1 Introduction

This document gives an overview about the recommended guidelines when using the measures that are available to qualified users on the ICAR website:
`https://icar-project.com/`

See Dworak et al. (2020) for further information about the development and validation of the International Cognitive Ability Resource (ICAR).

If not specified by authors of specific item types, you are encouraged to acknowledge the ICAR project by citing our website: The International Cognitive Ability Resource Team (2014): `https://icar-project.com/`.

Contents

1.1 Overview of ICAR Measures

The following table gives an overview of the existing ICAR item types:

Measure	Source
Letter and Number Series	Condon & Revelle (2014)
Matrix Reasoning	Condon & Revelle (2014)
Three-Dimensional Rotation	Condon & Revelle (2014)
Verbal Reasoning	Condon & Revelle (2014)
Face Detection	Verhallen & Mollon (2015)
Figural Analogies	Blum, Holling, Galibert & Forthmann (2016)
Melodic Discrimination	Harrison, Musil & Müllensiefen (2016)
Number Series	Loe (2017)
Perceptual Maze	Loe & Sanchez (2017)
Progressive Matrices	Loe & Rust (2019)

At `https://icar-project.com/projects/icar-download/documents` you can find the items available for download as well as psychometric data and automated reports (descriptive analysis, Cronbach's alpha, Spearman Brown and factor analysis).

1.2 General Guidelines

No general instructions are needed for the test as a whole, though an important point for paper-and-pencil administration is that no instruments should be used to arrive at the correct answer (jotting in the margins, etc.). Specific guidelines for the above mentioned measures are explained in the following sections.

Tests of validity and reliability should be performed before any interpretation of results takes place.

For further information and more detailed guidelines have a look at `https://icar-project.com/projects/icar-download/documents` as well as the original sources.

2 ICAR 16 and ICAR 60 Sample Tests

The ICAR 16 sample test consists of four items from each of the following four item types: Letter and Number Series, Verbal Reasonsing, Three-Dimensional Rotation and Matrix Reasoning. The 60 item ICAR sample test accordingly consists of 60 items from those four item types (but not 15 of each).

The suggested scoring is to score a correct answer with 1 point and 0 points otherwise. Only one answer per item is correct.No instruments should be used to arrive at the correct answer.

The ICAR measures are power tests so timing is not part of the administration or scoring. Still, in the interest of keeping administration moving, it can be useful to set an upper limit. If possible, we recommend piloting your study with a handful of participants in your target population. For the 16 item ICAR Sample Test, we recommend a maximum of 16 minutes for young adult participants (18-25 years old); the majority will be done in half that time. In the event that you are using a different set of items, you'll want to keep in mind that the spatial items (i.e. Three Dimensional Rotation) tend to take some participants much longer than other types. Researchers are free to modify the scoring and time limit though.

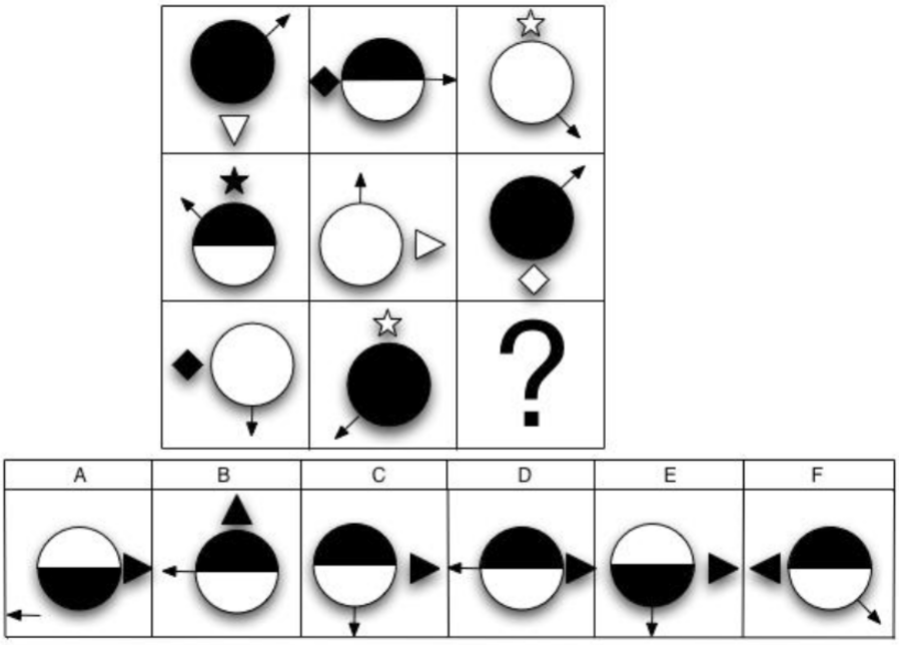
For further information see Condon & Revelle (2014).

Note that this test is aligned to Western languages. If you are interested in translations of the ICAR sample test, please address admin@icar-project.com.

The following examples represent the four item types with required instructions.

2.1 Matrix Reasoning

Instructions: Please indicate which is the best answer to complete the figure below.



Answer options: (1) A (2) B (3) C (4) D (5) E (6) F

Correct: (4) D

2.2 Letter and Number Series

Instructions: In the following alphanumeric series, what letter comes next?

V Q M J H

Answer options: (1) E (2) F (3) G (4) H (5) I (6) J

Correct: (3) G

2.3 Verbal Reasoning

Instructions: Select the correct answer to the question based on the given information.

Zach is taller than Matt and Richard is short than Zach. Which of the following statements would be most accurate?

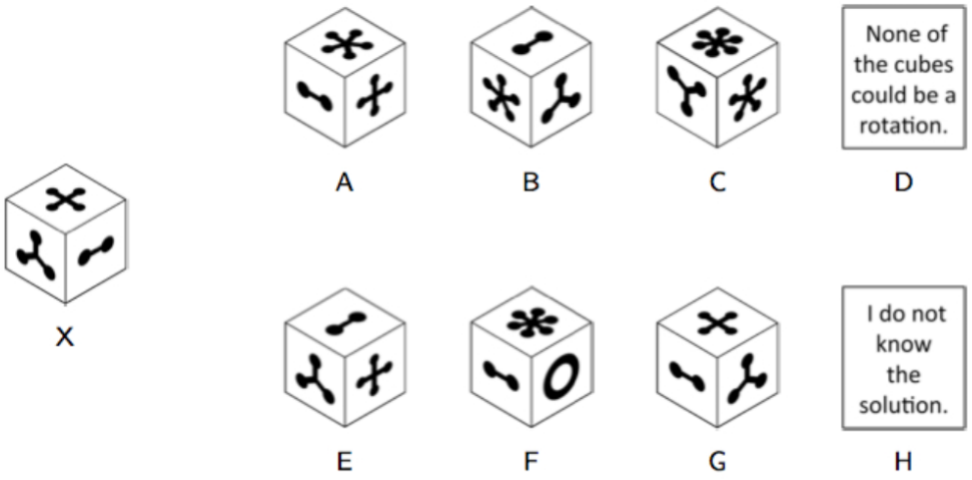
Answer options:

1. Richard is taller than Matt.
2. Richard is shorter than Matt.
3. Richard is as tall as Matt.
4. It's impossible to tell.

Correct answer: (4)

2.4 3-Dimensional Rotation

Instructions: All the cubes below have a different image on each side. Select the choice that represents a rotation of the cube labeled X.



Options: (1) A (2) B (3) C (4) D (5) E (6) F (7) G (8) H

Correct: (3) C

3 Face Detection

This test is an extended version of the Mooney test and suitable both for online testing and for a test–retest paradigm. The measure of interest is the number of trials on which participants correctly click on either of the eyes of the face (not just on the correct image out of three).

See Verhallen & Mollon (2015) for more details.

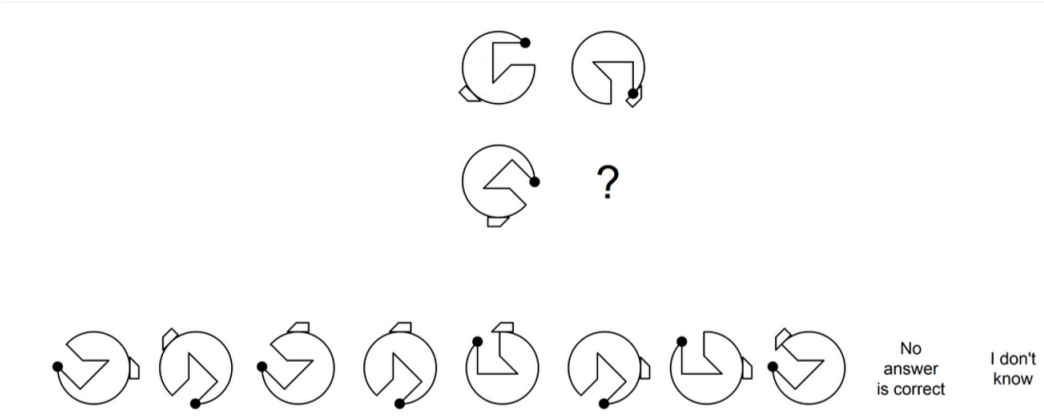
If you use this test, please ensure to cite Verhallen & Mollon (2015) and the ICAR Team (2014).

Instructions: Find out of the three images the one which shows a face and click on either of the eyes of the face within that image.

Correct: (1)

4 Figural Analogies

Instructions: In the upper part, a matrix with three shapes is presented. A forth shape is missing, and the space that it is supposed to occupy has been filled with a question mark. Select the missing shape out of the eight options of shapes in the lower part. If you think that the missing shape is not among the options then choose the option "No answer is correct". If the exercise is so difficult that you cannot find a proper answer, then choose the option "I don't know."



Answer options:
(1) (2) (3) (4) (5) (6) (7) (8) (9) No answer is correct. (10) I don't know.

Correct: (6)

Please do not take notes while doing the test. It is particularly important to work alone and concentrate. Distractions from other people or media should be avoided.

Once the data has been recollected, responses should be converted to binary values for the cases of right (1) and wrong (0) answers respectively. Then the total score of a given test taker is simply calculated as the sum of all binary values belonging to that person.

For further information see Blum, Abal, Lozzia, Picon Janeiro & Attorresi (2011), Blum, Holling, Galibert & Forthmann (2016) and Blum, Lozzia, Abal & Attorresi (2015).

If you use this test, please ensure to cite Blum, Holling, Galibert & Forthmann (2016) and the ICAR Team (2014).

5 Melodic Discrimination

In each trial of the melodic discrimination test, the test-taker is played several versions of the same melody, and their task is to identify differences between these versions. This test does not require any knowledge of formal musical notation, and so is well-suited for assessing musical skills in both trained musicians and non-musicians.

The test implementation provided on the ICAR website should be easy to trial and adapt for different experimental purposes. We recommend a test length of 15 items for most purposes, though for time-limited online studies 10 items may be more appropriate.

See Harrison (2015), Harrison & Müllensiefen (2016) and Harrison, Musil & Müllensiefen (2016) for more details.

If you use this test, please ensure to cite Harrison, Musil & Müllensiefen (2016) and the ICAR Team (2014).

6 Number Series

48 number series items were created by a newly developed Automatic Number Series Item Generator (ANSIG), which is fully available as an R package "NumGen". Participants are asked to fill in one or two numbers that follow in the sequence without time limitation. See Loe (2017) for further information.

If you want to use the items, please cite Loe, Sun, Simonfy, & Doebler (2018) and the ICAR Team (2014).

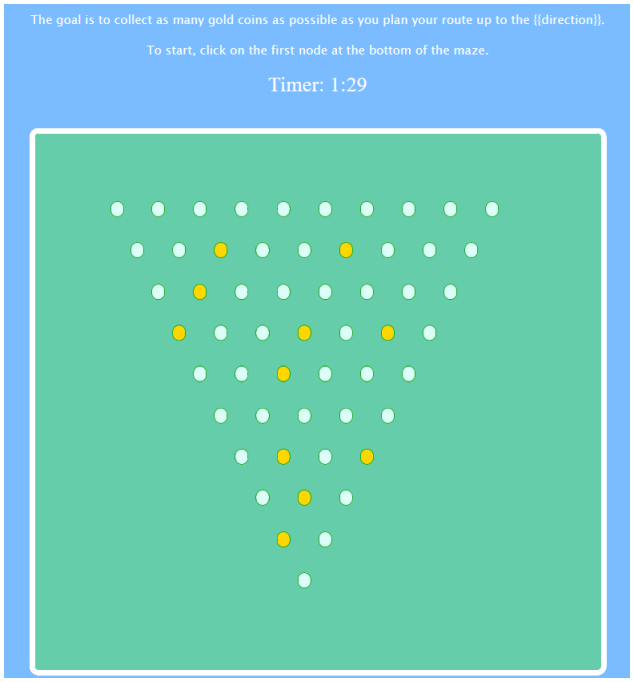
Instructions: In the following number sequence, what number comes next?

11 14 21 32 47

Correct: 66

7 Perceptual Maze

The test consists of 18 mazes with each group having 6 mazes per rank (10, 14, and 18 ranks). In each group, it contains 2 mazes of 20%, 30% and 40% saturation. It is highly recommended that participants complete the entire assessment in one sitting. Participants have 1 minute and 30 seconds to complete each maze.



Instructions: There are four conditions in the test.

1. Participants must begin from the first green dot located at the bottom of the apex.
2. Participants will not be able to skip between the green dots, cut white spaces or start a new path halfway during the task.
3. At each intersection, participants can only move upward left or right. They are not allowed to return to a previously traced dot or double back.
4. Participants are only able to work their way upward to the top of the maze by clicking on the dots using a computer mouse.

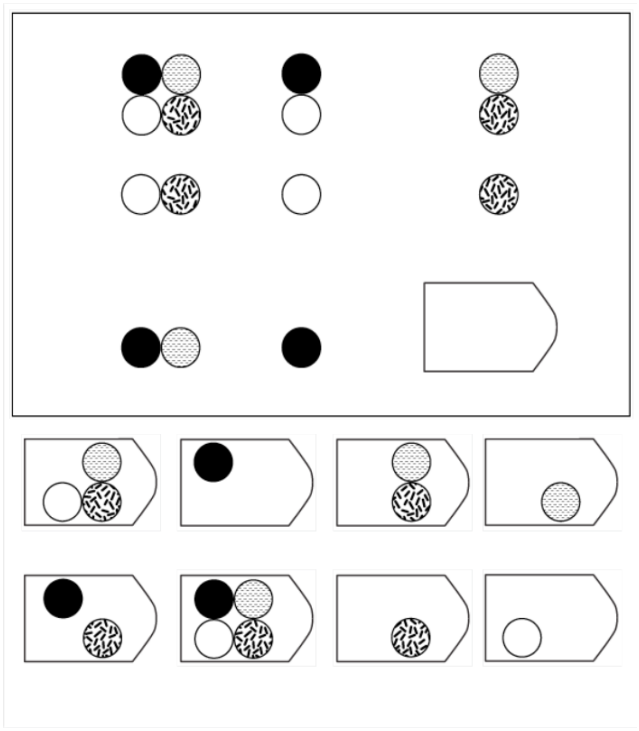
A prompt will be displayed immediately if participants do not adhere to these instructions. Gold colored dots are randomly distributed across the maze and the goal is to trace through as many gold colored dots as possible while they make

their way up to the top of the maze. They are awarded a score of 0 if they fail in tracing through the path with the maximum number of gold colored dots or complete the maze within the time limit. Once the maze is completed or the time limit is up, participants will then move on to the next maze. They are not allowed to return to the previous maze once completed. See Loe & Sanchez (2017) for further information.

8 Progressive Matrices

27 items have been designed based on similar rules followed by the Raven's Progressive Matrices. Each item has 8 distractors. See more information or register to use the test at `http://yinwah.com/test/mart-register`.

Instructions: In the upper part, a matrix with eight figures is presented. The ninth figure is missing. Select the missing figure out of the eight options of shapes in the lower part.



Answer options (from left to right and top to bottom):
(1) (2) (3) (4) (5) (6) (7) (8)

Correct: (4)

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