

# 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

In the measurement of lengths, the ratio between the measures of two fixed lengths  $a$  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 length.

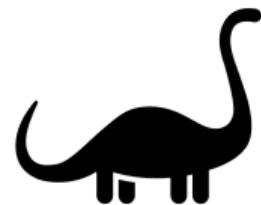
### Meaningful comparisons

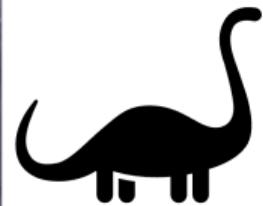
The comparison between  $a$  and  $b$  is meaningful if it is invariant under all the unit transformations.

40s



20s





Meaningfulness

└ The case in point

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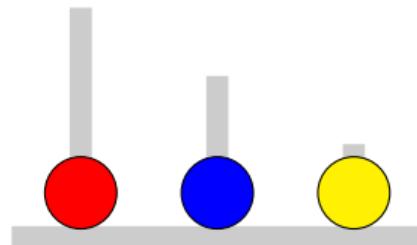
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Meaningfulness

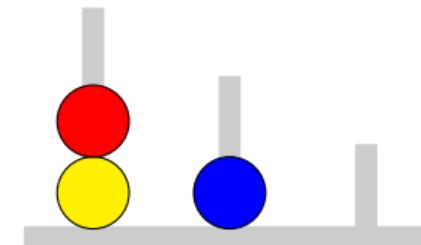
└ The case in point

└ Tower of London

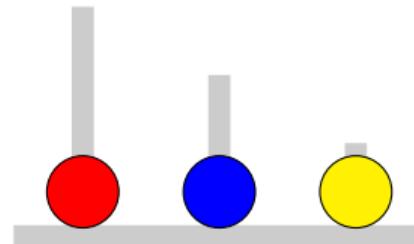
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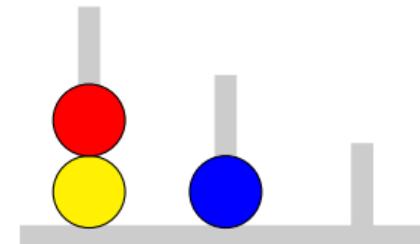
Starting configuration



Goal configuration



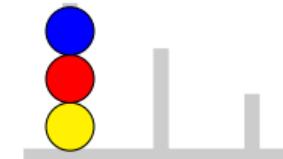
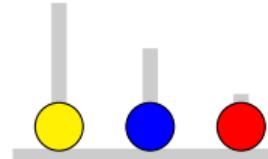
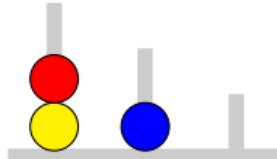
Starting configuration



Goal configuration

Problem difficulty influenced by:

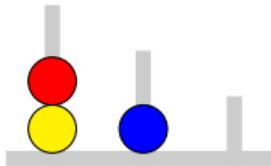
- Number of minimum moves to reach the goal configuration
- Number of alternative paths for reaching the goal configuration
- Hierarchy of the starting/goal configuration



# The Tower of London Test (ToL Test)

Shallice (1982)

- 12 problems
- Same starting configuration



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

Meaningfulness

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  └ Scoring systems

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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	$\geq$ 60 s

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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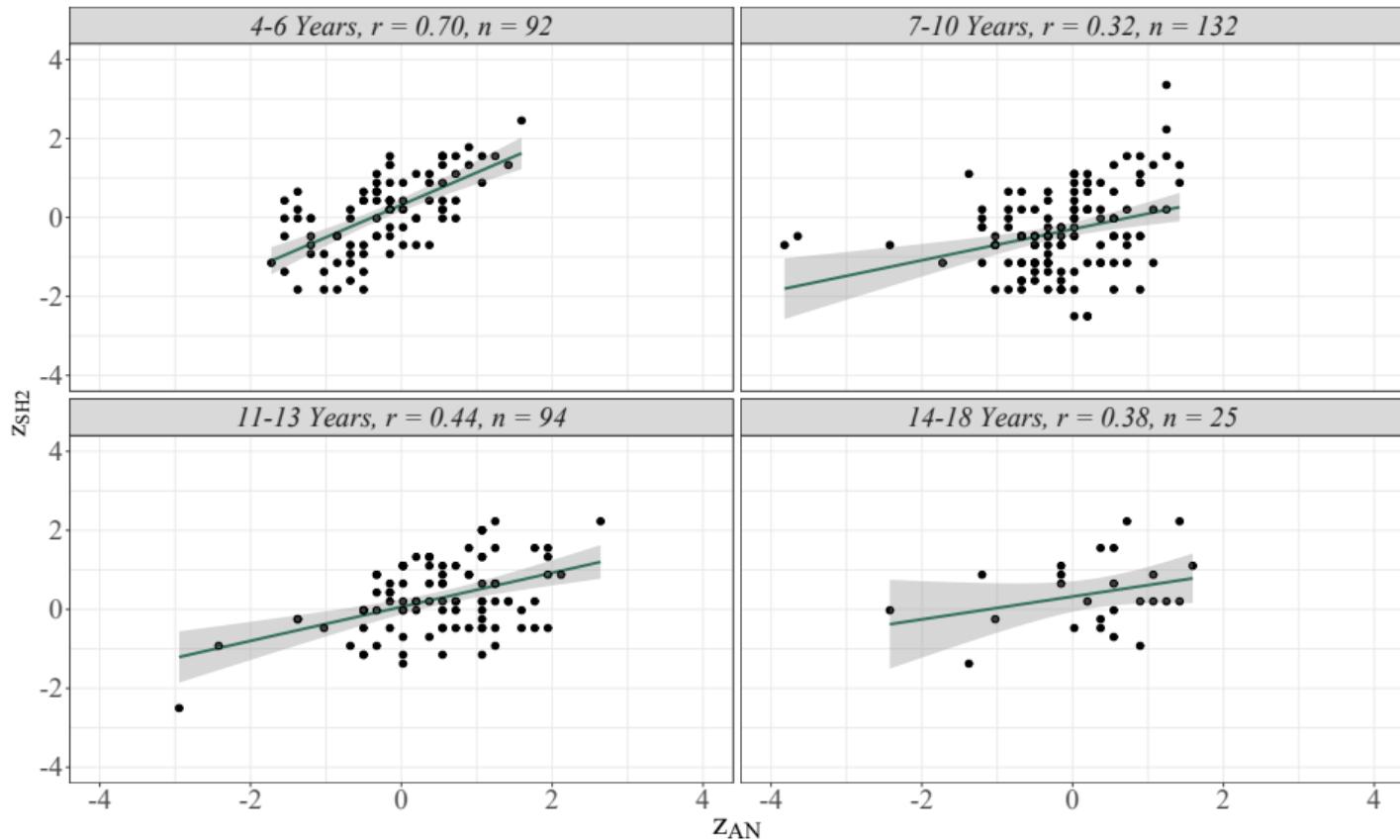
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# Is it really bad...?

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

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

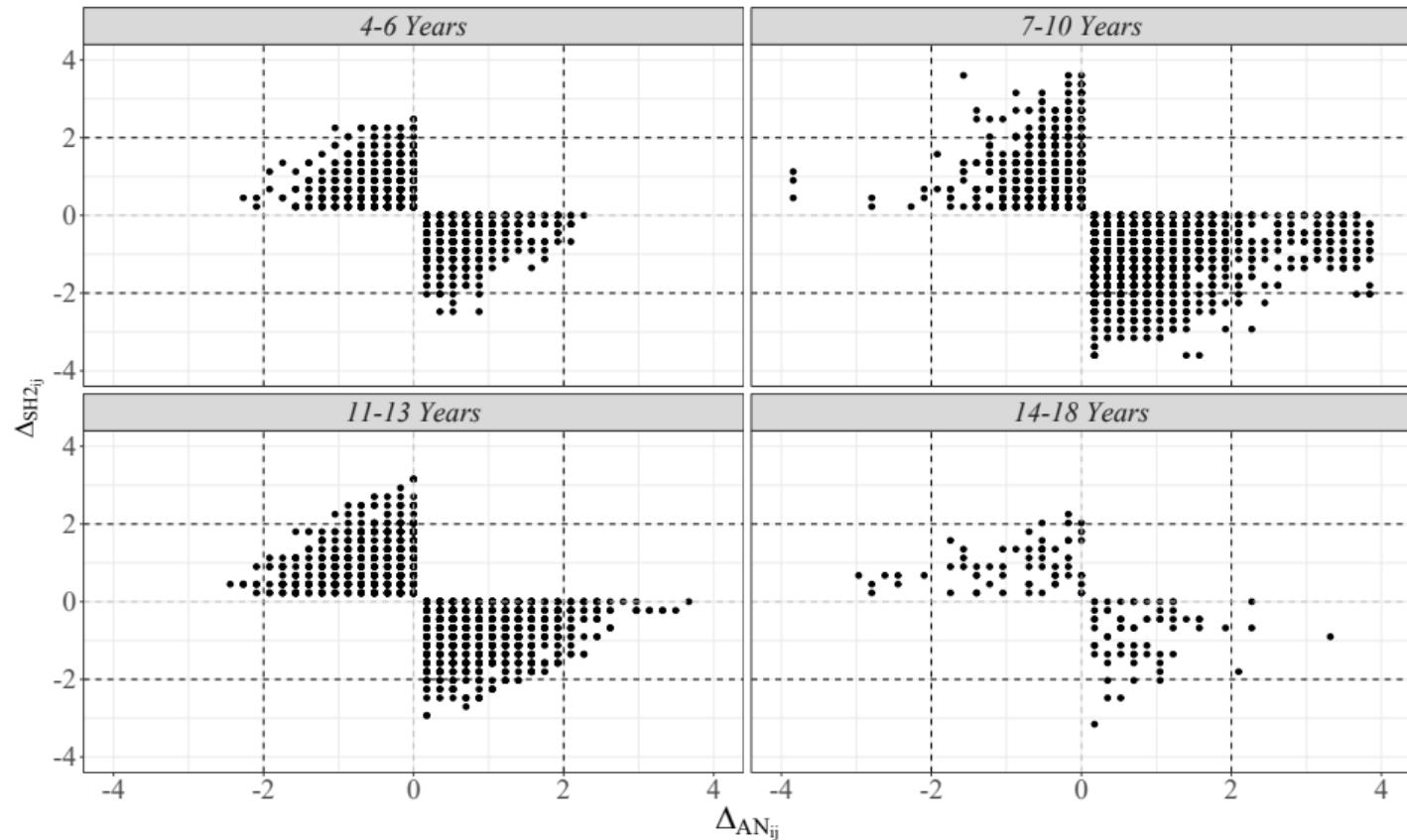
$$\Delta_{\text{AN}_{ij}} = z_{\text{AN}_i} - z_{\text{AN}_j}$$

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

$$\Delta_{\text{SH2}_{ij}} = z_{\text{SH2}_i} - z_{\text{SH2}_j}$$

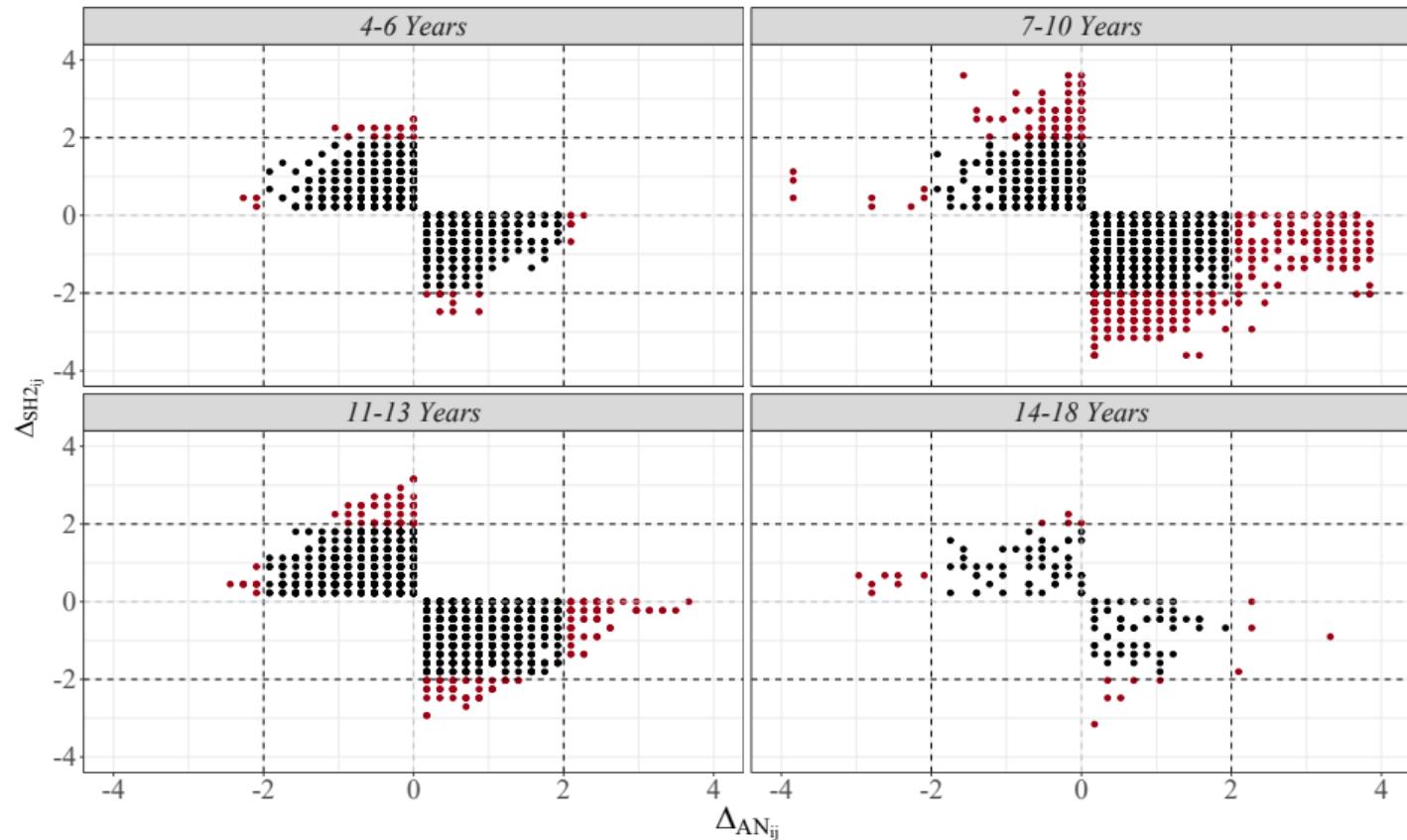
## Meaningfulness

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## Meaningfulness

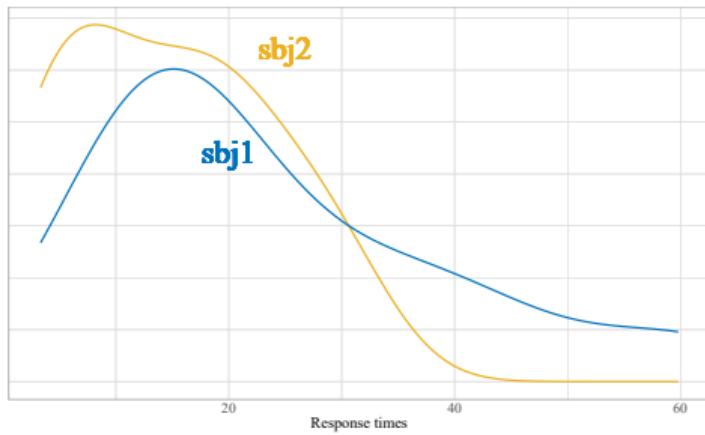
└ Real data application



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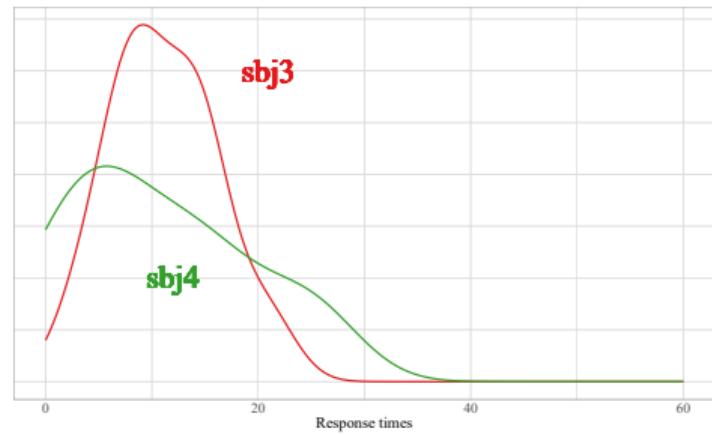
### └ Real data application

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



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

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



	$\Delta_{AN}$	$\Delta_{SH2}$
<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

Live long and prosper