

Multimethod & Intensive Longitudinal Designs in Occupational Health Psychology

Better understanding the individual functioning at work

Luca Menghini Ph.D.

Dep. of General Psychology, University of Padova
Dep. of Psychology, University of Bolonga



Associazione
Italiana
di Psicologia



XXX Conference Italian Association of Psychology (AIP)

AIP 2022, Padova, 27-30 July 2022

Interdisciplinary symposium:

*“Connecting People and Ideas from Psychology and Statistics:
The Psicostat Experience”*



OHP
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Psicostat
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Isomorphism
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Homology
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Multimethod
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Discussion & Refs
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OHP



Occupational Health Psychology

OHP concerns the **application** of psychology to improving the quality of work life, and to protecting and promoting the safety, health & well-being of workers.

NIOSH, US Centers for Disease Control and Prevention

Work stress management:

Identifying, quantifying, & preventing the work-related environmental conditions (**job stressors**) thought to impact the health and well-being of the worker (**job strain**)

Hurrell et al., 1998

EU regulation & monitoring:

2000: EU-OSHA Commissioned report on work-related stress

2004: EU Social Partners' Framework Agreement on Work-related stress

2008: D.Lgs. 81/08 Testo Unico Salute e Sicurezza sul Lavoro

1990-2021: Eurofound's European Working Conditions Surveys

Theories & Methods in OHP

Mainly
theory-based/deductive approach

e.g., Work stress

Identifying parsimonious models of
stressful job characteristics &
dimensions of **stressful appraisals**

- Job Demand-Control
- Effort-Reward Imbalance
- Job Effort-Recovery
- ...

Mainly quantitative

- 41% cross-sectional self-reports
- 29% longitudinal self-reports
- 10% multisource (self & others)
- 7% (quasi-)experimental

Mainly regression & SEM

- 52% multivariate or multilevel
- 45% multiple regression
- 21% CFA, 5% EFA

Spector & Pindek (2015)

N = 322 published from 2010 to 2014
in *JOHP* and *Work & Stress*

Issues & perspectives in OHP

Long-standing issues:

- mostly based on **cross-sectional questionnaires**
- common method bias, retrospective, response style & traits
- hard to find objective measures

Current perspectives:

- Intensive longitudinal designs
Daily diaries & Experience sampling methods
- Applied psychophysiology
Ambulatory assessment & Multimethod approach
- **Multilevel modeling**
of group phenomena & intraindividual fluctuations over time

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Psicostat



My experience at Psicostat

We are an interdisciplinary research group interested in Psychology and Statistics. Our goal is to promote the connection between the two fields in order to benefit the progress of scientific research.

Dagli “incontri clandestini” sulle meta-analisi Psicostat 2.0...



...alla Comunità Psicostat verso l'edizione 3.3

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Psicostat
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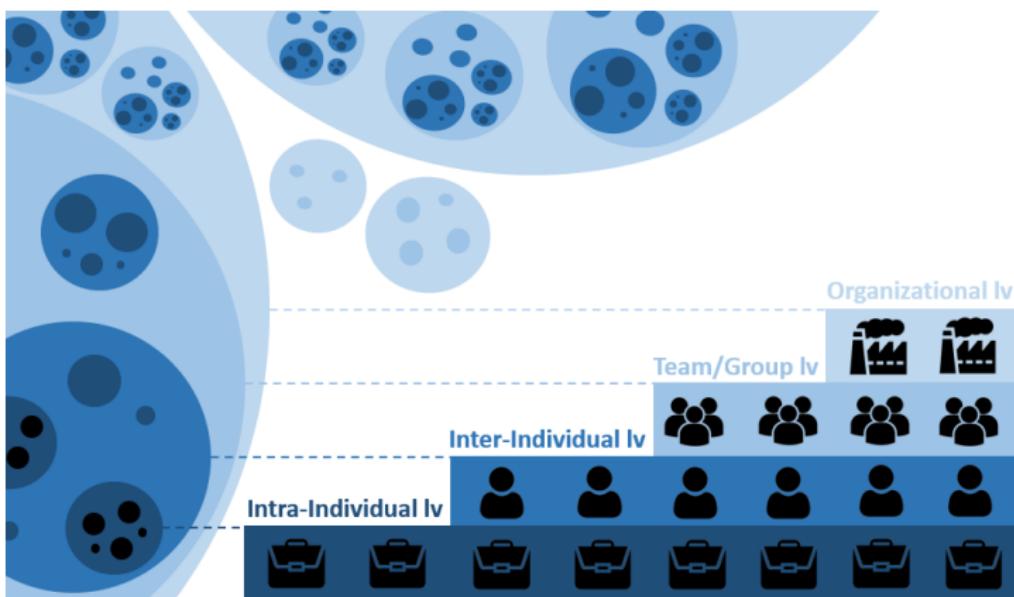
Isomorphism
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Discussion & Refs
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Psicostat × Multilevel



$$Y_{ij} = \beta_0 + \beta_1 X_{ij} + \epsilon_{ij} \quad (\text{lv 2: between})$$

$$Y_{ij} = (\beta_0 + \lambda_{0j}) + (\beta_1 + \lambda_{1j}) X_{ij} + \epsilon_{ij} \quad (\text{lv 1: within})$$

Theory ∨ Method ?



- «sentiamo il parere dello statistico»
- «nel nostro ambito queste cose non hanno importanza»
- «non lo fa nessuno, perché ci perdi tempo?»
- «hai un profilo troppo metodologico»

Construct validation: Theory \wedge Method

“Construct validation refers to the process of simultaneously validating measures of psychological constructs and the theories of which the constructs are a part” (Strauss & Smith, 2009)

Construct validation in a multilevel framework:

1. Cross-level isomorphism

Same construct on different levels?

2. Cross-level homology

Same relationships on different levels?

3. Multimethod approach

Same conclusions with different methods?

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Discussion & Refs
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Isomorphism

Cross-level isomorphism & measurement invariance

Isomorphism:

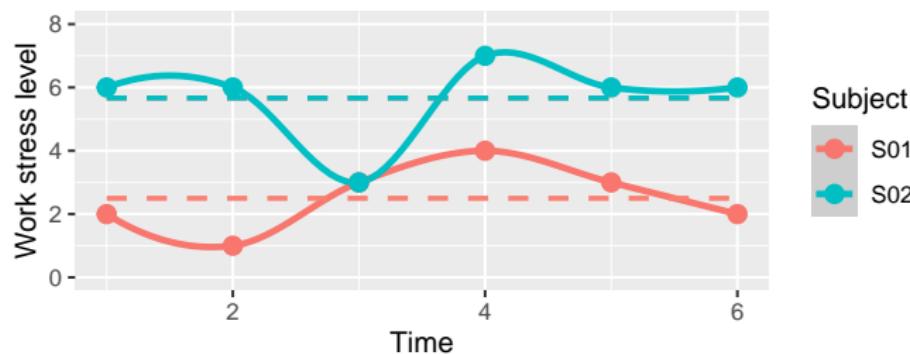
similarity among elements

Psychometric isomorphism:

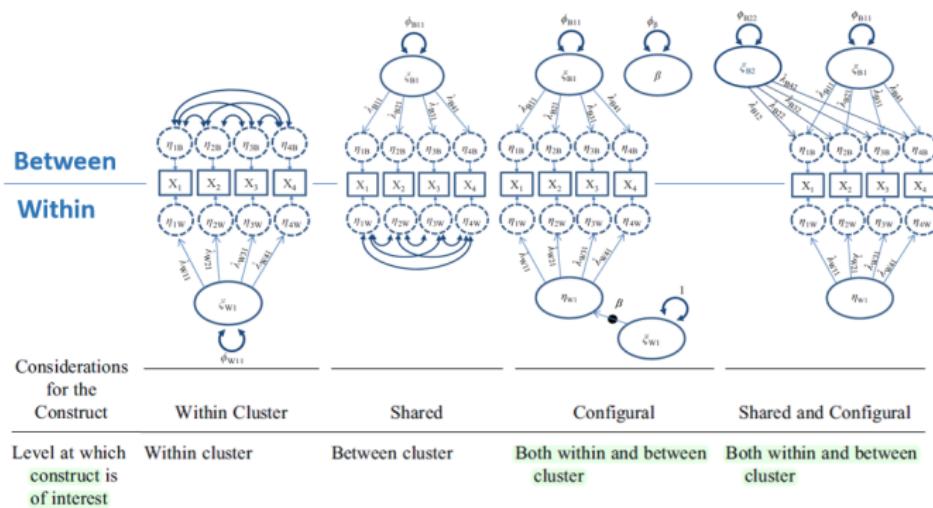
equivalence (*invariance*) of measurements among different populations (multigroup), over time (longitudinal) or between ‘clusters’ (multilevel)

Cross-level isomorphism:

“implies that higher-level constructs have similar meanings and properties as their lower-level counterparts” Tay et al., 2014



Cross-level isomorphism: From method to theory



Stapleton, L. M., Yang, J. S., & Hancock, G. R. (2016). Construct meaning in multilevel settings. *Journal of Educational and Behavioral Statistics*, 41(5), 481–520

Example 1: Configural multilevel construct

Job Demand (lv2)

perceived amount/difficulty of one's job

Task Demand (lv1)

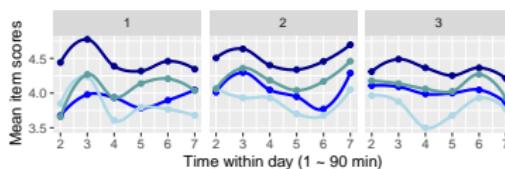
perceived amount/difficulty of a job task

Sample & procedure:

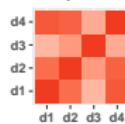
139 full-time office workers

7 surveys/day over 3 workdays

Four 7-point VAS items



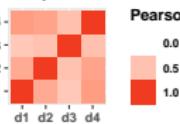
lv2 (means)



Pearson r



lv1 (mean-centered)



Pearson r



```
# configural                                # weak invariance

m1 <- 'level: 1'                           m2 <- 'level: 1'

TD == d1 + d2 + d3 + d4                   TD == a*d1 + b*d2 + c*d3 + d*d4

level:2                                     level:2

JD == d1 + d2 + d3 + d4                   JD == a*d1 + b*d2 + c*d3 + d*d4'

library(lavaan)

conf <- cfa(m1, data = s, cluster = "ID", std.lv = TRUE)
weak <- cfa(m2, data = s, cluster = "ID", std.lv = TRUE)

##      npar    chisq rmsea     cfi srmr_within srmr_between AIC_weight
## conf     20  25.886  0.060  0.992      0.013      0.037      0.32
## weak    16  32.335  0.045  0.991      0.016      0.061      0.68
```

Menghini, Pastore, & Balducci

(2022) *Eu J Psych Assessment*

<https://doi.org/10.1027/1015-5759/a000725>

Example 1: Standardized loadings

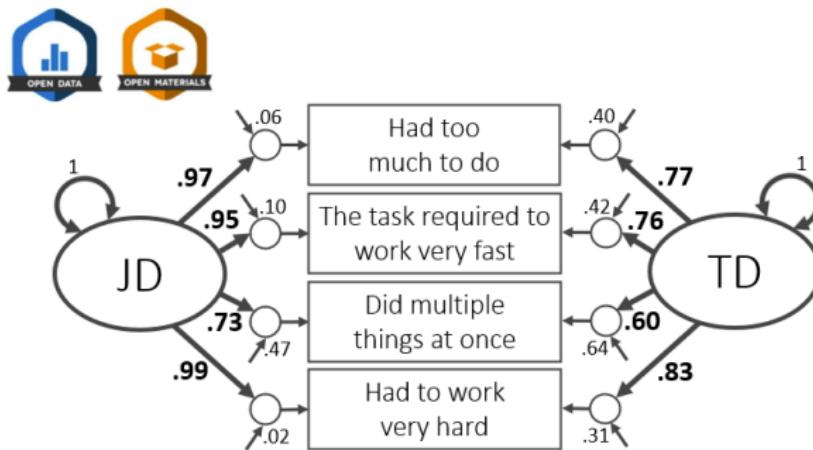
European Journal of Psychological Assessment (2022)

Original Article

Workplace Stress in Real Time

Three Parsimonious Scales for the Experience Sampling Measurement of Stressors and Strain at Work

Luca Menghini¹✉, Massimiliano Pastore², and Cristian Balducci¹



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Isomorphism
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Discussion & Refs
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Homology

Homology across levels

Homology:

similar relationships (*nomological network*) across levels ('nomological isomorphism')

Kozlowski & Klein, 2000

Homologous theory:

Theory predicting *similar* patterns of relationships (significance, direction, and/or magnitude) between two levels of analysis

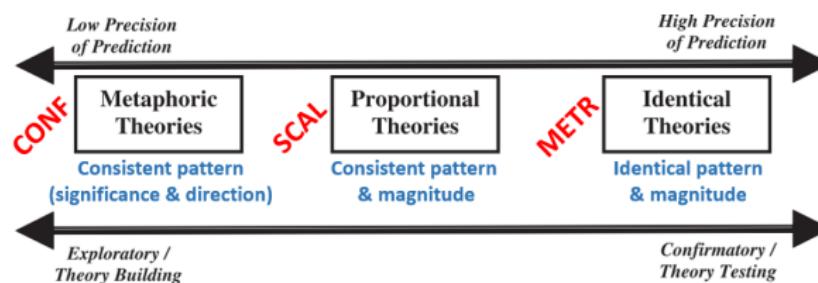
Chen, G., Bliese, P. D., & Mathieu, J. E. (2005). Conceptual framework and statistical procedures for delineating and testing multilevel theories of homology. *Organizational Research Methods*, 8, 375-409.



Homology: From method to theory

“Tests of homology can and should play an integral role in the validation of multilevel constructs and theories”

Chen et al., 2004



Ecological fallacy: thinking that relationships observed among groups (*between*) necessarily hold at the individual level (*within*)

Piantadosi et al 1988

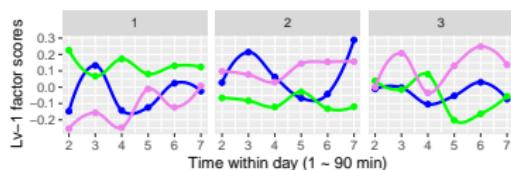
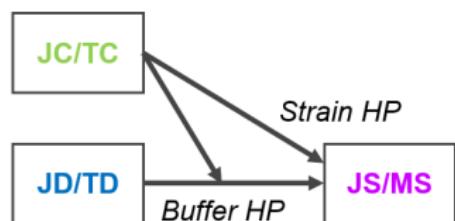
Ergodicità: implies equivalence between variability *within* and *between*

Richiede *omogeneità* & *stazionarietà*, rarely met by psychological processes

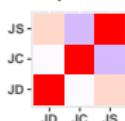
→ need to analyze the two levels separately?

Molenaar, 2004

Example 2: Metaphorical theory

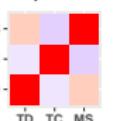


lv2, N=139



Pearson r
-1
0
1

lv2, N=1473



Pearson r
-1
0
1

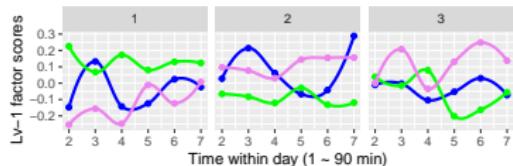
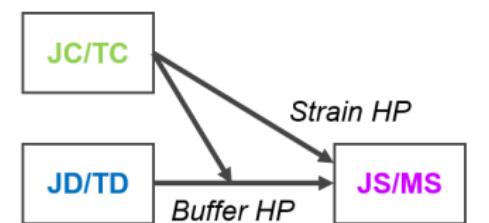
Job Demand-Control (lv2)

- Higher Job Demand and lower Job Control imply higher Job Strain
- JC mitigates the effect of JD on JS

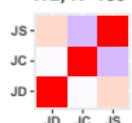
Task Demand-Control (lv1)

- Higher-than-usual TD and lower-than-usual TC imply higher Momentary Strain
- TC mitigates the effect of TD on MS

Example 2: Configural similarity



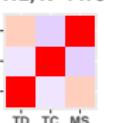
lv2, N=139



Pearson r

- 1
- 0
- 1

lv2, N=1473



Pearson r

- 1
- 0
- 1

```
lv2 <- lm("JS ~ JD + JC + JD:JC", data = wide)
```

	Estimate	Std. Error	t value
## (Intercept)	0.00	0.08	0.02
## JD	0.23	0.09	2.42
## JC	-0.31	0.09	-3.58
## JD:JC	0.09	0.08	1.09

```
library(lme4)
```

```
lv1 <- lmer("MS ~ TD + TC + TD:TC + (1|ID)", data = long)
```

	Estimate	Std. Error	t value
## (Intercept)	0.03	0.09	0.32
## TD	0.21	0.02	8.83
## TC	-0.18	0.03	-6.86
## TD:TC	-0.04	0.02	-1.55

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Psicostat
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Isomorphism
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Homology
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Multimethod
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Discussion & Refs
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Multimethod

Multimethod approach

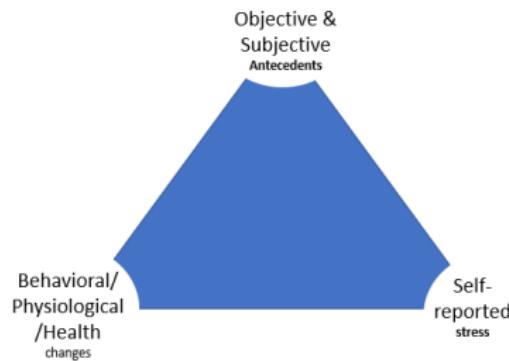
Multi-modal constructs:

constructs manifesting at different epistemological levels (e.g., stress)

Principle of triangulation:

strategy of fixing a particular position or finding by examining it from at least three different points of view (e.g., PsychoPhysiological assessment)

Triangulation in Work Stress Assessment (Cox et al. 2000; Kristensen, 1996)



		Stressor			Strain		
		Independent	Self-rated	Average	Physical	Self-rated	Behavior
Stressor	Independent						
	Self-rated						
	Average						
Strain	Physical						
	Self-rated						
	Behavior						

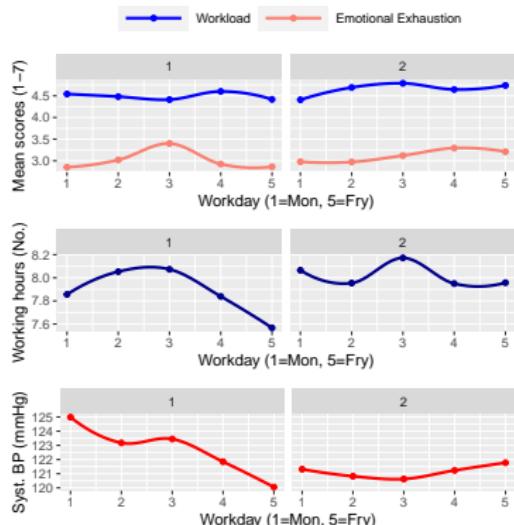
Example 3: Workload & Stress

RQ: Is workload associated with stress?

Sample & procedure:

135 full-time office workers

3 surveys/day + BP over 10 workdays



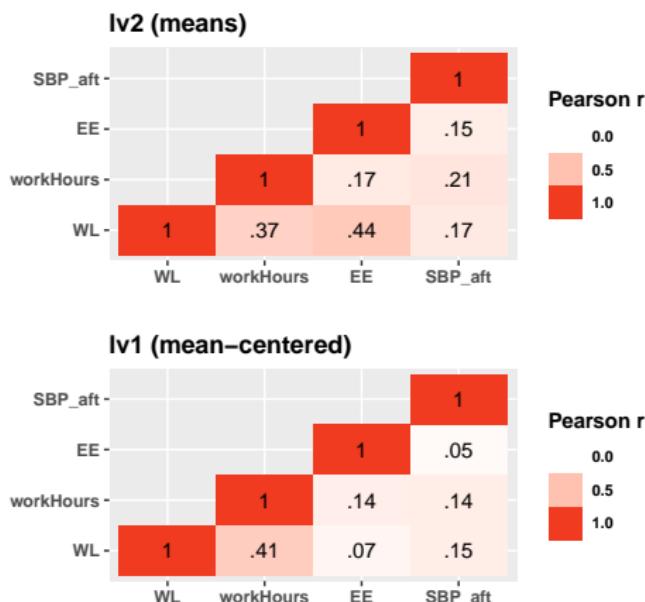
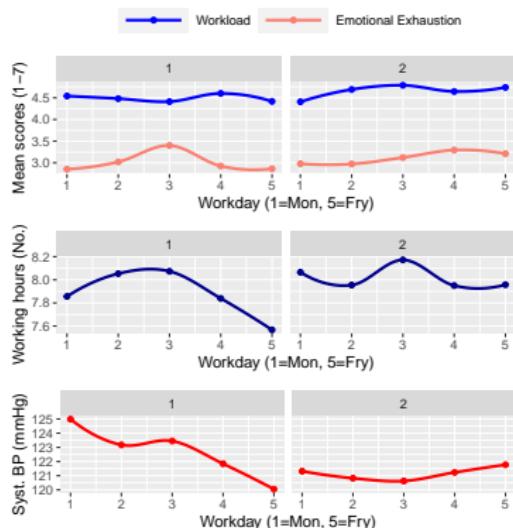
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Multimethod
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Discussion & Refs
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Discussion & Refs

Theory \wedge Method

“Construct validation refers to the process of simultaneously validating measures of psychological constructs and the theories of which the constructs are a part” (Strauss & Smith, 2009)

Construct validation in a multilevel framework:

1. Cross-level isomorphism

Same construct on different levels? → anche con **multilevel IRT** (Tay et al., 2014)

2. Cross-level homology

Same relationships on different levels?

3. Multimethod approach

Same conclusions with different methods?

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Isomorphism
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Discussion & Refs
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Thank you!



Luca Menghini Ph.D.,
Department of General Psychology,
University of Padova

- luca.menghini.3@phd.unipd.it
- @LuMenPsy
- researchgate.net/profile/Luca-Menghini
- linkedin.com/in/menghiniluca/



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Homology
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Discussion & Refs
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Psicostat × Spritz (Spritzostat?)



Vi aspettiamo più tardi all'AIPeritivo! ;)

https://github.com/Luca-Menghini/psicostat_aip2022



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Tay, L., Woo, S. E., & Vermunt, J. K. (2014). A conceptual and methodological framework for psychometric isomorphism: Validation of multilevel construct measures. *Organizational Research Methods*, 17, 77-106.