

matRiks

An R package for the automatic generation of Raven-like matrices

Ottavia M. Epifania, Andrea Brancaccio, Debora de Chiusole

Universty of Padova, IT

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① Introduction

② Generating rules

③ The matRiks package

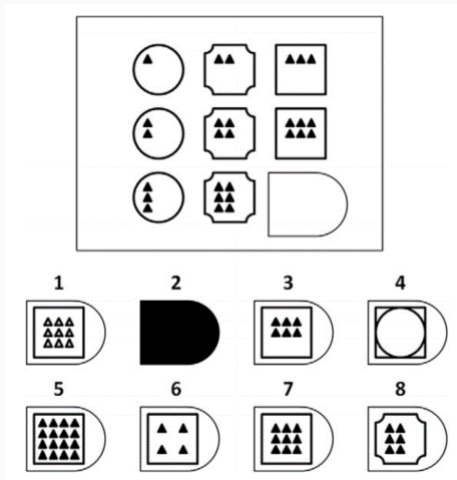
④ Why?



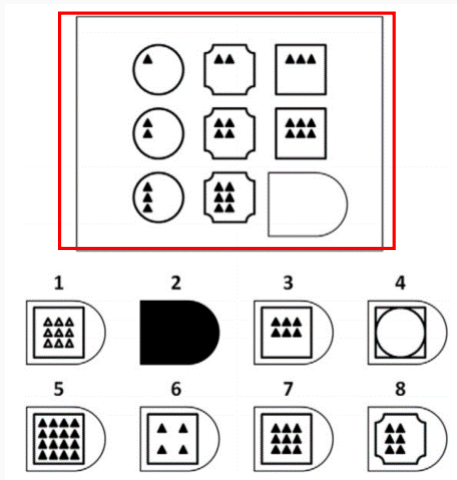
Assessment of fluid intelligence or abstract reasoning
Job recruitment, clinical assessment



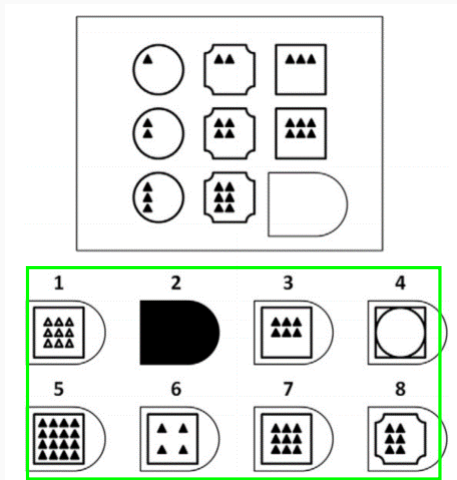
An example



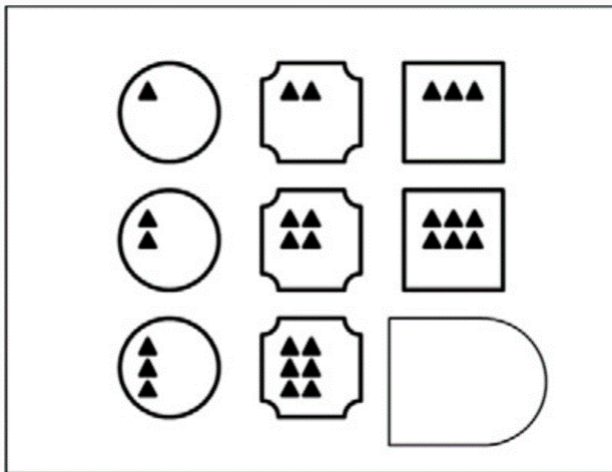
An example



An example

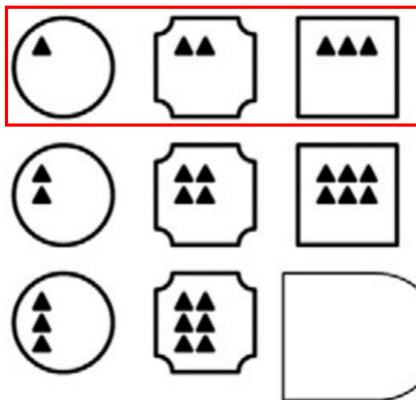


An example: The matrix

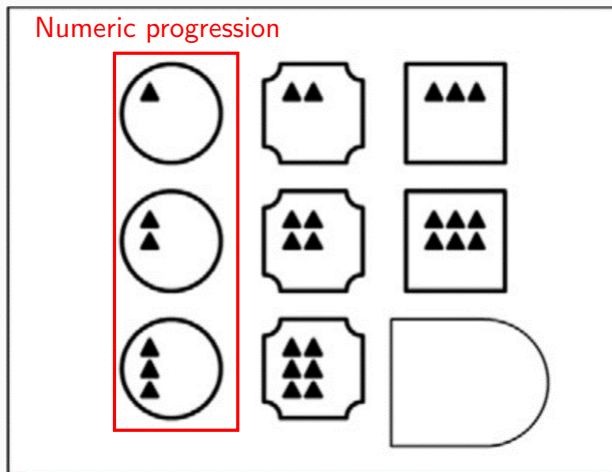


An example: The matrix

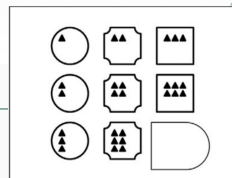
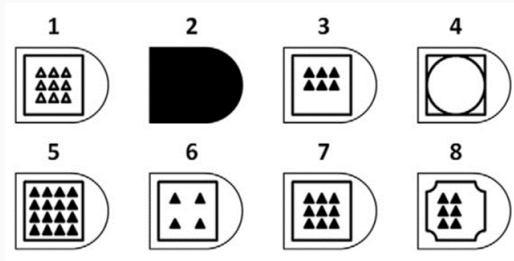
Change shapes & numeric progression



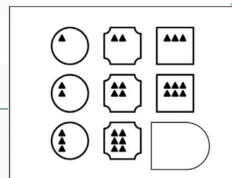
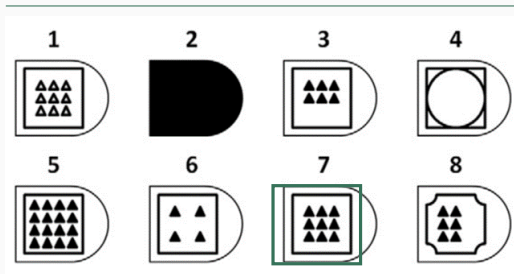
An example: The matrix



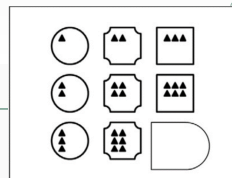
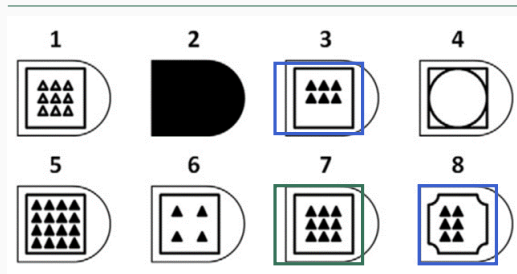
An example: The response list



An example: The response list



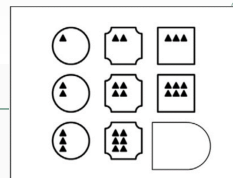
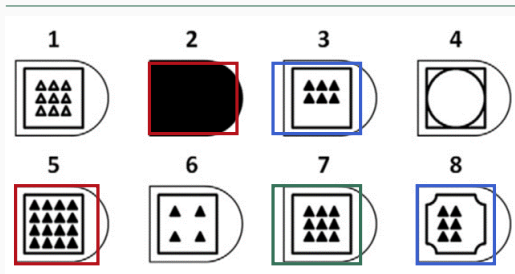
An example: The response list



Repetition of a cell **adjacent** to the blank space

Repetition

An example: The response list



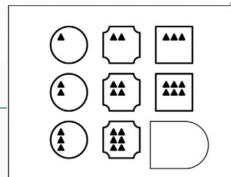
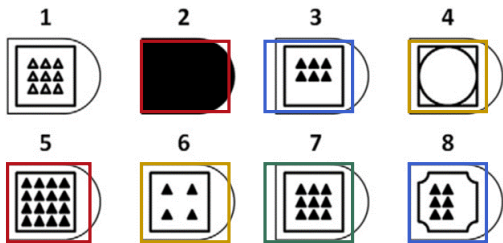
Repetition

Difference

Repetition of a cell **adjacent** to the blank space

Different in appearance from every element of the matrix

An example: The response list



Repetition

Difference

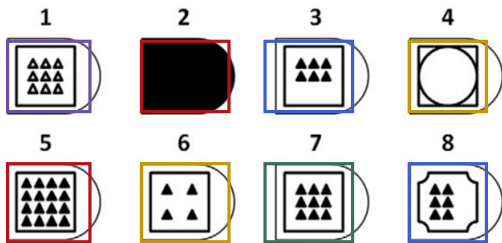
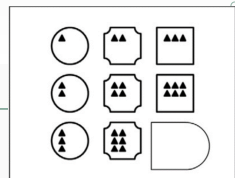
Wrong Principle

Repetition of a cell **adjacent** to the blank space

Different in appearance from every element of the matrix

Copy of a cell or combination of cells

An example: The response list



Repetition

Difference

Wrong Principle

Incomplete Correlate

Repetition of a cell **adjacent** to the blank space

Different in appearance from every element of the matrix

Copy of a cell or combination of cells

Almost the correct response

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④ Why?

Category	Rule name	Definition
Visuospatial rules	Object addition/subtraction	Visually merge two elements
	Movement	With a steady background, the movement is created by changing the position of an object across the cells
	Rotation	The spatial orientation of the figure changes across the cells
	Mental transformation	The third cell results from the application of the characteristics in the second cell to the figures in the first cell.
	Numeric progression	Quantitative increase or decrease in the number of features from cell to cell
	Changes in shape	The figures change across cells
	Changes in shade	The shading of the figures changes across cells
	Changes in size	The size of the figures changes across cells
Logical rules	Changes in margins	The margins of the figures change across cells
	AND	The third cell contains ONLY the elements that appeared in both the first and second cells
	OR	The third cell contains ALL the elements in the first and second cells
	XOR	The third cell contains the elements in the first cell not present in the second cell and viceversa

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2 Generating rules

3 The matRiks package

4 Why?

The matRiks architecture: Matriks generator

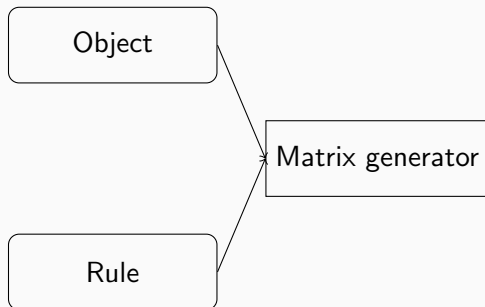
Object

The matRiks architecture: Matriks generator

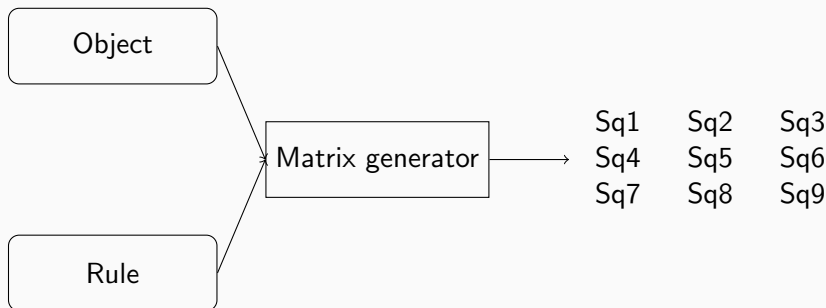
Object

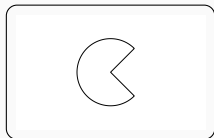
Rule

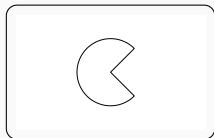
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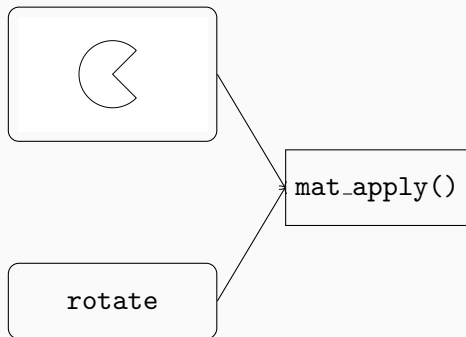
The matRiks architecture: Matriks generator

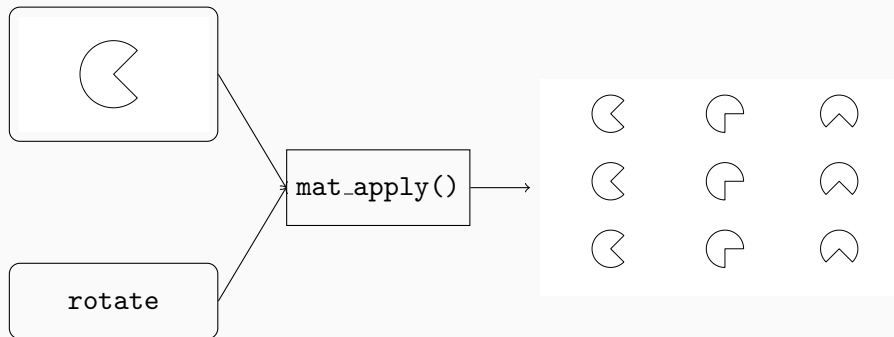






rotate





The matRiks architecture: Response options generator

Sq1	Sq2	Sq3
Sq4	Sq5	Sq6
Sq7	Sq8	Sq9

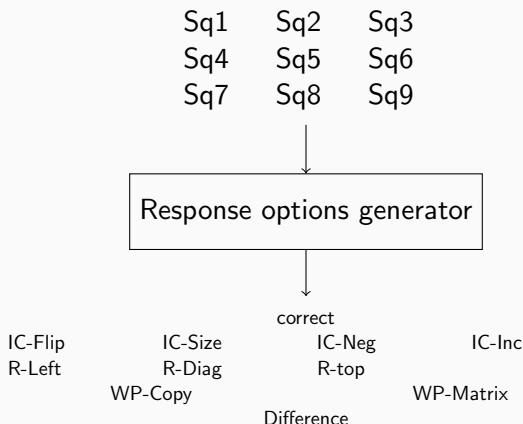
The matRiks architecture: Response options generator

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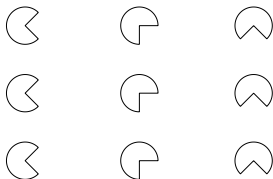


Response options generator

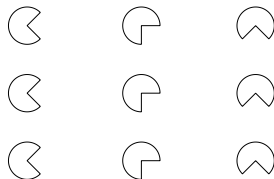
The matRiks architecture: Response options generator







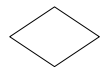
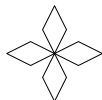
```
response_list()
```



`response_list()`



(Some) of the available figures

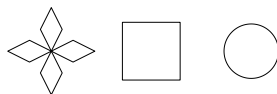


Visuospatial rules

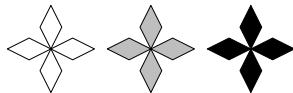
Rotate



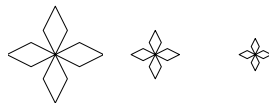
Shape



Shade



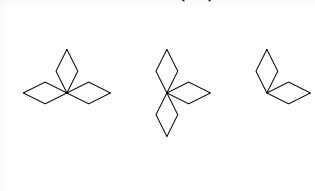
Size



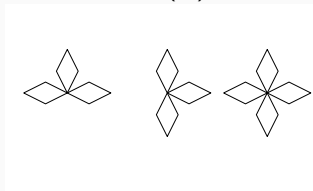
...

Logical rules

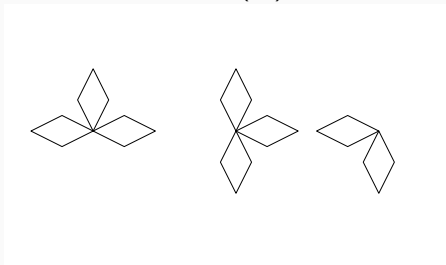
AND (\cap)



OR (\cup)



XOR (Δ)



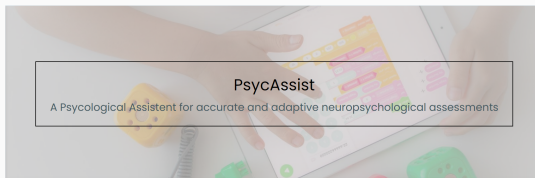
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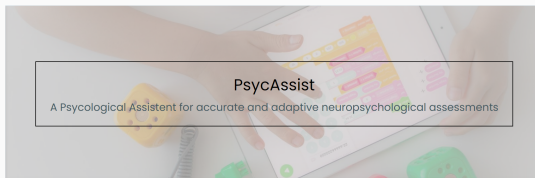
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④ Why?

PsycAssist



PsycAssist



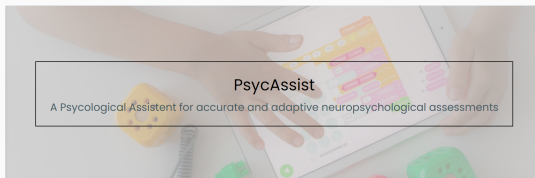
Sample

$n = 600$ children aged 4-11, recruited in Italian schools

$F = 48\%$

30% preschoolers

PsycAssist



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$n = 600$ children aged 4-11, recruited in Italian schools

$F = 48\%$

30% preschoolers

Stimuli

40 Raven-like matrices:

- 5 Mono images
- 2×2 matrices
- 3×3 matrices

Rasch validation

- Monotonicity check
- Fit the Rasch model:
 - ① Item infit and outfit
 - ② Local dependence

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- Monotonicity check
- Fit the Rasch model:
 - ① Item infit and outfit
 - ② Local dependence

Note

2 matrices were eliminated because of technical issues

4 matrices were eliminated because a lack of monotonicity

Starting model

The starting model included 34 matrices:

Madcov	SRMR	SRMSR	MADaQ3	<i>p</i> -value
0.97	0.06	0.08	0.05	< 0.001

Oufit statistic suggested the underfit of one matrix (item 21) → removed and refitted the model

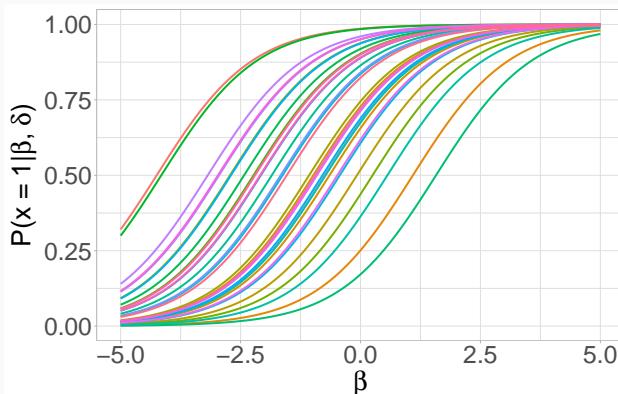
- Check for infit/outfit → no matrices were identified as underfitting
- Check for local dependence:
 - Matrix 37 – 36 → Matrix 37 eliminated
 - Matrix 28 – 40 → Matrix 40 eliminated

The final model

Madcov	SRMR	SRMSR	MADaQ3	<i>p</i> -value
0.96	0.06	0.08	0.05	< 0.001

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- Generate similar but different matrices → parallel forms
- Formalization of the matrix generation and response options generation processes
- Reproducibility of the stimuli
- Ease of use (for useR)

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SOON

