

# Le misure in psicologia sono significanti?

## Il caso del test della Torre di Londra

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Simposio: Crisi di replicabilità o crisi di validità? L'importanza delle  
misure

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## ① Meaningfulness

## ② The case in point

- Tower of London
- Scoring systems

## ③ Real data application

## ④ Final remarks

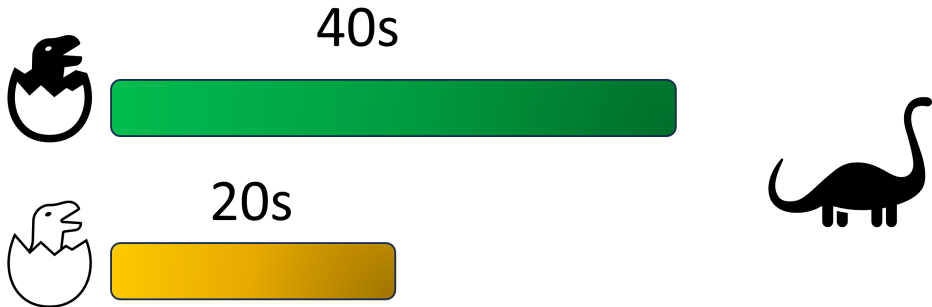
The ratio between the measures of  $a$  and  $b$  is constant and independent of the measurement unit:

$$\frac{\varphi(a)}{\varphi(b)} = \frac{\varphi'(a)}{\varphi'(b)},$$

where  $\varphi$  and  $\varphi'$  are two different scales of measurement of the same variable.

## Meaningful comparisons

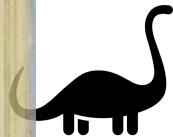
The comparison between  $a$  and  $b$  is meaningful if it is invariant under all the unit transformations.





40s

20s



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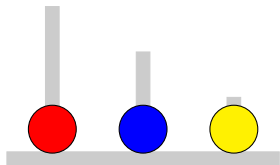
## 3 Real data application

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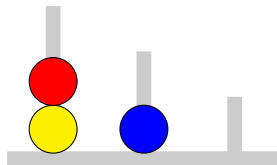
## Meaningfulness

- └ The case in point

- └ Tower of London

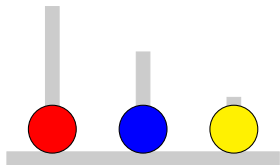


Starting configuration

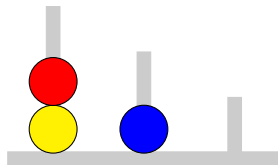


Goal configuration





Starting configuration



Goal configuration

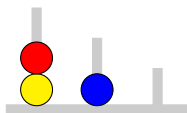
Item difficulty influenced by:

- Number of moves
- Number of alternative paths
- Hierarchy of the starting/goal configuration

# The Tower of London Test (ToL Test)

Shallice (1982)

- 12 problems
- Same starting configuration
- More than one attempt per item



Problem	Minimum moves	Alternative paths
Example	2	1
1	2	1
2	2	1
3	3	2
4	3	1
5	4	2
6	4	1
7	4	1
8	4	1
9	5	2
10	5	1
11	5	1
12	5	2

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└ Scoring systems

Scoring	Attempts	Response times	Item score	Total score
Shallice 1	✓	✓	0-1	0-12
Shallice 2	×	✓	0-3	0-36
Anderson et al.	✓	✓	0-9	0-108
Kirkorian et al.	✓	×	0-3	0-36

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Shallice 2 – SH2

Anderson et al. – AN

For each of the 12 items:

Assign	if time is
3	< 15 s
2	< 30 s
1	< 60 s
0	≥ 60 s

For each of the 12 items:

Assign	if time is
9	< 6 s
8	6 – 10 s
7	11 – 20 s
6	21 – 40 s
5	41 – 60 s
0	> 60 s

Subtract the number of unsuccessful attempts

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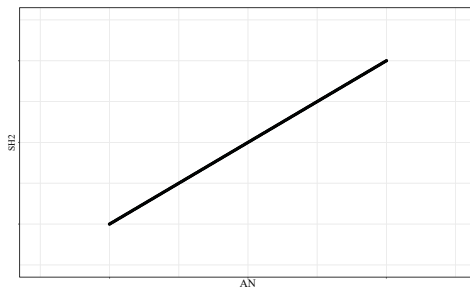
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# The expectation

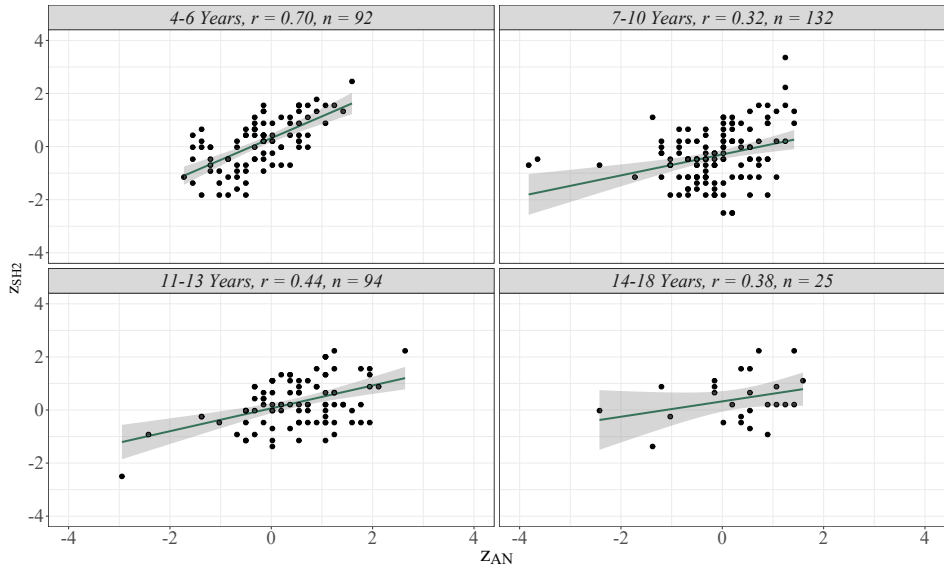
Both scoring are based on the discretization of the response times →  
There should not be differences in the **order** of the total score of the respondents according to the scoring method

# The expectation

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## Is it really bad...?

Respondent  $i, j \in \{1, \dots, N\}$

- AN Comparison ( $\Delta_{AN}$ ): The standardized AN score of each subject  $i$  is compared against the standardized AN score of every other subject  $j$

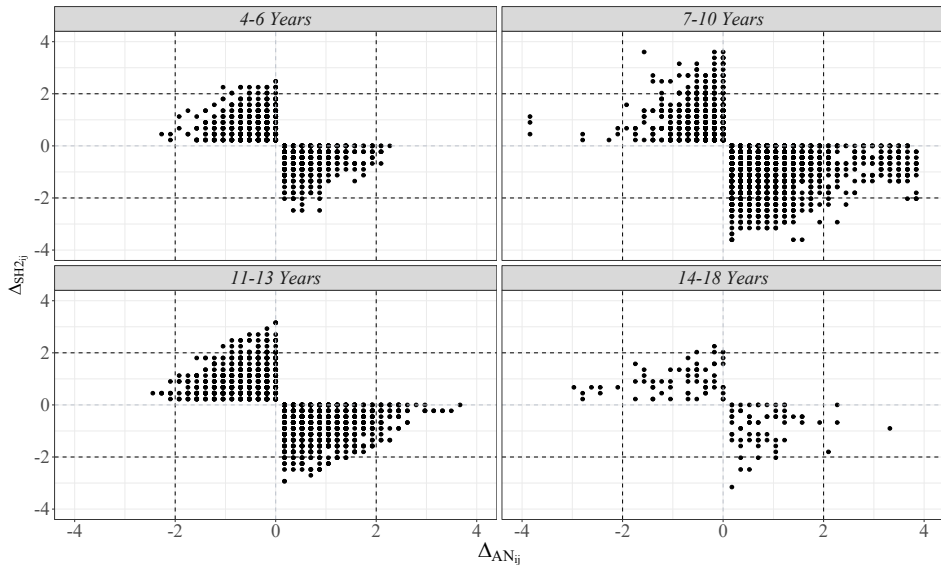
$$\Delta_{AN_{ij}} = z_{AN_i} - z_{AN_j}$$

- SH2 Comparison ( $\Delta_{SH2}$ ): The standardized SH2 score of each subject  $i$  is compared against the standardized SH2 score of every other subject  $j$

$$\Delta_{SH2_{ij}} = z_{SH2_i} - z_{SH2_j}$$

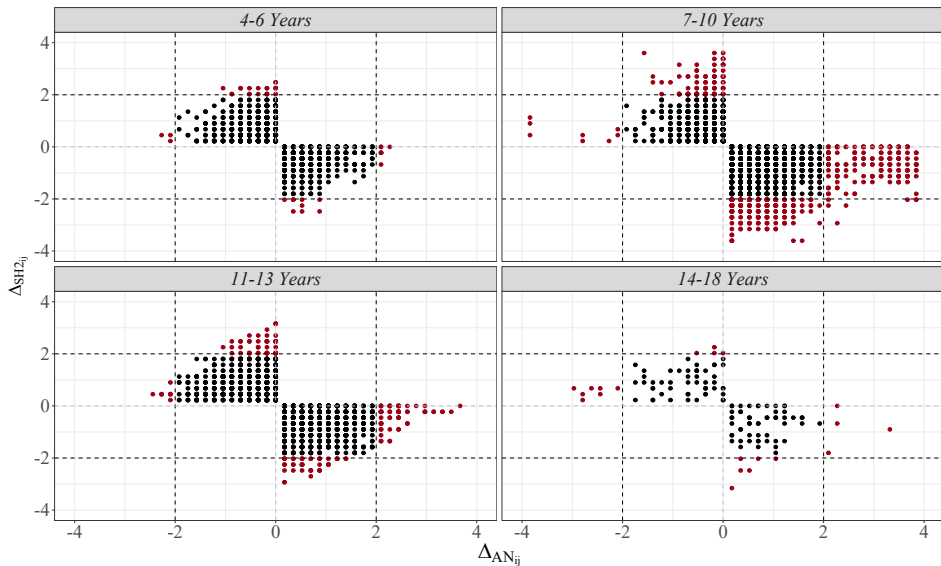
Meaningfulness

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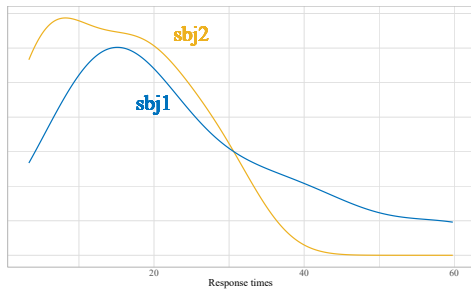


Meaningfulness

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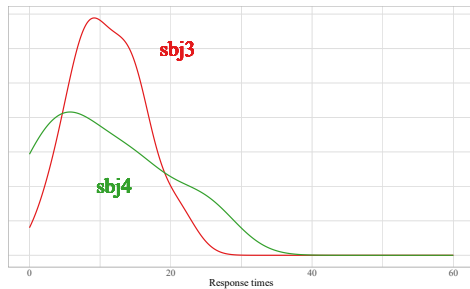
$$\Delta_{AN} > 2 \text{ \& } \Delta_{SH2} \approx 0$$



	$z_{AN}$	$z_{SH2}$	Accuracy	Time (sd)
<b>sbj1</b>	-1.55	0.43	0.75	24.10 (15.60)
<b>sbj2</b>	0.72	0.43	0.75	14.51 (9.22)

	$\Delta_{AN}$	$\Delta_{SH2}$
<b>sbj1 - sbj2</b>	2.27	0.00

$$\Delta_{AN} \approx 0 \text{ \& } \Delta_{SH2} > 2$$



	$z_{AN}$	$z_{SH2}$	Accuracy	Time (sd)
<b>sbj3</b>	-0.15	1.55	0.75	11.14 (4.96)
<b>sbj4</b>	0.20	-0.70	0.58	10.72 (8.60)

	$\Delta_{AN}$	$\Delta_{SH2}$
<b>sbj3 - sbj4</b>	-0.35	2.25

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## Highlights

- Different scoring systems → The focus is shifted: Fast and furious or slow and steady?
- Different scoring systems might favor a cognitive theory over a contrasting one (raising also replicability issues)

## But

What if the performance of the respondents could suggest the most appropriate scoring system? Currently underway

Thank you!

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