

Personality and Ability: Assessing ability using the International Cognitive Ability Resource (ICAR)

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- 2 Prior work
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Personality and ability

- ① Traditional research in personality (1850-1950) included ability
 - Emphasis upon broad individual differences (Galton, 1865, 1892; Stern, 1910; Cattell, 1946; Eysenck, 1952; Eysenck & Eysenck, 1985)
 - Cognitive and non-cognitive aspects of personality were independent predictors of life outcomes (Kelly & Fiske, 1951; Terman & Baldwin, 1926; Terman & Oden, 1947)
- ② This trend still continues, although primarily in Europe.
 - primarily at ISSID
 - less so at ECP (except for today!)
 - Much less so at ARP
- ③ Rather awkward phrasing of cognitive and non-cognitive aspects of personality or even more awkward: affective/behavioral/cognitive/motivational aspects of personality or Temperament, Ability, Interests, Character (TAIC)
- ④ For short hand: Personality and Ability

Reasons for the lack of integration

- ① (non-cognitive) personality tends to emphasize what we usually do: multiple constructs, each assessed rapidly
 - Tend to use open source items (e.g., the IPIP), short forms (BFI, TPI) and assess many people
 - Group or web based administration
 - Scales have reliabilities in the .60s-.80s
- ② Constructs measured are self report or peer ratings
 - Giant 3: Sociability/Stability/Social Cohesion (ENP)
 - Big 5 (CANOE or OCEAN) or 6 (HEXAXO)
- ③ Cognitive personality (Ability) measures study what we can do: emphasize fewer constructs, more carefully assessed
 - Tend to use proprietary scales
 - Individual administration
 - Reliabilities $> .90$
- ④ In the US, ability has been ignored by personality psychologists given a concern about ethnic differences (Kamin, 1974; Gould, 1981; Herrnstein & Murray, 2010)

Some integrative studies: e.g., this symposium

- ① This symposium
 - Jens Asendorpf and the developmental relationships of personality and ability
 - Sophie von Stumm and the need for cognition as it relates to intelligence
 - Anja Strobel and investment theory
- ② John Horn and Ray Cattell emphasized investments in cognitive tasks (Horn & Cattell, 1982)
- ③ Phil Ackerman's PPIK theory (Ackerman, 1997)
- ④ Sophie von Stumm has studied intellectual hunger (von Stumm, Chamorro-Premuzic & Ackerman, 2011)

Integrating personality and ability: a proposal to share public domain measures

- 1 Many studies of (non-cognitive) personality now take advantage of web based data collection using open source items (e.g., the International Personality Item Pool or IPIP).
- 2 Can we develop web based, open source items to measure ability?
- 3 Items need to be "google resistant", power items that are not susceptible to practice.
- 4 By using computer generated items, we can automatically produce an infinite number of parallel forms. This allows people to practice on item types without invalidating tests.

ICAR is to ability as IPIP is to non-cognitive personality

- ① The success of the International Personality Item Pool since it was announced at the ECP in Ghent has been amazing.
 - > 1,812 citations to the original announcement (Goldberg, 1999)
 - > 1,119 to the followup (Goldberg, Johnson, Eber, Hogan, Ashton, Cloninger & Gough, 2006)
- ② The goal of the IPIP was to allow all personality researchers access to a common core of validated personality items.
 - These were based upon (adapted from) the NEO-PI-R, the MPQ, the HPI, the JPRF, etc.
 - Include normal temperamental as well as vocational and avocational interests (Pozzebon, Visser, Ashton, Lee & Goldberg, 2010).
- ③ Similar goals of the International Cognitive Ability Resource:
 - To provide a shared common core of ability items that we can all use in our research.
 - To share the item statistics, so that we can all develop better and broader scales of ability.

The initial (NU) data sets using SAPA methods

- ① Using Synthetic Aperture Personality Assessment (SAPA) techniques to collect data
 - Temperament Items (> 696)
 - Interests (> 200)
 - Ability ($\approx 60 - 80$)
 - Demographics (e.g., age, gender, education, occupation, parental education, nationality, BMI, ...)
- ② Subjects
 - Multiple samples ranging from 25,000 to 100,000
- ③ Prior reports
 - Revelle, Wilt & Rosenthal (2010)
 - Condon & Revelle (2013)
 - Condon & Revelle (2014)

Some of the early work

The initial (NU) validation data (Condon and Revelle, 2014)

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The international cognitive ability resource: Development and initial validation of a public-domain measure



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ABSTRACT

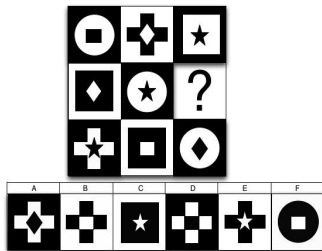
For all of its versatility and sophistication, the extant toolkit of cognitive ability measures lacks a public-domain method for large-scale, remote data collection. While the lack of copyright protection for such a measure poses a theoretical threat to test validity, the effective magnitude of this threat is unknown and can be offset by the use of modern test-development techniques. To the extent that validity can be maintained, the benefits of a public-domain resource are considerable for researchers, including: cost savings; greater control over test content; and the potential for more nuanced understanding of the correlational structure between constructs. The International Cognitive Ability Resource was developed to evaluate the prospects for such a public-domain measure and the psychometric properties of the first four item types were evaluated based on administrations to both an offline university sample and a large online sample. Concurrent and discriminative validity analyses suggest that the public-domain status of these item types did not compromise their validity despite administration to 97,000 participants. Further development and validation of extant and additional item types are recommended.

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Some of the early work

Sample (NU) ICAR items

Matrix Reasoning



Verbal Reasoning

What number is one fifth of one fourth of one ninth of 90

- (1) 2 (2) 3 (3) 4 (4) 5 (5) 6 (6) 7

If the day after tomorrow is two days before Thursday,
then what day is it today?

- (1) Friday (2) Monday (3) Wednesday
(4) Saturday (5) Tuesday (6) Sunday

Letter and Number Series

In the following alphanumeric series, what letter comes next?

I J L O S

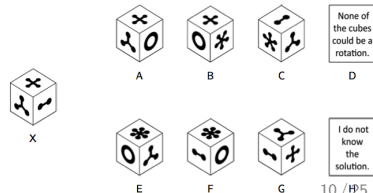
- (1) T (2) U (3) V (4) X (5) Y (6) Z

In the following alphanumeric series, what letter comes next?

Q S N P L

- (1) J (2) H (3) I (4) N (5) M (6) L

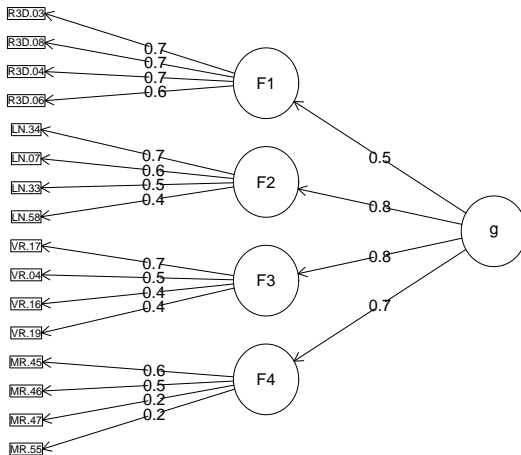
Three-Dimensional Rotation



A quick summary of results so far

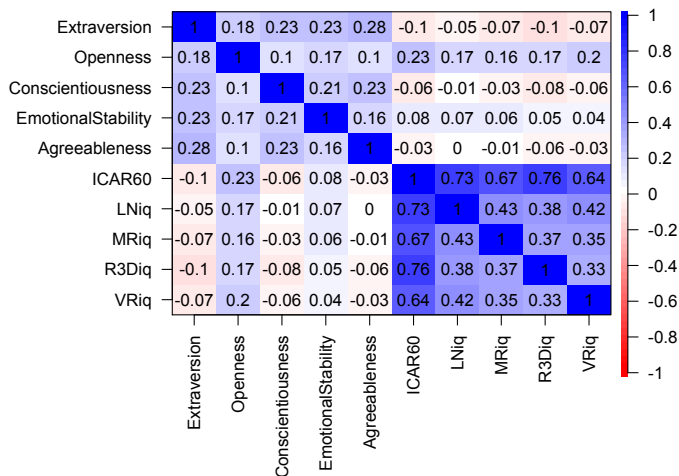
- ① Psychometrics are good
 - Clear general and hierarchical structure
 - Good reliabilities of overall scale
 - Overall scales correlate meaningfully with known criteria
- ② Structure of ability and personality differs at different levels of aggregation
 - Big 5 and ability correlations are low (at the individual level)
 - Openness/intellect is the highest correlate of ability
 - Structure is very different when aggregating by college major or occupation

Four item types show clear structure with a higher order g factor



Personality and ability at the individual level

Correlation plot of Big 5 and ICAR scales

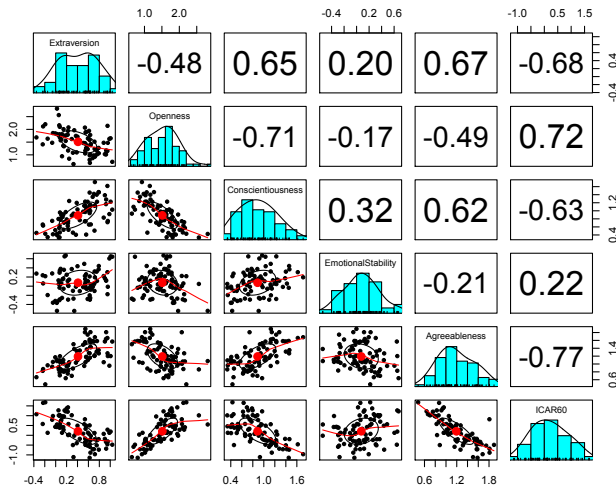


Personality at multiple levels of analysis

- ① As we have discussed before (Revelle & Condon, 2013, 2014), TAIC structures are not the same at the individual and at the group level.
- ② This may be accounted for by niche selection, positive feedback on small initial individual differences, differential survival rates in different niches.
- ③ One example of this is the effect of personality and ability assortment by college major. Although the structure within groups is similar to that of general findings, the structure between groups is very different.

Personality and Ability

Personality and ability at the level of college major reflects choice based upon temperament and ability



ICAR : IPIP :: Ability : Personality

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International Cognitive Ability Resource (ICAR project)

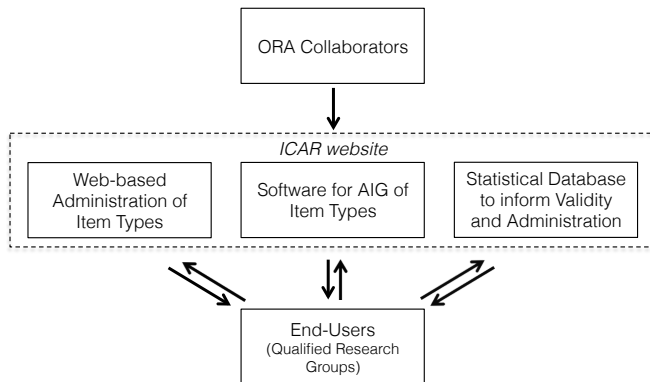
The International Cognitive Ability Resource (ICAR), a public-domain and open-source tool with funding in part from the Open Research Area Plus for the Social Sciences, is to provide a large and dynamic bank of cognitive ability measures for use in a wide variety of applications.

It represents the collaboration of three research groups in three countries.

- ① Germany (Münster)
 - Philipp Doebler, Heinz Holling, Ehsan Masoudi
- ② United Kingdom (Cambridge) <http://icar-project.com>
 - John Rust, Luning Sun, David Stillwell, Michal Kosinski
- ③ United States (Northwestern) <http://icar-project.org>
 - William Revelle, David Condon

Others are invited to participate.

The basic ICAR structure



a wiki is under construction at icar-project.com

Users who just want item types can register to get access to the items.

WWU Münster, Germany

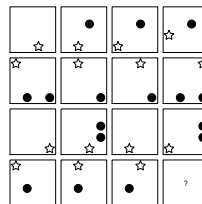


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WILHELMS-UNIVERSITÄT
MÜNSTER

P. Doeblér, H. Holling & E. Masoudi

Main contributions to ICAR

- Item generators
 - Progressive matrices
 - Figural analogies
 - Number and letter sequences
- Methods
 - Modelling speeded administration with count data IRT models
 - Multidimensional IRT models for rule-based item generation



Examples of work in progress: Germany

Rule-based figural analogies (work in progress)

- Generator: Written in R, most rules can be combined with each other, color-blind friendly design
- Explain all simple rules before testing, also mention combinations and that correct answer might be missing

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Example

- Rule 1: Rotation by 90 degrees counter-clockwise
- Rule 2: Swap the outer colors

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

Example

- Rule 1: Rotation by 90 degrees counter-clockwise
- Rule 2: Swap the outer colors

Figure illustrating a rule-based figural analogy problem. The analogy is presented as:



Below the analogy, there are eight possible answers, each in a box with a corresponding checkbox:

							
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The last two boxes contain text:

- The correct answer is missing.
- I don't know.

Work in progress in Cambridge

- ① The Concerto testing platform
 - Open source, online, R-based, testing platform
 - <http://www.psychometrics.cam.ac.uk/newconcerto>
 - Adaptive testing
- ② Hosting of the (in progress) WIKI for current and potential collaborators
 - <http://ICAR-project.com>
- ③ Item development
 - Raven's like items

Development of the Concerto platform for test administration

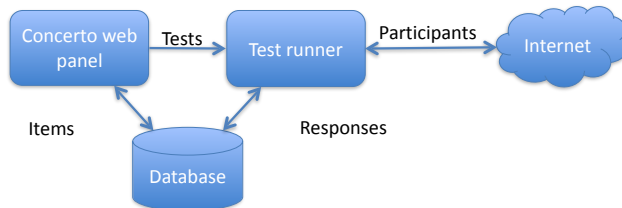
Testing Platform: Concerto

<http://www.psychometrics.cam.ac.uk/newconcerto>



Open-source Online R-based Testing Platform

- Provide html menus for test development and online administration
- Incorporate additional item material (e.g. images, videos) and response options
- Interact with MySQL databases for storing item bank and data collection
- Specify IRT models and CAT options with *ltm* and *catR* as underlying routines
- Deliver tests through a variety of web browsers and on mobile and tablet devices



Examples of work in progress: US

Items developed and under development

Prior contributions to ICAR

- ① Item created
 - 3 D rotation (by algorithm)
 - Matrix reasoning (by hand)
 - Number and letter sequences
- ② Methods
 - *psych* package in R
 - SAPA data collection

Planned contributions to ICAR

- ① Item generators
 - 2 D rotation
 - multiple choice Remote Associates
 - Number and letter sequences
- ② Methods
 - further development of *psych*

Please join us

Join us

For more information,
go to <http://ICAR-project.com> or
<http://ICAR-project.org>

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- Alan Rosenthal
- Melissa Mitchell
- Gregory Laun

- ③ ORA+ collaborators

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