

# Le misure in psicologia sono significanti?

## Il caso del test della Torre di Londra

**Ottavia M. Epifania**, Luca Stefanutti, Pasquale Anselmi, Andrea  
Brancaccio, Debora de Chiusole



Dipartimento di Filosofia, Sociologia, Pedagogia e Psicologia Applicata,  
Università di Padova

Convegno AIP-Sezione Sperimentale 2023  
Simposio: Crisi di replicabilità o crisi di validità? L'importanza delle  
misure

19 Settembre 2023

## 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.

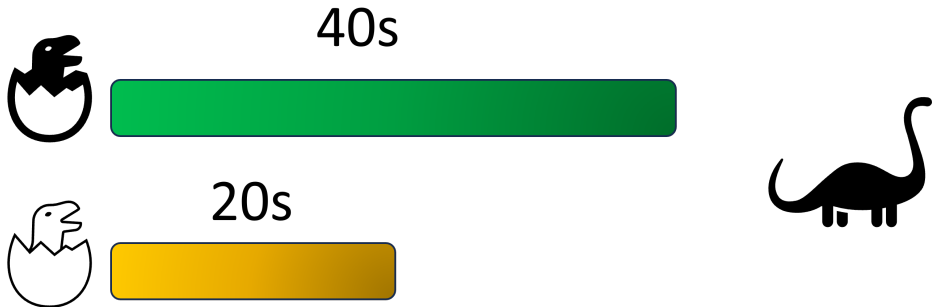
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## Meaningful comparisons

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





40s

20s



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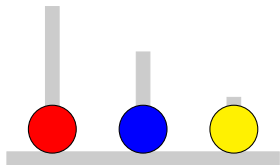
## 4 Final remarks



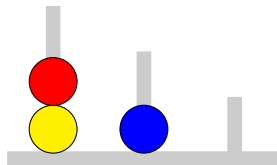
## Meaningfulness

- └ The case in point

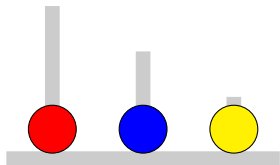
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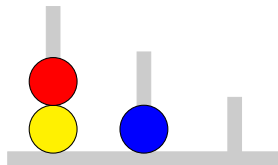
Starting configuration



Goal configuration



Starting configuration



Goal configuration

Item difficulty influenced by:

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

## Shallice (1982)

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## Meaningfulness

└ The case in point

└ 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	$\leq 15$ s
2	$15 \div 30$ s
1	$30 \div 60$ s
0	$> 60$ s

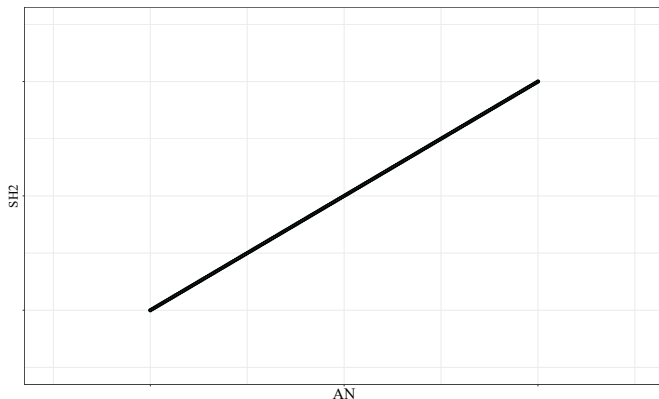
For each of the 12 items:

Assign	if time is
9	$\leq 6$ s
8	$6 \div 10$ s
7	$11 \div 20$ s
6	$21 \div 40$ s
5	$41 \div 60$ s
0	$> 60$ s

Subtract the number of unsuccessful attempts

Both scorings 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

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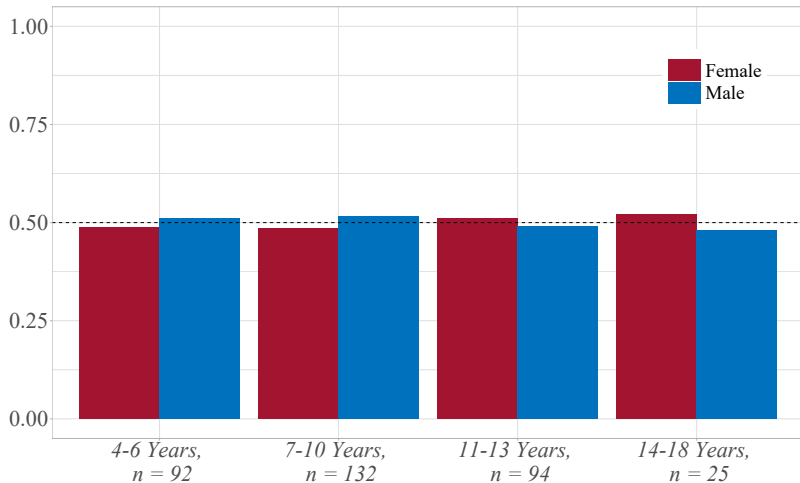
## ① Meaningfulness

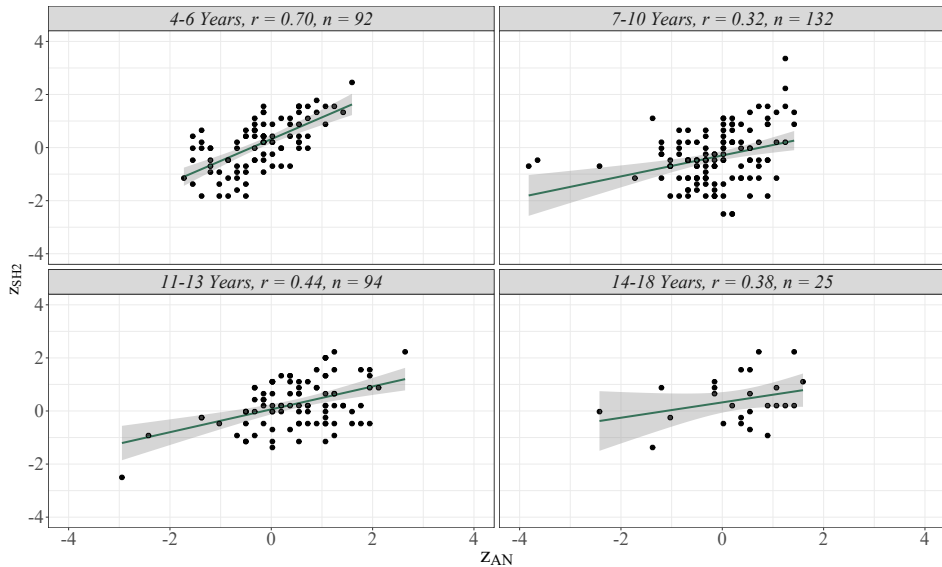
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$n = 343$ 



## Is it really bad...?

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

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

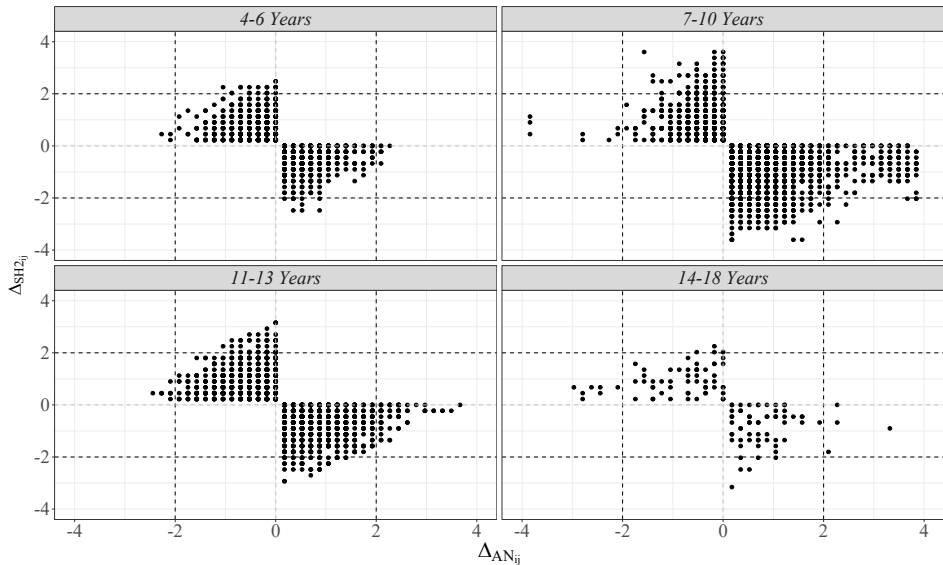
$$\Delta_{AN_{ij}} = z_{AN_i} - z_{AN_j}$$

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

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

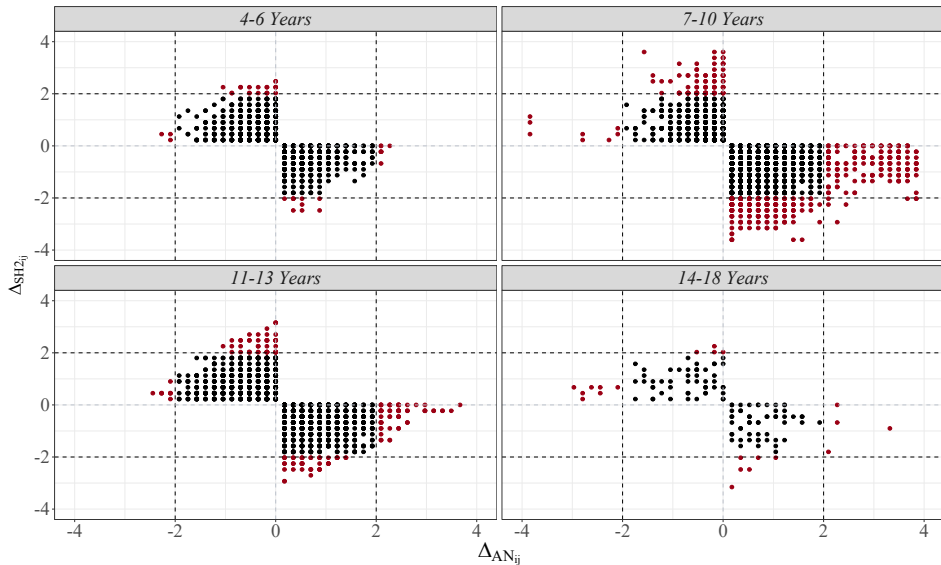
Meaningfulness

└ Real data application

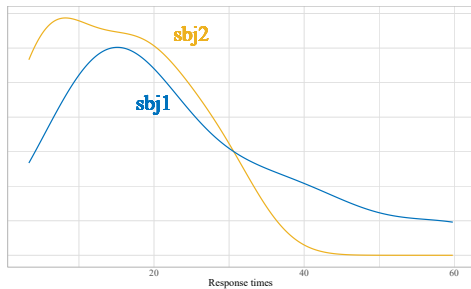


Meaningfulness

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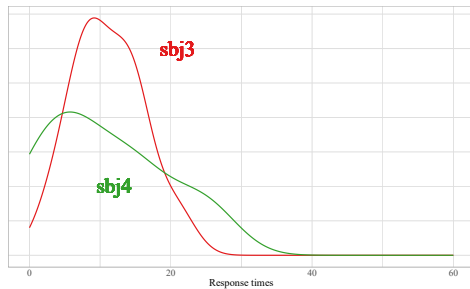
$$\Delta_{AN} > 2 \text{ \& } \Delta_{SH2} \approx 0$$



	$z_{AN}$	$z_{SH2}$	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!

[ottavia.epifania@unipd.it](mailto:ottavia.epifania@unipd.it)