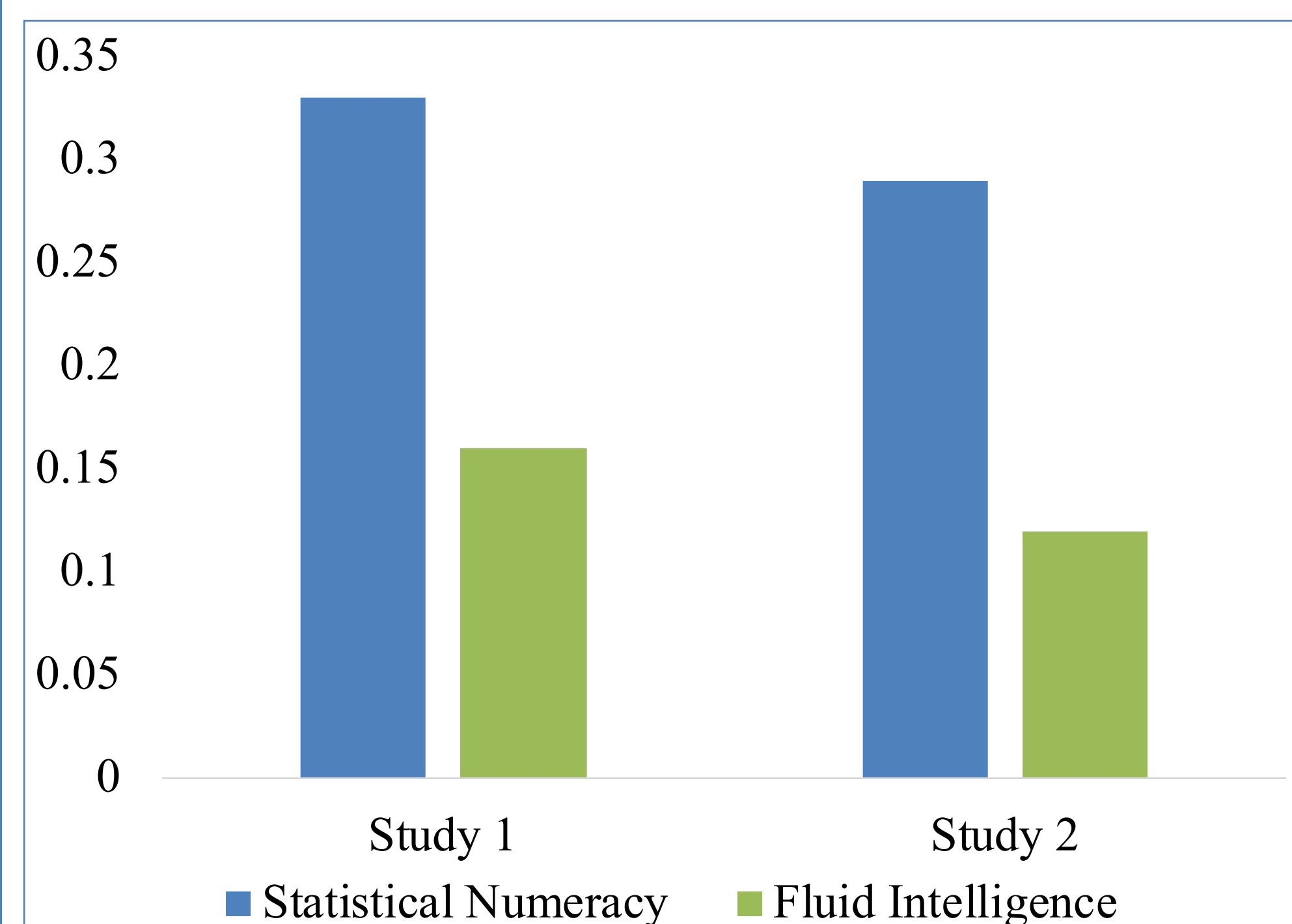
Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological review, 100*(3), 363.

Ghazal, S. (2014). *Component numeracy skills and decision making*. PhD Dissertation, Michigan Technological University.

Gigerenzer, G., Todd, P. M., & ABC Research Group, T. (1999). *Simple heuristics that make us smart*. Oxford University Press.

INTELLIGENCE vs. NUMERACY

COMPARATIVE PREDICTION ON DECISION MAKING ABILITY



Statistical numeracy is the strongest single predictor or decision making skill, almost doubling the predictive power of fluid intelligence.

As measured by The Berlin Numeracy Test (a 4 minute, 7 item scale; RiskLiteracy.org).

Note. Each bar represents the R² from a single-predictor simple linear regression, with a composite of decision making quality as the dependent variable.