Supplementary Materials

The International Cognitive Ability Resource: Development and initial validation of a public-domain measure

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 are 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 is recommended.

Appendix A – *ICAR Sample Test*

The following items represent the 16 item ICAR Sample Test that is referenced in the submitted manuscript and several other locations. These items represent a subset of the four item types described in the main text. The Verbal Reasoning items are denoted as VR, Letter and Number Series as LN, Matrix Reasoning as MR, and Three-Dimensional Rotation as R3D.

VR.4
What number is one fifth of one fourth of one ninth of 900?
(1) 2 (2) 3 (3) 4 (4) 5 (5) 6 (6) 7

VR.16
Zach is taller than Matt and Richard is shorter than Zach. Which of the following statements would be most accurate?
(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

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VR.17
Joshua is 12 years old and his sister is three times as old as he. When Joshua is 23 years old, how old will his sister be?
(1) 35 (2) 39 (3) 44 (4) 47 (5) 53 (6) 57

VR.19
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

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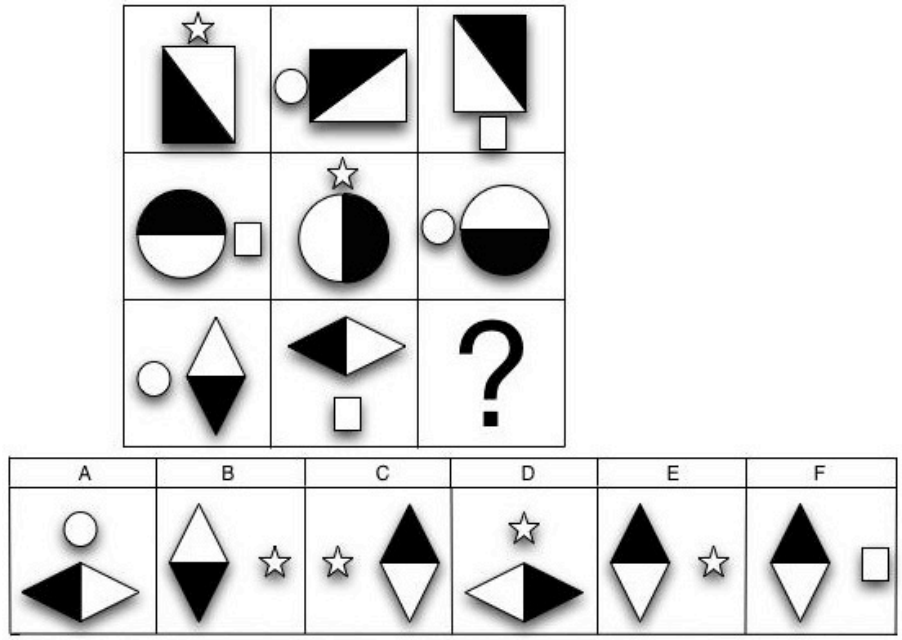
LN.7
In the following alphanumeric series, what letter comes next? K N P S U
(1) S (2) T (3) U (4) V (5) W (6) X

LN.33
In the following alphanumeric series, what letter comes next? V Q M J H
(1) E (2) F (3) G (4) H (5) I (6) J

LN.34
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

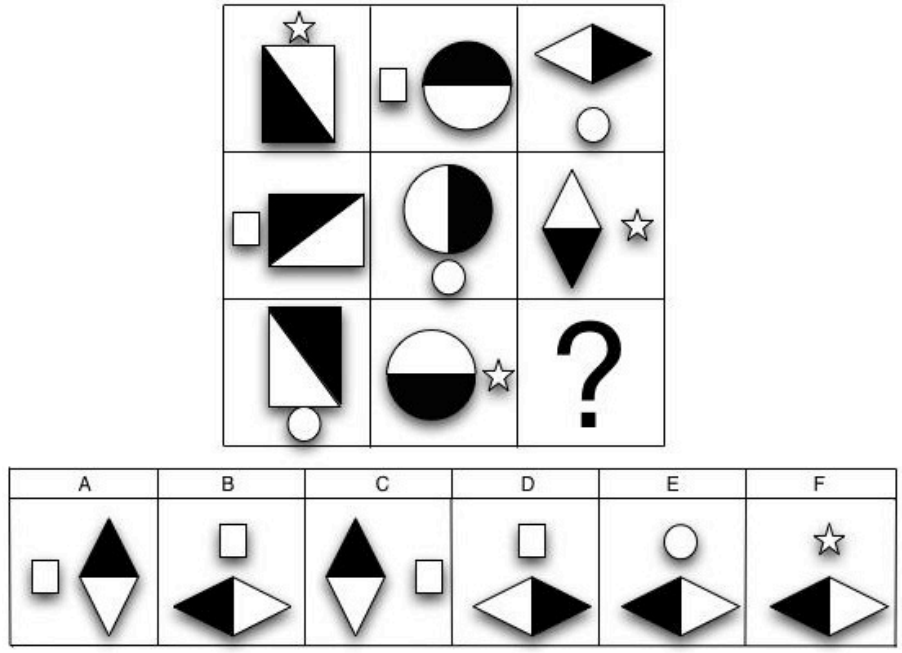
LN.58
In the following alphanumeric series, what letter comes next? Q S N P L
(1) J (2) H (3) I (4) N (5) M (6) L

MX.45 Please indicate which is the best answer to complete the figure below.



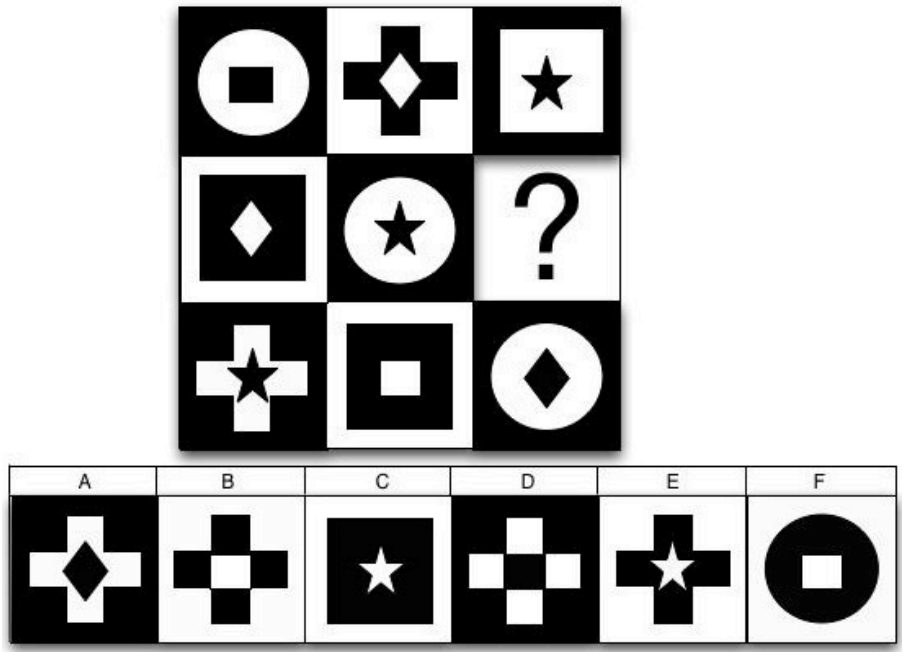
(1) A (2) B (3) C (4) D (5) E (6) F

MX.46 Please indicate which is the best answer to complete the figure below.



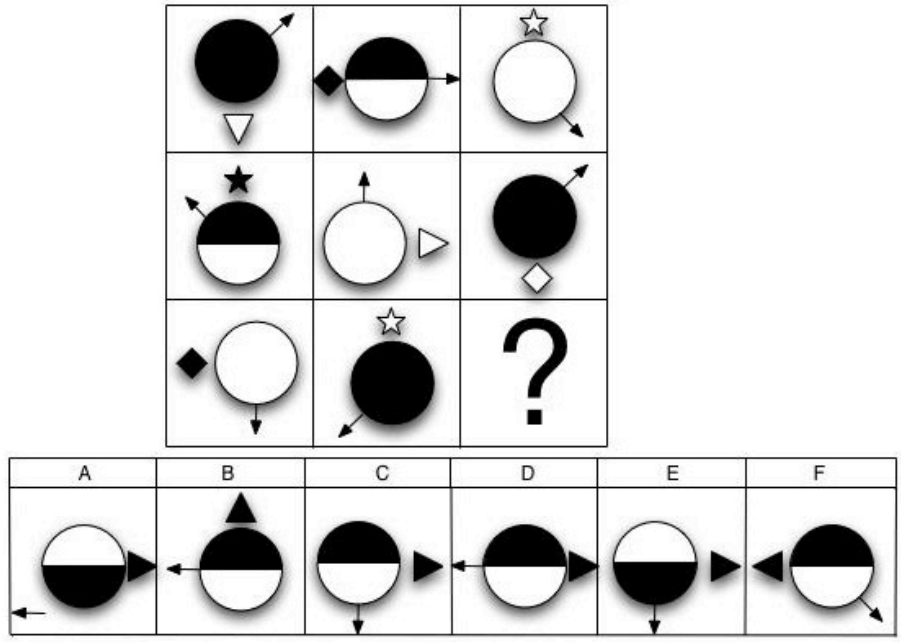
(1) A (2) B (3) C (4) D (5) E (6) F

MX.47 Please indicate which is the best answer to complete the figure below.



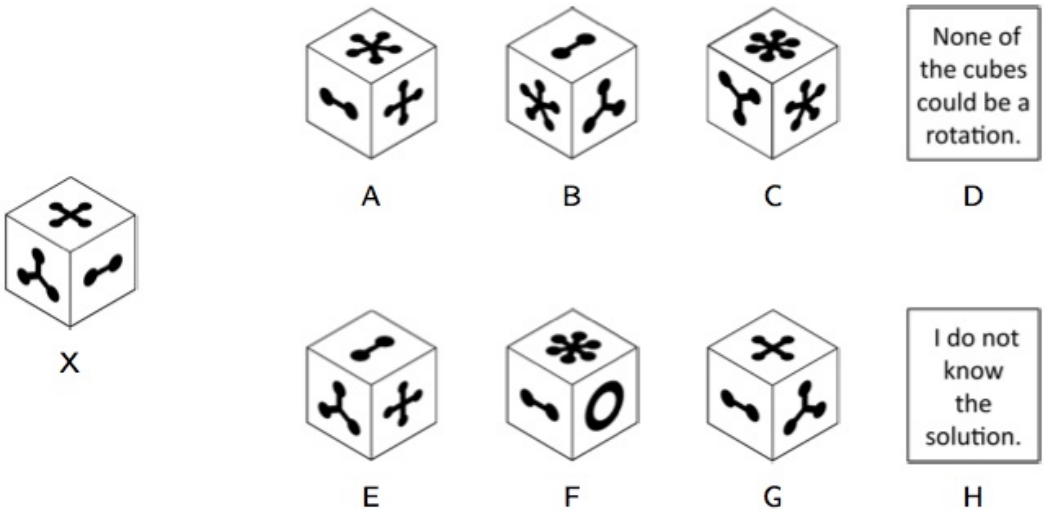
(1) A (2) B (3) C (4) D (5) E (6) F

MX.55 Please indicate which is the best answer to complete the figure below.



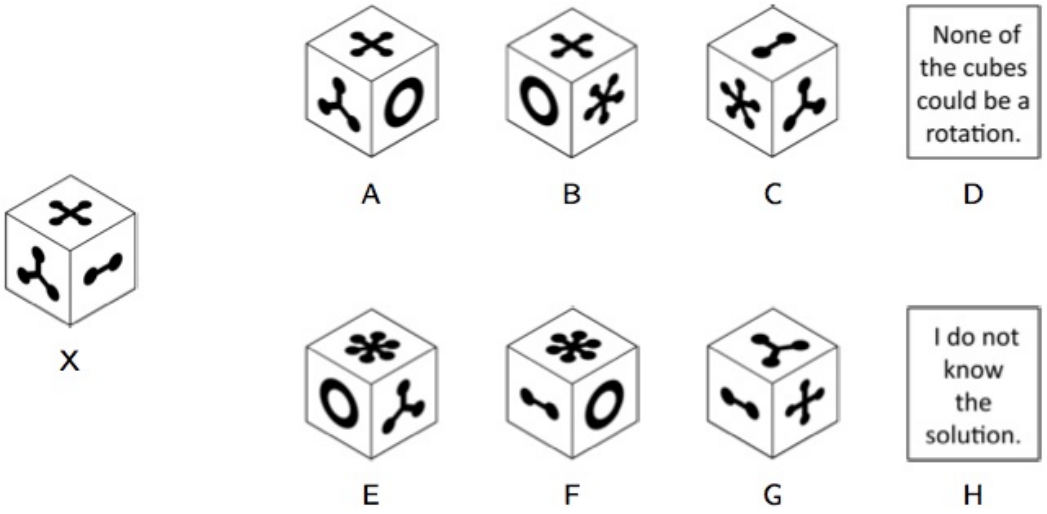
(1) A (2) B (3) C (4) D (5) E (6) F

R3D.3 All the cubes below have a different image on each side. Select the choice that could represent a rotation of the cube labeled X.



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

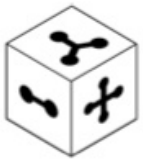
R3D.4 All the cubes below have a different image on each side. Select the choice that could represent a rotation of the cube labeled X.



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

R3D.6 All the cubes below have a different image on each side. Select the choice that could represent a rotation of the cube labeled X.

X



A

B

C

None of the cubes could be a rotation.

D

E

F

G

I do not know the solution.

H

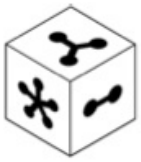
(1) A (2) B (3) C (4) D (5) E (6) F (7) G (8) H

R3D.8 All the cubes below have a different image on each side. Select the choice that could represent a rotation of the cube labeled X.

X

A

B

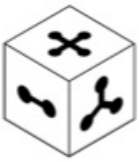


C

None of the cubes could be a rotation.

D

E



F

G

I do not know the solution.

H

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

Supplementary Tables

Table 1: Three factor solution based on all 60 ICAR items

ICAR item	Factor 1	Factor 2	Factor 3
LN.01	**0.54**	-0.01	-0.03
VR.17	**0.54**	0.00	0.00
VR.04	**0.53**	-0.01	0.05
LN.07	**0.52**	-0.01	0.00
LN.34	**0.52**	0.01	0.01
VR.14	**0.52**	0.00	0.03
LN.03	**0.51**	0.04	0.03
LN.58	**0.47**	0.05	0.06
VR.19	**0.46**	0.01	0.02
VR.16	**0.46**	0.00	0.02
LN.33	**0.45**	0.02	0.03
LN.05	**0.45**	0.01	-0.03
VR.31	**0.43**	-0.03	-0.07
VR.32	**0.42**	0.04	0.00
MR.47	**0.41**	0.04	0.06
LN.06	**0.39**	0.06	0.07
MR.43	**0.38**	0.00	0.04
MR.46	**0.37**	0.01	0.06
VR.11	**0.35**	-0.01	-0.01
LN.35	**0.35**	0.06	0.05
MR.45	**0.35**	0.03	0.07
VR.09	**0.32**	-0.03	0.01
VR.36	**0.31**	0.06	0.08
VR.39	**0.30**	0.02	-0.06
MR.53	**0.30**	0.03	0.05
VR.42	**0.29**	-0.01	0.04
VR.23	**0.28**	0.06	0.10
MR.54	**0.28**	-0.02	0.05
MR.44	**0.26**	0.00	0.12
MR.56	**0.24**	0.04	0.08
VR.13	**0.23**	0.01	0.10
VR.26	**0.23**	0.01	0.03
MR.48	**0.22**	0.04	0.09
MR.55	**0.21**	0.09	0.11
VR.18	**0.21**	-0.01	-0.04
MR.50	**0.19**	0.10	0.10
R3D.14	0.13	**0.85**	-0.16
R3D.07	0.03	**0.83**	-0.07
R3D.19	0.00	**0.70**	0.02
R3D.21	0.05	**0.62**	-0.02

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Table 1 – continued from previous page

ICAR item	Factor 1	Factor 2	Factor 3
R3D.11	-0.02	**0.55**	0.14
R3D.02	-0.07	**0.51**	0.31
R3D.18	-0.03	**0.50**	0.30
R3D.17	0.01	**0.46**	0.32
R3D.12	-0.02	**0.46**	0.21
R3D.13	-0.02	**0.41**	0.26
R3D.01	-0.13	**0.41**	0.28
R3D.15	0.02	**0.33**	0.32
R3D.10	-0.03	**0.31**	0.28
R3D.06	0.07	-0.06	**0.74**
R3D.22	0.12	-0.08	**0.69**
R3D.05	0.06	-0.01	**0.66**
R3D.09	0.07	0.00	**0.61**
R3D.16	0.07	0.00	**0.61**
R3D.20	0.19	-0.04	**0.53**
R3D.24	-0.01	0.32	**0.49**
R3D.04	0.07	0.22	**0.49**
R3D.08	-0.01	0.29	**0.45**
R3D.03	-0.01	0.38	**0.40**
R3D.23	0.07	0.27	**0.36**
SS Loadings	5.88	5.38	5.37
% of Variance	0.35	0.32	0.32
Score Correlation	0.94	0.95	0.94

Fit statistics: RMSR = 0.05; RMSEA = 0.059; TLI = 0.70

Table 2: Correlations between factors for the three factor solution

	Factor 1	Factor 2	Factor 3
Factor 1	1.00		
Factor 2	0.27	1.00	
Factor 3	0.43	0.54	1.00

Table 3: Four factor solution based on all 60 ICAR items

ICAR item	Factor 1	Factor 2	Factor 3	Factor 4
LN.07	**0.56**	0.02	-0.06	-0.03
LN.34	**0.55**	0.02	-0.03	-0.01
LN.01	**0.54**	-0.06	-0.01	0.01
VR.04	**0.53**	-0.04	0.06	0.01
VR.17	**0.53**	-0.09	0.03	0.06
LN.03	**0.52**	0.04	0.01	-0.02
VR.14	**0.52**	-0.04	0.05	0.01
LN.58	**0.49**	0.04	0.02	0.04
LN.05	**0.48**	0.02	-0.08	-0.01
LN.33	**0.48**	0.05	-0.01	-0.04
VR.19	**0.46**	-0.07	0.06	0.06
VR.16	**0.45**	-0.02	0.04	-0.02
VR.31	**0.43**	-0.10	-0.02	0.01
VR.32	**0.43**	0.01	0.00	0.02
MR.47	**0.42**	0.06	0.03	-0.02
LN.06	**0.41**	0.11	0.02	-0.04
MR.46	**0.38**	0.06	0.03	-0.06
MR.43	**0.38**	0.00	0.04	-0.02
LN.35	**0.36**	0.04	0.02	0.04
MR.45	**0.35**	0.02	0.06	0.00
VR.11	**0.35**	-0.04	0.02	-0.01
VR.09	**0.32**	-0.04	0.02	-0.01
MR.53	**0.31**	0.06	0.04	-0.04
VR.39	**0.30**	-0.02	-0.03	0.00
VR.36	**0.30**	-0.01	0.09	0.08
VR.42	**0.30**	0.03	0.01	-0.05
VR.23	**0.29**	0.09	0.06	-0.01
MR.54	**0.28**	0.00	0.05	-0.03
MR.44	**0.27**	0.02	0.10	0.00
VR.13	**0.25**	0.11	0.05	-0.11
MR.56	**0.24**	0.08	0.05	-0.02
VR.26	**0.24**	0.02	0.02	-0.02
MR.48	**0.23**	0.08	0.06	-0.03
MR.55	**0.22**	0.09	0.08	0.02
MR.50	**0.21**	0.19	0.04	-0.09
VR.18	**0.21**	-0.05	-0.02	0.03
R3D.19	0.05	**0.77**	-0.09	-0.06
R3D.07	0.06	**0.73**	-0.10	0.07
R3D.02	-0.03	**0.63**	0.15	0.00
R3D.18	0.01	**0.56**	0.14	0.08
R3D.01	-0.08	**0.50**	0.10	0.10
R3D.14	0.11	**0.49**	-0.11	0.37
R3D.10	0.01	**0.46**	0.15	-0.07

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Table 3 – continued from previous page

ICAR item	Factor 1	Factor 2	Factor 3	Factor 4
R3D.24	0.03	**0.45**	0.32	0.02
R3D.03	0.01	**0.44**	0.30	0.00
R3D.12	0.00	**0.44**	0.11	0.15
R3D.08	0.02	**0.42**	0.29	0.02
R3D.11	-0.02	**0.39**	0.08	0.28
R3D.17	0.02	**0.36**	0.23	0.25
R3D.23	0.10	**0.33**	0.22	0.09
R3D.13	0.00	**0.33**	0.16	0.24
R3D.06	0.03	0.02	**0.71**	0.00
R3D.22	0.07	-0.06	**0.69**	0.05
R3D.05	0.03	0.10	**0.64**	-0.06
R3D.09	0.02	0.03	**0.63**	0.01
R3D.16	0.03	0.01	**0.60**	0.05
R3D.20	0.14	-0.05	**0.57**	0.04
R3D.04	0.06	0.29	**0.42**	-0.01
R3D.15	0.01	0.28	**0.29**	0.11
R3D.21	0.01	0.00	0.01	**0.91**
SS Loadings	6.01	5.17	4.24	1.71
% of Variance	0.35	0.30	0.25	0.10
Score Correlation	0.94	0.94	0.92	0.93

Fit statistics: RMSR = 0.05; RMSEA = 0.058; TLI = 0.71

Table 4: Correlations between factors for the four factor solution

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1.00			
Factor 2	0.30	1.00		
Factor 3	0.49	0.57	1.00	
Factor 4	0.24	0.54	0.31	1.00

Table 5: Five factor solution based on all 60 ICAR items

ICAR item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
LN.07	**0.56**	-0.05	0.03	-0.04	-0.01
VR.04	**0.55**	0.02	-0.01	-0.02	0.01
LN.34	**0.55**	-0.03	0.01	-0.01	0.00
LN.01	**0.54**	-0.02	-0.06	0.00	0.00
VR.17	**0.54**	0.00	-0.04	-0.02	0.04
LN.03	**0.53**	-0.01	0.03	0.02	-0.02
VR.14	**0.52**	0.02	-0.03	-0.01	0.00
LN.58	**0.49**	0.02	0.03	-0.01	0.05
LN.05	**0.48**	-0.07	0.02	-0.02	0.01
LN.33	**0.48**	-0.01	0.01	0.02	-0.03
VR.19	**0.46**	0.04	-0.05	-0.02	0.04
VR.16	**0.46**	0.02	-0.04	0.04	-0.04
MR.47	**0.44**	0.01	0.05	0.02	-0.02
VR.32	**0.43**	-0.01	-0.01	0.03	0.00
VR.31	**0.42**	-0.01	-0.13	0.02	-0.01
LN.06	**0.41**	0.02	0.07	0.03	-0.03
MR.43	**0.39**	0.01	0.01	0.00	-0.02
MR.46	**0.39**	0.03	0.00	0.06	-0.06
MR.45	**0.37**	0.03	0.03	0.01	0.00
LN.35	**0.37**	0.02	0.02	0.01	0.05
VR.11	**0.35**	0.01	-0.05	0.02	-0.03
VR.09	**0.32**	0.02	-0.05	0.00	-0.02
VR.42	**0.32**	-0.02	0.05	-0.02	-0.04
VR.23	**0.31**	0.02	0.12	-0.02	-0.01
MR.53	**0.31**	0.05	-0.01	0.06	-0.04
VR.36	**0.30**	0.09	-0.04	0.04	0.07
VR.39	**0.29**	-0.02	-0.08	0.06	-0.02
MR.54	**0.29**	0.03	0.00	0.00	-0.03
MR.44	**0.28**	0.07	0.06	-0.03	0.01
VR.13	**0.26**	0.03	0.09	0.02	-0.10
MR.56	**0.26**	0.03	0.07	0.01	-0.01
VR.26	**0.25**	-0.02	0.05	-0.02	-0.01
MR.48	**0.25**	0.04	0.07	0.02	-0.03
MR.55	**0.23**	0.07	0.07	0.03	0.03
MR.50	**0.22**	0.04	0.11	0.09	-0.07
VR.18	**0.22**	-0.04	-0.03	-0.02	0.02
R3D.06	-0.01	**0.78**	0.00	-0.03	-0.01
R3D.22	0.06	**0.72**	0.00	-0.10	0.04
R3D.09	-0.01	**0.69**	-0.04	0.05	-0.02
R3D.05	0.00	**0.69**	0.06	0.02	-0.09
R3D.16	-0.01	**0.67**	-0.04	0.02	0.05
R3D.20	0.15	**0.55**	-0.01	-0.03	0.03
R3D.04	0.06	**0.45**	0.17	0.16	-0.02

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Table 5 – continued from previous page

ICAR item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
R3D.15	-0.01	**0.35**	0.11	0.21	0.07
R3D.03	0.01	**0.30**	0.28	0.27	-0.02
R3D.01	0.00	-0.06	**0.68**	-0.02	0.14
R3D.24	0.08	0.24	**0.54**	-0.01	0.06
R3D.18	0.06	0.07	**0.52**	0.17	0.10
R3D.02	-0.01	0.15	**0.47**	0.24	0.01
R3D.23	0.15	0.14	**0.43**	-0.05	0.14
R3D.08	0.06	0.24	**0.42**	0.05	0.06
R3D.13	0.04	0.08	**0.42**	0.04	0.25
R3D.10	0.05	0.08	**0.41**	0.14	-0.04
R3D.12	0.01	0.13	**0.31**	0.19	0.14
R3D.11	-0.01	0.09	**0.28**	0.22	0.25
R3D.17	0.02	0.26	**0.26**	0.17	0.24
R3D.14	0.04	0.05	-0.17	**0.85**	0.23
R3D.07	0.03	-0.02	0.21	**0.72**	-0.05
R3D.19	0.02	0.01	0.25	**0.66**	-0.14
R3D.21	0.01	-0.01	0.08	0.05	**0.88**
SS Loadings	6.11	4.34	3.54	2.76	1.47
% of Variance	0.34	0.24	0.19	0.15	0.08
Score Correlation	0.94	0.94	0.92	0.95	0.93

Fit statistics: RMSR = 0.05; RMSEA = 0.058; TLI = 0.71

Table 6: Correlations between factors
for the five factor solution

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	1.00				
Factor 2	0.53	1.00			
Factor 3	0.24	0.53	1.00		
Factor 4	0.26	0.41	0.48	1.00	
Factor 5	0.22	0.29	0.30	0.47	1.00

Table 7: Item and test information for the 60 ICAR items

	Latent Trait Level (normal scale)						
Item	-3	-2	-1	0	1	2	3
LN.01	0.11	0.23	0.31	0.24	0.11	0.04	0.01
LN.03	0.05	0.14	0.31	0.37	0.22	0.08	0.03
LN.05	0.08	0.14	0.18	0.16	0.11	0.06	0.03
LN.06	0.04	0.1	0.19	0.26	0.21	0.12	0.05
LN.07	0.06	0.14	0.23	0.25	0.16	0.08	0.03
LN.33	0.06	0.12	0.21	0.24	0.17	0.09	0.04
LN.34	0.06	0.15	0.27	0.28	0.18	0.08	0.03
LN.35	0.04	0.09	0.16	0.2	0.17	0.10	0.05
LN.58	0.03	0.09	0.21	0.35	0.29	0.14	0.05
MR.43	0.09	0.16	0.20	0.18	0.11	0.05	0.02
MR.44	0.07	0.11	0.15	0.15	0.12	0.07	0.04
MR.45	0.05	0.10	0.16	0.19	0.16	0.09	0.05
MR.46	0.06	0.11	0.17	0.18	0.14	0.08	0.04
MR.47	0.06	0.15	0.26	0.28	0.17	0.08	0.03
MR.48	0.05	0.08	0.10	0.12	0.10	0.07	0.05
MR.50	0.03	0.06	0.10	0.14	0.15	0.12	0.07
MR.53	0.06	0.1	0.14	0.14	0.11	0.07	0.04
MR.54	0.04	0.05	0.07	0.08	0.08	0.06	0.05
MR.55	0.04	0.07	0.12	0.16	0.15	0.11	0.06
MR.56	0.04	0.07	0.10	0.12	0.12	0.09	0.06
R3D.01	0.00	0.01	0.03	0.13	0.38	0.53	0.27
R3D.02	0.00	0.00	0.03	0.18	0.75	0.76	0.19
R3D.03	0.00	0.00	0.02	0.16	0.83	0.91	0.19
R3D.04	0.00	0.00	0.03	0.23	1.07	0.73	0.12
R3D.05	0.00	0.01	0.06	0.37	0.95	0.47	0.09
R3D.06	0.00	0.01	0.09	0.53	1.05	0.33	0.05
R3D.07	0.00	0.00	0.02	0.12	0.57	0.88	0.28
R3D.08	0.00	0.00	0.02	0.17	0.8	0.85	0.19
R3D.09	0.00	0.02	0.11	0.46	0.75	0.32	0.07
R3D.10	0.00	0.02	0.07	0.22	0.45	0.39	0.16
R3D.11	0.00	0.00	0.02	0.10	0.44	0.75	0.33
R3D.12	0.00	0.01	0.04	0.18	0.54	0.58	0.21
R3D.13	0.00	0.00	0.02	0.10	0.46	0.82	0.34
R3D.14	0.00	0.00	0.03	0.17	0.65	0.74	0.22
R3D.15	0.00	0.02	0.09	0.34	0.61	0.36	0.10
R3D.16	0.01	0.03	0.14	0.49	0.66	0.27	0.06
R3D.17	0.00	0.00	0.02	0.14	0.74	0.95	0.22
R3D.18	0.00	0.00	0.01	0.09	0.61	1.12	0.30
R3D.19	0.00	0.01	0.06	0.24	0.58	0.48	0.16
R3D.20	0.01	0.04	0.22	0.70	0.61	0.17	0.03
R3D.21	0.00	0.00	0.02	0.11	0.40	0.68	0.33

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Table 7 – continued from previous page

	Latent Trait Level (normal scale)						
Item	-3	-2	-1	0	1	2	3
R3D.22	0.00	0.02	0.11	0.56	0.94	0.30	0.05
R3D.23	0.00	0.01	0.04	0.25	0.83	0.61	0.14
R3D.24	0.00	0.00	0.01	0.15	0.98	1.02	0.16
VR.04	0.07	0.19	0.38	0.36	0.17	0.06	0.02
VR.09	0.05	0.07	0.08	0.08	0.07	0.05	0.03
VR.11	0.1	0.14	0.16	0.13	0.08	0.04	0.02
VR.13	0.03	0.05	0.08	0.11	0.12	0.10	0.07
VR.14	0.09	0.23	0.38	0.31	0.14	0.04	0.01
VR.16	0.08	0.15	0.23	0.22	0.14	0.07	0.03
VR.17	0.08	0.22	0.36	0.30	0.14	0.05	0.02
VR.18	0.06	0.06	0.06	0.05	0.04	0.03	0.02
VR.19	0.06	0.13	0.22	0.24	0.16	0.08	0.03
VR.23	0.03	0.06	0.12	0.19	0.21	0.15	0.08
VR.26	0.03	0.05	0.06	0.06	0.06	0.05	0.04
VR.31	0.11	0.15	0.16	0.12	0.07	0.04	0.02
VR.32	0.05	0.11	0.17	0.20	0.16	0.09	0.04
VR.36	0.04	0.08	0.15	0.20	0.18	0.12	0.06
VR.39	0.09	0.11	0.11	0.09	0.06	0.04	0.02
VR.42	0.05	0.08	0.09	0.09	0.08	0.06	0.04
TIF	2.16	4.38	7.78	13.01	21.55	17.76	5.60
SEM	0.68	0.48	0.36	0.28	0.22	0.24	0.42
Reliability	0.54	0.77	0.87	0.92	0.95	0.94	0.82

Table 8: Item and test information for the 9 Letter and Number Series items

	Latent Trait Level (normal scale)						
Item	-3	-2	-1	0	1	2	3
LN.01	0.11	0.30	0.45	0.29	0.10	0.03	0.01
LN.03	0.04	0.15	0.36	0.43	0.23	0.08	0.02
LN.05	0.09	0.31	0.58	0.38	0.11	0.03	0.01
LN.06	0.03	0.09	0.27	0.45	0.33	0.13	0.04
LN.07	0.03	0.17	0.69	0.74	0.20	0.03	0.01
LN.33	0.04	0.15	0.40	0.49	0.24	0.07	0.02
LN.34	0.03	0.18	0.67	0.71	0.20	0.04	0.01
LN.35	0.04	0.10	0.21	0.28	0.23	0.12	0.05
LN.58	0.01	0.05	0.26	0.76	0.55	0.14	0.02
TIF	0.42	1.51	3.89	4.54	2.21	0.66	0.17
SEM	1.55	0.82	0.51	0.47	0.67	1.24	2.41
Reliability	NA	0.34	0.74	0.78	0.55	NA	NA

Table 9: Item and test information for the 11 Matrix Reasoning items

	Latent Trait Level (normal scale)						
Item	-3	-2	-1	0	1	2	3
MR.43	0.10	0.22	0.32	0.25	0.12	0.05	0.02
MR.44	0.07	0.15	0.25	0.25	0.16	0.07	0.03
MR.45	0.03	0.12	0.33	0.49	0.29	0.10	0.03
MR.46	0.05	0.15	0.33	0.38	0.21	0.08	0.02
MR.47	0.06	0.16	0.34	0.37	0.20	0.07	0.02
MR.48	0.05	0.10	0.17	0.20	0.16	0.09	0.04
MR.50	0.03	0.06	0.10	0.14	0.14	0.11	0.07
MR.53	0.06	0.13	0.20	0.22	0.15	0.08	0.04
MR.54	0.04	0.08	0.14	0.19	0.18	0.12	0.06
MR.55	0.03	0.08	0.15	0.22	0.21	0.13	0.07
MR.56	0.04	0.08	0.15	0.21	0.19	0.12	0.06
TIF	0.55	1.33	2.49	2.92	2.02	1.02	0.45
SEM	1.34	0.87	0.63	0.58	0.70	0.99	1.49
Reliability	NA	0.25	0.6	0.66	0.51	0.02	NA

Table 10: Item and test information for the 24 Three Dimensional Rotation items

	Latent Trait Level (normal scale)						
Item	-3	-2	-1	0	1	2	3
R3D.01	0.00	0.00	0.00	0.04	0.30	1.08	0.60
R3D.02	0.00	0.00	0.00	0.03	0.51	1.98	0.34
R3D.03	0.00	0.00	0.00	0.05	0.65	1.77	0.28
R3D.04	0.00	0.00	0.02	0.19	1.15	0.88	0.12
R3D.05	0.00	0.01	0.06	0.36	1.01	0.49	0.08
R3D.06	0.00	0.01	0.08	0.53	1.15	0.35	0.05
R3D.07	0.00	0.00	0.00	0.04	0.38	1.55	0.50
R3D.08	0.00	0.00	0.01	0.08	0.76	1.37	0.24
R3D.09	0.00	0.02	0.10	0.47	0.86	0.34	0.06
R3D.10	0.00	0.01	0.04	0.20	0.61	0.60	0.19
R3D.11	0.00	0.00	0.00	0.03	0.29	1.23	0.63
R3D.12	0.00	0.00	0.01	0.10	0.60	1.01	0.29
R3D.13	0.00	0.00	0.00	0.04	0.33	1.27	0.57
R3D.14	0.00	0.00	0.01	0.11	0.66	1.08	0.26
R3D.15	0.00	0.01	0.06	0.33	0.88	0.50	0.10
R3D.16	0.00	0.02	0.13	0.53	0.77	0.28	0.06
R3D.17	0.00	0.00	0.00	0.05	0.56	1.72	0.33
R3D.18	0.00	0.00	0.00	0.02	0.26	1.95	0.65
R3D.19	0.00	0.00	0.02	0.15	0.79	0.94	0.20
R3D.20	0.01	0.05	0.23	0.63	0.55	0.17	0.03
R3D.21	0.00	0.00	0.01	0.05	0.33	1.03	0.54
R3D.22	0.00	0.02	0.11	0.55	0.87	0.29	0.05
R3D.23	0.00	0.00	0.03	0.23	0.90	0.69	0.14
R3D.24	0.00	0.00	0.00	0.04	0.70	2.03	0.23
TIF	0.02	0.15	0.94	4.84	15.87	24.6	6.54
SEM	6.34	2.55	1.03	0.45	0.25	0.20	0.39
Reliability	NA	NA	NA	0.79	0.94	0.96	0.85

Table 11: Item and test information for the 21 Verbal Reasoning items

	Latent Trait Level (normal scale)						
Item	-3	-2	-1	0	1	2	3
VR.04	0.05	0.24	0.69	0.56	0.15	0.03	0.01
VR.09	0.07	0.13	0.18	0.17	0.12	0.06	0.03
VR.11	0.15	0.31	0.36	0.21	0.08	0.03	0.01
VR.13	0.03	0.05	0.09	0.12	0.13	0.10	0.07
VR.14	0.08	0.34	0.71	0.42	0.10	0.02	0.00
VR.16	0.07	0.22	0.43	0.38	0.16	0.05	0.01
VR.17	0.07	0.33	0.77	0.45	0.10	0.02	0.00
VR.18	0.14	0.16	0.14	0.09	0.05	0.02	0.01
VR.19	0.04	0.17	0.45	0.50	0.22	0.06	0.01
VR.23	0.02	0.05	0.14	0.28	0.32	0.20	0.09
VR.26	0.04	0.07	0.10	0.13	0.12	0.09	0.06
VR.31	0.20	0.39	0.36	0.17	0.06	0.02	0.00
VR.32	0.04	0.13	0.30	0.39	0.24	0.09	0.03
VR.36	0.03	0.08	0.17	0.24	0.22	0.13	0.06
VR.39	0.15	0.22	0.21	0.14	0.07	0.03	0.01
VR.42	0.06	0.10	0.14	0.14	0.11	0.07	0.04
TIF	1.25	3.00	5.25	4.39	2.26	1.03	0.44
SEM	0.90	0.58	0.44	0.48	0.67	0.99	1.50
Reliability	0.20	0.67	0.81	0.77	0.56	0.03	NA

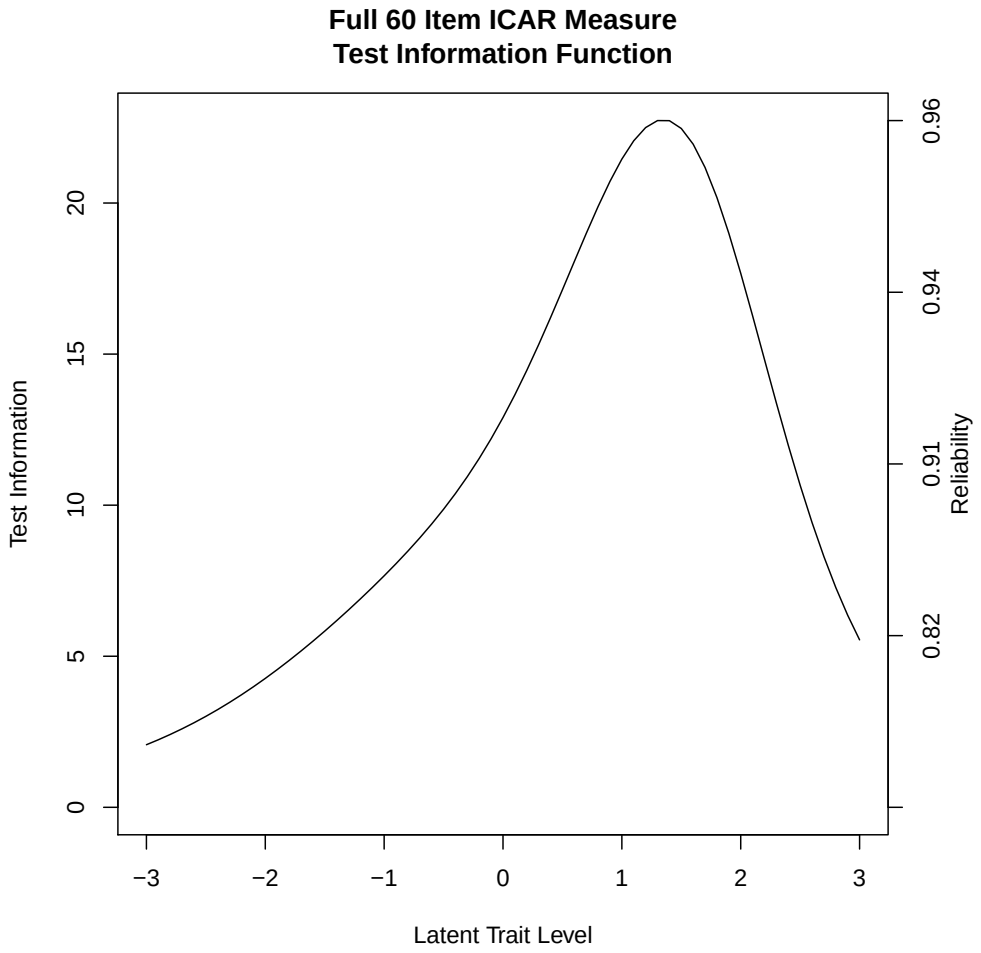

Figure 1. Test Information Function for the 60 ICAR items