

Measurement invariance as a tool for theory development or refinement: The case of basic human values

Eldad Davidov

Institute of Sociology and Social Psychology, University of Cologne;
URPP „Social Networks“ and Institute of Sociology, University of Zurich

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Introduction

- Measurement invariance has been proposed in the **1971 by Jöreskog** (Psychometrika 57, 409 - 426) and proven as a necessary condition by **Meredith in 1993**.



- Without examining measurement invariance, we just **do not know** if comparisons are meaningful, even if they may be.

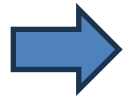
Four common types (,ideal types‘) of cross-cultural studies

Consideration of contextual factors	Orientation	
	Hypothesis Testing	Exploration
No	Theory-driven	Group differences
Yes		External validation

From van de **Vijver and Leung, 1997**

Two general orientations in cross-cultural research on core theory: level and structure

- **Structure-oriented studies**: focus on **relationships** and their **differences** across cultures.
- For example: is the **effect of values on attitudes to immigration equal across European countries?**
- **Level-oriented studies**: focus on **differences in magnitude** of variables
- For example: do **individuals in Austria show higher levels of tradition values compared with Germans?**
- But there are also **measurement theories** as discussed below.



These different studies have one issue in common: The need for measurement invariance

- There are studies where **measurement invariance** is not the goal, but rather an **empirical question to allow meaningful substantive comparisons**.
- In other studies, measurement invariance is the **goal**, for example when assessing newly developed scales.
- However, **in most sociological studies it is common practice to assume invariance rather than test it**.

Why do we need to test it?

- **Attitudes toward immigrants in Denmark**



- **Religiosity in Turkey**



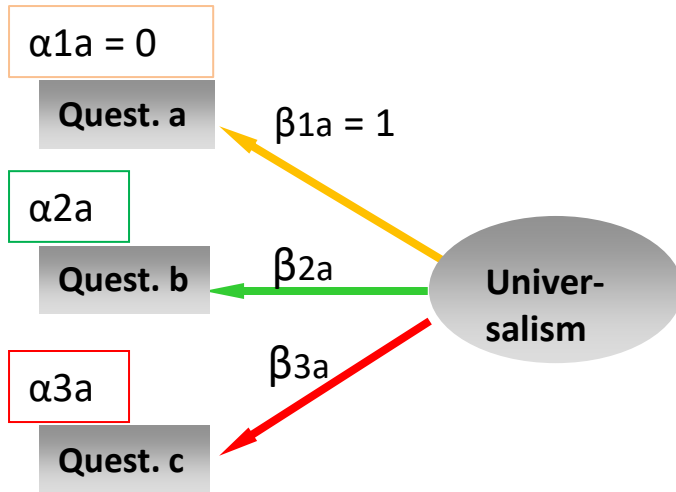
Other reasons

- **Incompatibilities in sampling and design**
- These may cause **item bias**
- But **even if data collection were comparable, scales may still be noninvariant across countries, over time, across methods.**
- Therefore, we **have to test for it.**
- It is not a magical medicine, but it allows to **trust** more substantive conclusions.

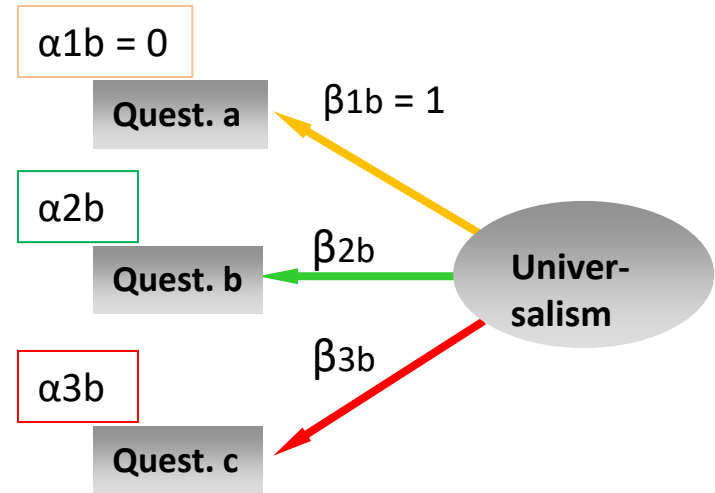
- The **conference program** includes several great studies that do it:
- **Awareness for personal privacy** (Neumann et al.)
- Invariance across **harmonization methods and education groups** (Roth and Singh)
- **Across modes** (Heller et al.)
- **Curiosity across countries** (Grüning and Lechner)
- Just to name a few.

Measurement equivalence

Group A (Culture, country, time point)



Group B (Culture, country, time point)



Metric: $\beta_{1a} = \beta_{1b} = 1$ $\beta_{2a} = \beta_{2b}$ $\beta_{3a} = \beta_{3b}$

Scalar – in addition: $\alpha_{1a} = \alpha_{1b} = 0$ $\alpha_{2a} = \alpha_{2b}$ $\alpha_{3a} = \alpha_{3b}$

- $\alpha_{1a} = \alpha_{1b}$ $\alpha_{2a} = \alpha_{2b}$ $\alpha_{3a} = \alpha_{3b}$
- Often no empirical support for scalar invariance

**OH NO,
NOT
AGAIN!**

- It is also good → This repeated result has led to developments on the interface of
- **data analysis**
- **methodological development**
- **software development**
- **theory refinement and development**

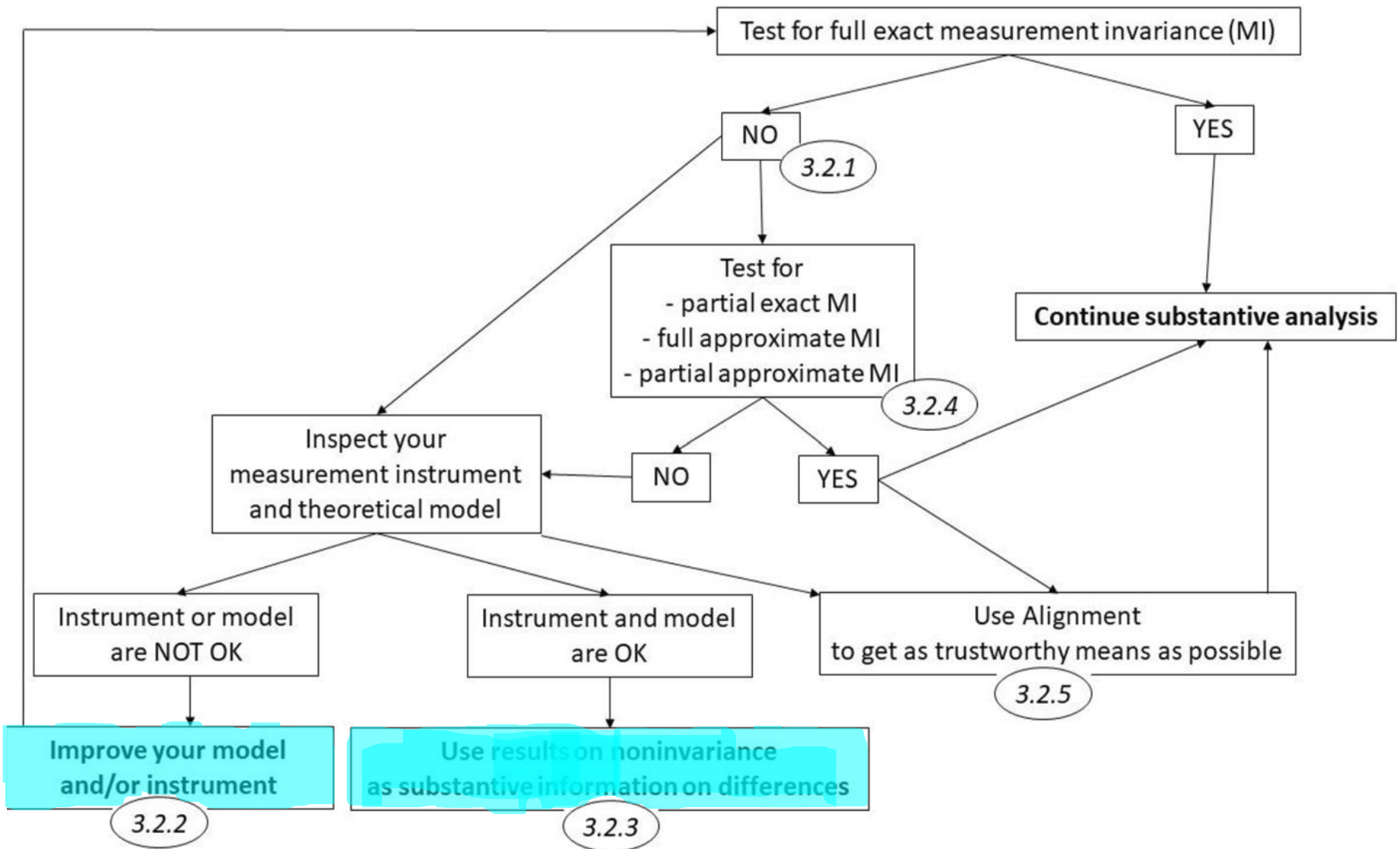
Measurement invariance as interface for

- **data analysis**
 - **Many studies examining** measurement invariance repeatedly in diverse fields with different methods and datasets, and on different topics: Attitudes to immigration, gender roles, subjective health, ageism, democracy attitudes etc... **across cultures and time.**
- methodological development
- software development
- theory refinement and development

- data analysis
- **methodological development**



- **software development**
 - **Bayesian approximate** measurement invariance, **alignment (across cultures and over time-e.g., Mplus: Muthén and Asparouhov reacted to the need of substantive researchers)**
 - **Simulations** to examine how much noninvariance may be tolerated to **not bias substantive conclusions** (Pokropek et al., 2019)
- theory refinement and development



Cieciuch, J., Davidov, E., Schmidt, P., Algesheimer, R. (2019). How to obtain comparable measures for cross-national comparisons. *Kolner Zeitschrift für Soziologie und Sozialpsychologie*, 71, 157-186

- data analysis
- methodological development
- software development
- **theory refinement and development**
 - The example of the **basic human values** theory of Schwartz
 - It is a major theory in social psychology: **Cited more than 150,000** times:
 - <https://scholar.google.co.il/citations?user=7gi3pqoAAA&hl=en>

Schwartz's theory of basic human values



Basic values – Schwartz 1992, 1994

Beliefs about the importance of abstract goals as guiding principles in life

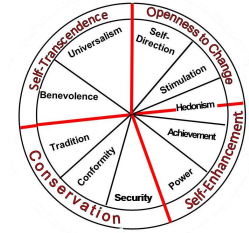
Main claims of the theory

(1) Differentiation among values

(2) Differentiation between **individual value priorities**
and a **universal value structure**

(3) Circular structure of
value

Main claims of the theory



(1) Differentiation among values

the key principle that differentiates among values **is the motivation**

values differ in their motivational content, which motivation do they express

Main claims of the theory



(1) Differentiation among values

the key principle that differentiates among values is the **motivation**

(2) Differentiation between **individual value priorities** and a **universal value structure**

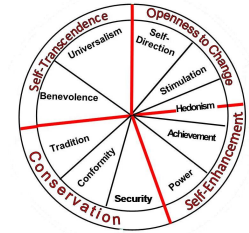
Value priorities

- refer to psychological individual differences
- value priorities are *hierarchically ordered* from the most to the least important value

Value structure

- rules of *universal relations* among the values based on their motivational content
- Close values share a similar motivation

Main claims of the theory



(1) Differentiation among values

the key principle that differentiates among values is the **motivation**

(2) Differentiation between **individual value priorities** and a **universal value structure**

(3) Circular structure of

value (1) circumplex continuum,

that can be divided into less or more narrowly defined values

(2) relation between values

- neighboring values are motivationally compatible;
- similarities among values decrease with the distance between them around the circle
- values located on opposite sides of the circle are motivationally

opposed

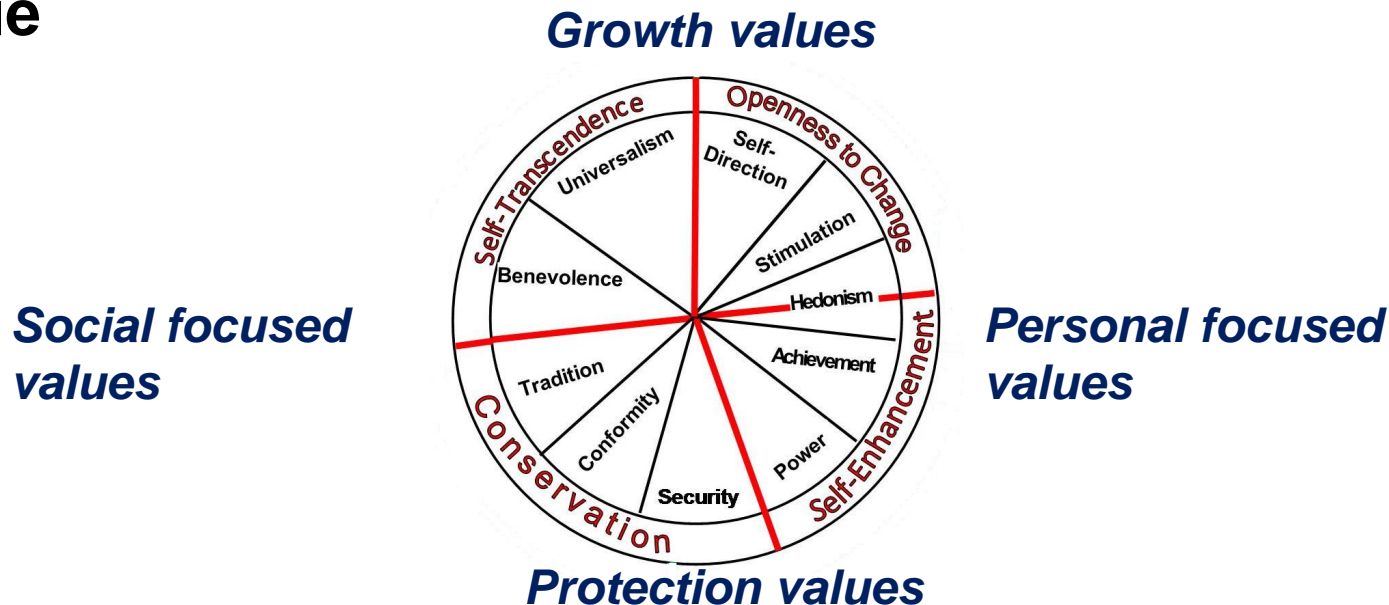
Main claims of the theory

(1) Differentiation among values

the key principle that differentiates among values is the **motivation**

(2) Differentiation between **individual value priorities** and a **universal value structure**

(3) Circular structure of value





A walk through the process:

A dialogue between MI testing and theory refinement

Station 1: Measurement invariance of values in the ESS

Station 1: Measurement invariance of values in the ESS

- - **The European Social Survey implemented a 21-item scale: Portrait Value Questionnaire (PVQ)-21.**
- - **each value measured by 2 items**
 - **(the only exception: 3 items for universalism)**
- - **items: verbal portraits of different people**
 - **(their goals, aspirations, what they find important)**

Portrait Values Questionnaire

- question: **How much like you is this person?**

- answers:

- 1 - Not like me at all
- 2 - Not like me
- 3 - A little like me
- 4 - Some-what like me
- 5 - Like me
- 6 - Very much like me

- Example: Universalism
- 3. He thinks it is important that every person in the world should be treated equally. He believes everyone should have equal opportunities in life.
- 8. It is important to him to listen to people who are different from him. Even when he disagrees with them, he still wants to understand them.
- 19. He strongly believes that people should care for nature. Looking after the environment is important to him.

Results:

only *metric invariance* was established for the seven values

...the comparison of latent means across countries was not allowed, only across subsets of countries.

Maybe the method is too strict?

How about testing for approximate measurement invariance?

**Station 2: Maybe the measurement invariance method was
too strict?**

**How about testing for approximate measurement
invariance?**

Bayesian approximate measurement invariance approach:

Exact
measurement invariance

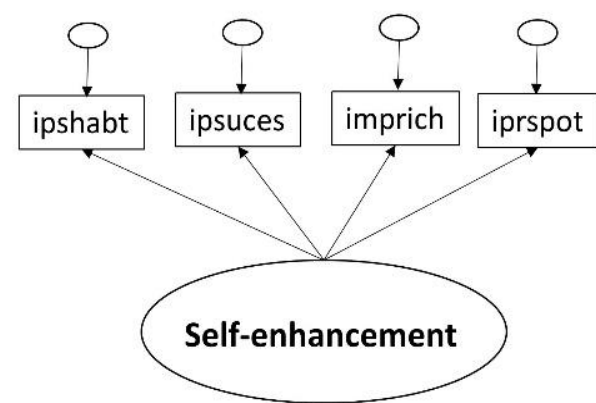
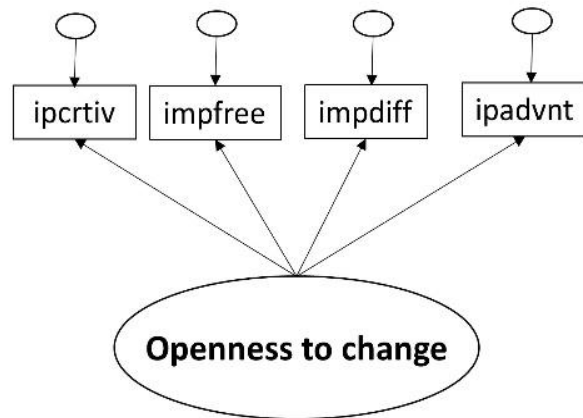
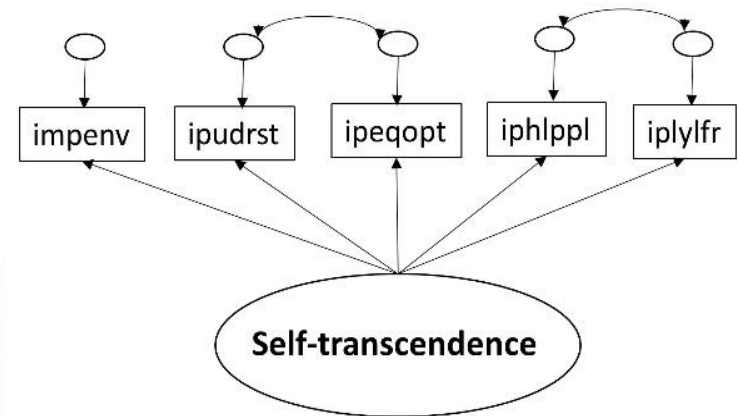
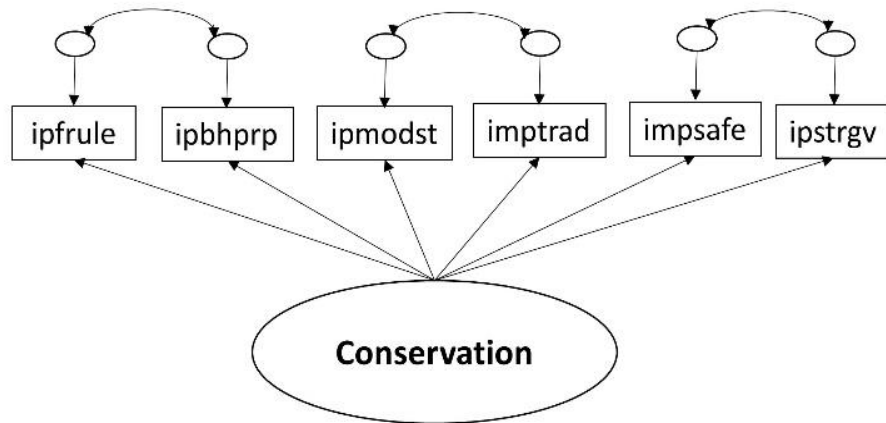
Approximate
measurement invariance

Differences between constrained parameters:

Exact zero =
with **mean = zero**
and a **variance = zero**

Approximate zero =
with **mean of zero**
and a **small-variance**

Tested models (magnifying glass strategy)



Cieciuch, J., Davidov, E., Algesheimer, R., Schmidt, P. (2018). Testing for approximate measurement invariance of human values in the European Social Survey. *Sociological Methods & Research*, 47(4), 665-686

Results

Self-enhancement across **ALL countries**

Openness (without hedonism) across **ALL countries:**

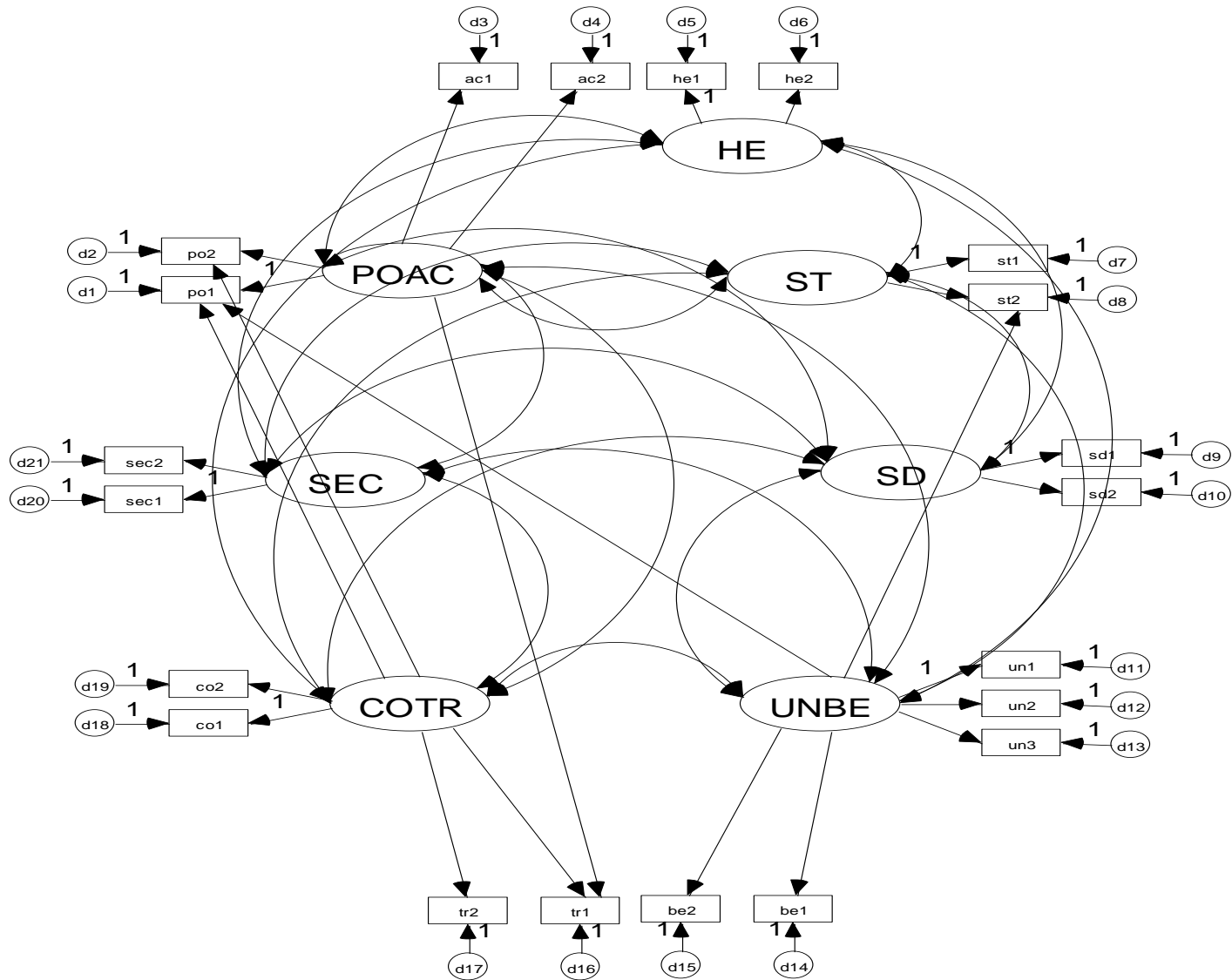
Self-transcendence in **12 countries**

Conservation in **10 countries**

So the results were *much* better.

Station 3: Reflection on further problems that came up in the analysis

- **7 values** were identified. **3 pairs** of values, which are **theoretically adjacent**, had to be **unified**, as they were not identified as distinct constructs: Universalism with benevolence, conformity with tradition and power with achievement.
- Several **cross-loadings** were necessary between values and items which were not supposed to measure them.



- **Knoppen and Saris (2009)** argued that **replacing several items** with others that can better **discriminate** between values **will solve the problem.**

Cieciuch and Davidov (2012):

the **PVQ-40** has **better invariance** properties than the **PVQ-21**. **more indicators** for values increases the chance of establishing a **higher partial level of measurement invariance**, including scalar invariance

So was it a **theory or a measurement problem?**

- **The conclusion was that it was a measurement problem:**
- It was probably an **artefact of the type of measurements** used in the ESS - **coverage** rather than **discrimination of values**.
- But **substantively**: it implied that there were „holes“ between values that allowed space for further values.

New goals:

- 1) **New more homogeneous items**
- 2) **New more narrowly defined values**

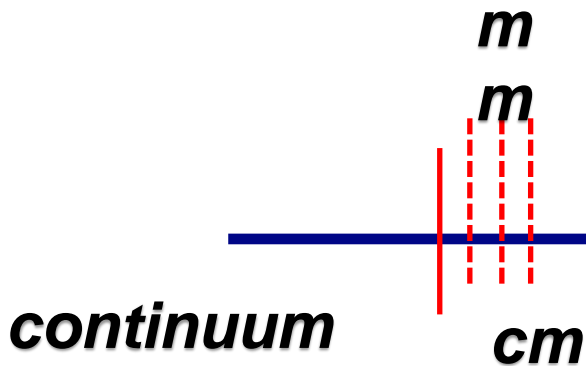
Schwartz's theory of basic human values

However....

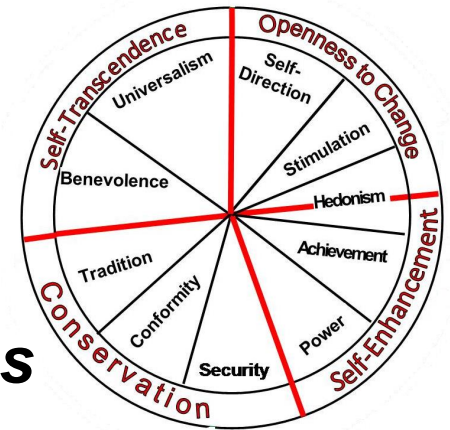
IF -
1) Structure: circumplex
continuum

WHY

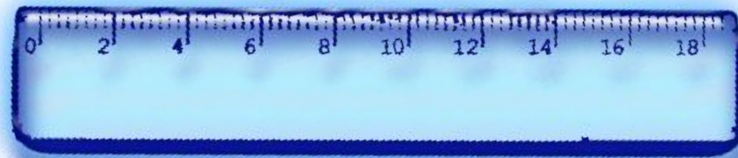
2) Content: 10 values



? → 19 values



and new measurement PVQ-57

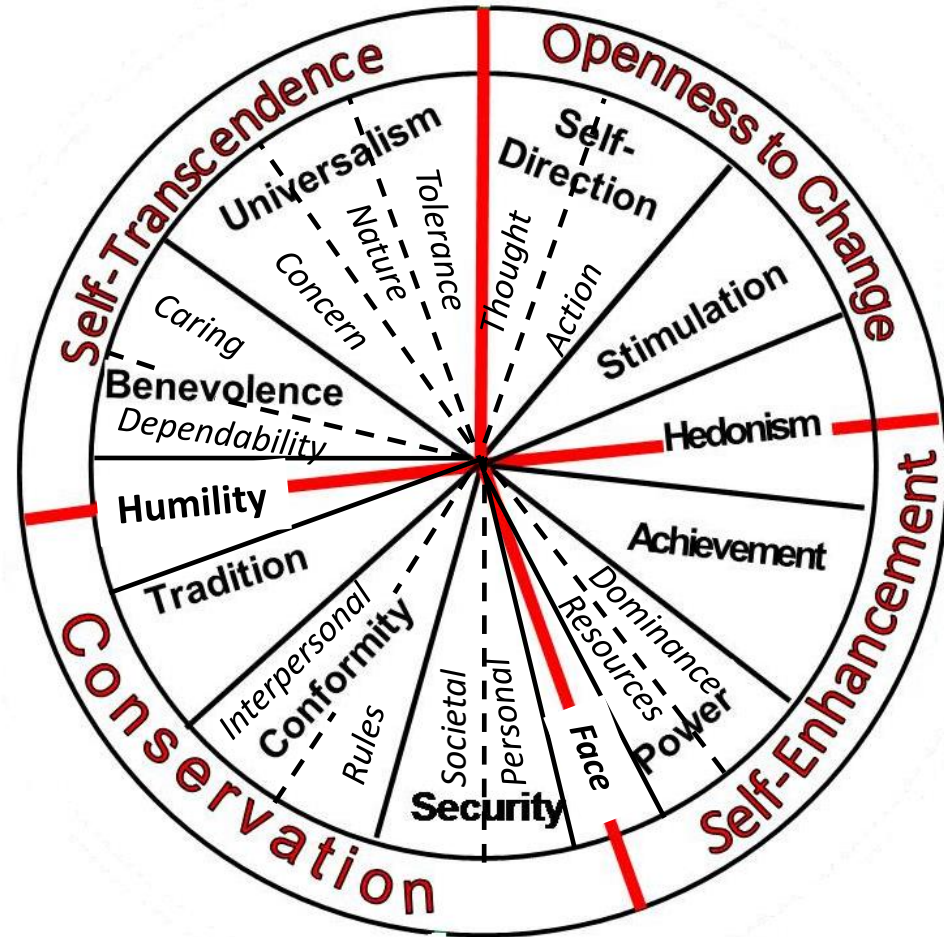


The „old” circle



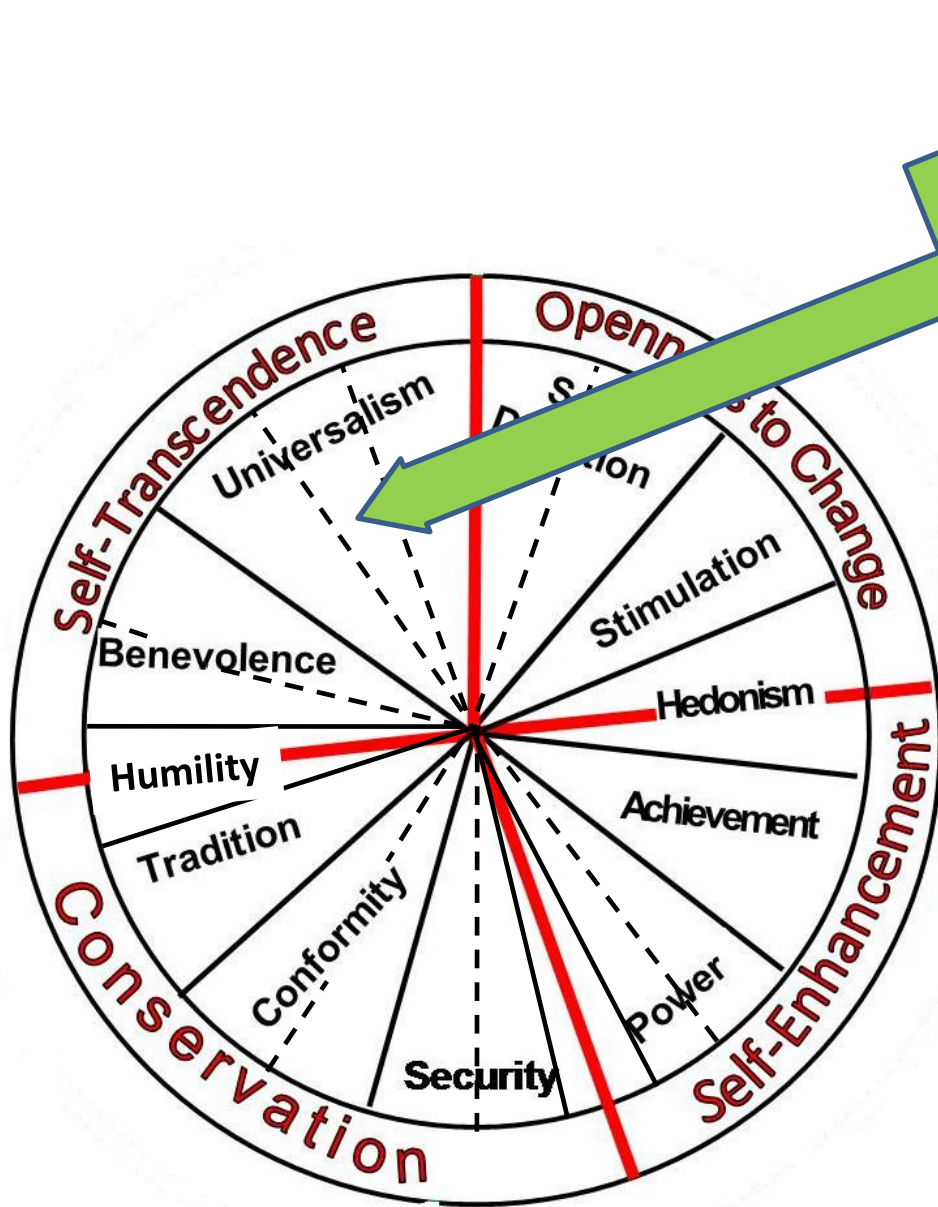
10 values
PVQ-40

The „new” circle



19 values
PVQ-57

Schwartz, S., J.Cieciuch, M. Vecchione, E. Davidov, R. Fischer, C. Beierlein, A. Ramos, M. Verkasalo, J.-E. Lönnqvist, K. Demirutku, O. Dirilen-Gumus, M. Konty (2012). Refining the theory of basic individual values. *Journal of Personality and Social Psychology*, 103(4), 663-688. DOI: [10.1037/a0029393](https://doi.org/10.1037/a0029393)



Universalism

→ **Universalism - Concern**
Commitment to equality, justice and protection for all people

→ **Universalism - Nature**
Preservation of the natural environment

→ **Universalism - Tolerance**
Acceptance and understanding of those who are different from oneself

Example: Universalism

PVQ-21 (ESS)

- 3. He thinks it is important that every person in the world should be treated equally. He believes everyone should have equal opportunities in life.
- 8. It is important to him to listen to people who are different from him. Even when he disagrees with them, he still wants to understand them.
- 19. He strongly believes that people should care for nature. Looking after the environment is important to him.

PVQ-RR

Concern: Equality, justice and protection for the weak in society

- 5. It is important to him that the weak and vulnerable in society be protected.
- 37. It is important to him that every person in the world have equal opportunities in life.
- 52. It is important to him that everyone be treated justly, even people he doesn't know.

Nature: Preservation of the natural environment

- 8. It is important to him to care for nature.
- 21. It is important to him to take part in activities to defend nature.
- 45. It is important to him to protect the natural environment from destruction or pollution.

Tolerance: Acceptance and understanding of those who differ from oneself

- 14. It is important to him to be tolerant toward all kinds of people and groups.
- 34. It is important to him to listen to and understand people who are different from him.
- 57. It is important to him to accept people even when he disagrees with them.

Station 5: Exact and approximate measurement invariance of the refined theory - summary of results, much better

- 14 of the 19 values demonstrated **full metric invariance** across all countries
- **full or partial scalar invariance** was supported for 10 values across nearly all countries

Cieciuch, J., E. Davidov, M. Vecchione, C. Beierlein and S. H. Schwartz (2014). The cross-national invariance properties of a new scale to measure 19 basic human values. A test across eight countries. *Journal of Cross Cultural Psychology*, 45(5), 764-776. DOI: 10.1177/0022022114527348

Results of the AMI bayesian analysis were also very good

Cieciuch, J., E. Davidov, P. Schmidt, R. Algesheimer and S.H. Schwartz (2014). Comparing results of an exact versus an approximate (Bayesian) measurement invariance test: A cross-country illustration with a new scale to measure 19 human values. *Frontiers in Psychology*, 5, 982. DOI: 10.3389/fpsyg.2014.00982

Good invariance properties even with non-Western cultures

Jagodzinski, W., K. Manabe, H. Duellmer, C. Hommerich and E. Davidov (2023). Examining cross-cultural value questionnaires with quantitative methods: Reliability and scalar equivalence of the measurement instruments of human values in Germany and Japan In Okada, A., Shigemasu, K., Yoshino, R., Yokoyama, S. (eds) Facets of Behaviormetrics. *Behaviormetrics: Quantitative Approaches to Human Behavior* 4, 99-121. DOI: 10.1007/978-981-99-2240-6_5

- **Questions answered:**

- 1) Can all 19 be **distinguished** empirically? **Yes**
- 2) Do value measures have better cross-cultural invariance properties? **Yes**

Questions to be answered:

- 3) Are they collapsible to 10 and 4 higher-order values?
- 4) Are the distinctions **useful**?

Station 6: Examining the hierarchical structure

Hierarchical structure of values

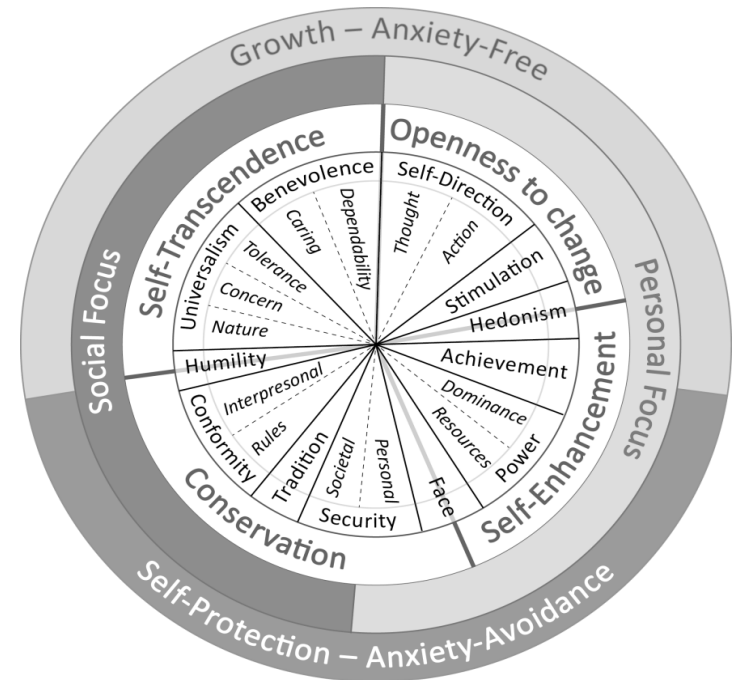
Higher order values (4)



Original values
(10)



More narrowly defined values
(19)



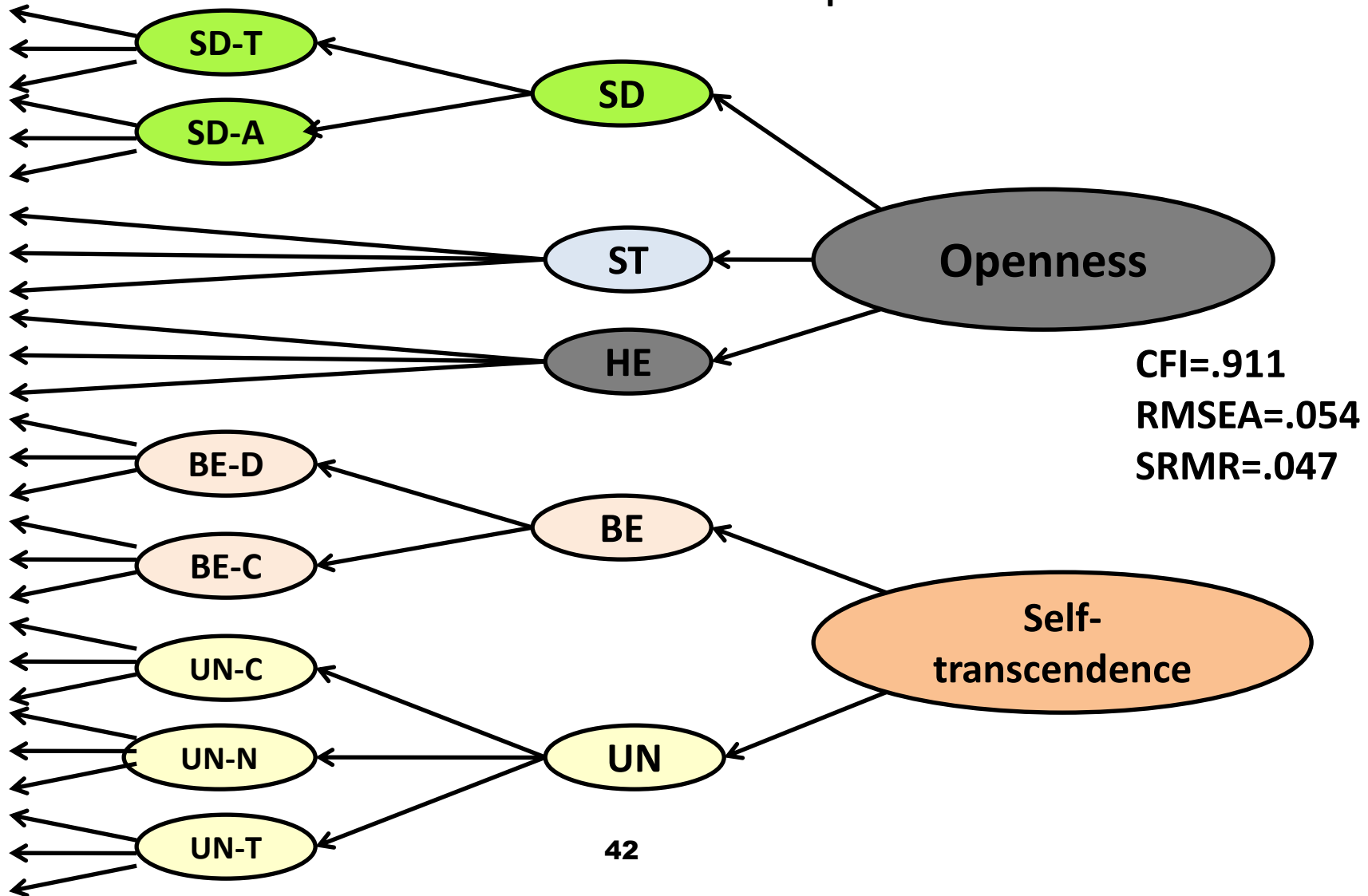
**Test for the hierarchical structure
in 3rd order Confirmatory Factor Analysis**

3rd order Confirmatory Factor Analysis

- I. Sample
- II. CFA with CF
- III. 2nd order CFA
- IV. 3rd order CFA

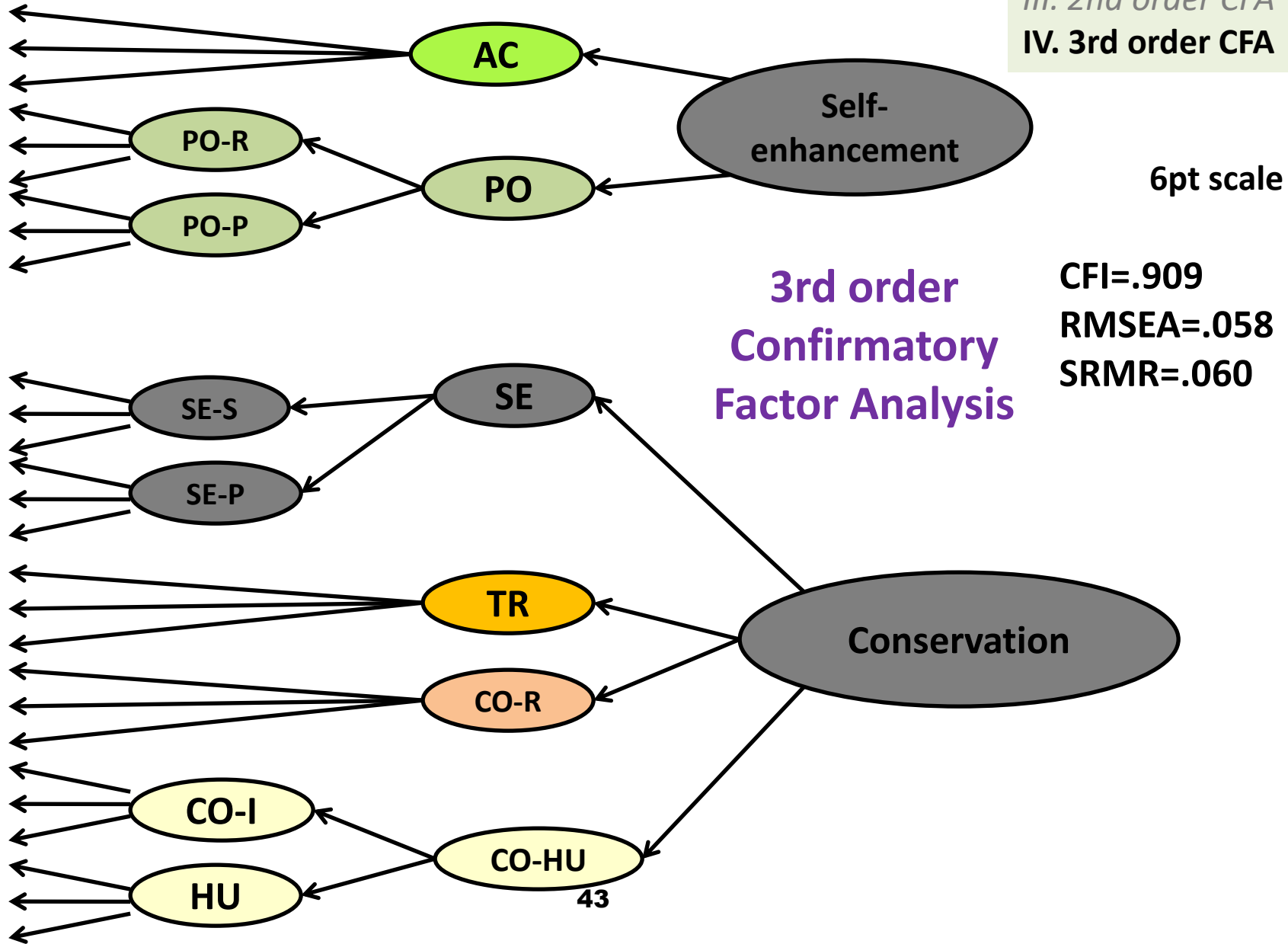
Openness – Self-transcendence

6pt scale



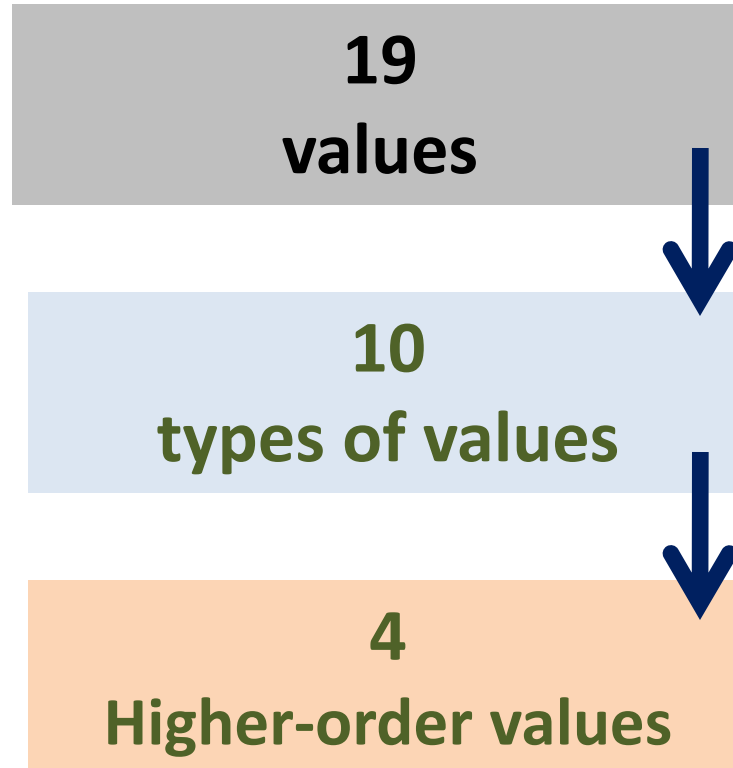
Conservation – Self-enhancement

- I. Sample
- II. CFA with CF
- III. 2nd order CFA
- IV. 3rd order CFA

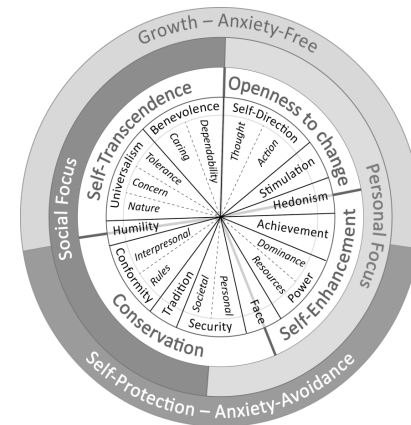


Confirmatory Factor Analysis

Conclusions



- I. Sample
- II. CFA with CF
- III. 2nd order CFA
- IV. 3rd order CFA



A hierarchical structure of basic human values in a third-order confirmatory factor analysis (2014). Cieciuch, J., E. Davidov, Vecchione, M. and S. H. Schwartz. *Swiss Journal of Psychology*, 73(3), 177-182. DOI: 10.1024/1421-0185/a000134

To answer question 4

- Are the distinctions **useful**? Yes. **Better predictions** of value expressive behaviors by more specific values.
- **Conclusion:** So we are doing better with the new scale and theory.

Station 7: What to do when there is no invariance?

Explaining it!

- This may be done by **cognitive pre-/post-tests** – see studies by **Meitinger** (e.g. Meitinger 2017, special issue in SRM 2020).
- And **also by theoretically-driven multilevel analyses.**

Explain noninvariance by introducing **contextual variables** and using **multilevel analysis** (Schlüter/Meulemann 2018).

Noninvariance as a useful source of information on cross-cultural differences (e.g., Poortinga 1989; Schlüter/Meulemann 2018).

Relying on previous studies (e.g., Hox/de Leeuw/Brinkhuis 2010, Muthén 1989, 1994; Jak et al. 2011)

In invariance testing, the **intercept** of the indicator **Environment** of the universalism values was **particularly different** across countries.

Davidov, E., H. Dülmer, E. Schlüter, P. Schmidt and B. Meuleman (2012). Using a multilevel structural equation modeling approach to explain cross-cultural measurement noninvariance. *Journal of Cross-Cultural Psychology*, 43(4), 558-575.

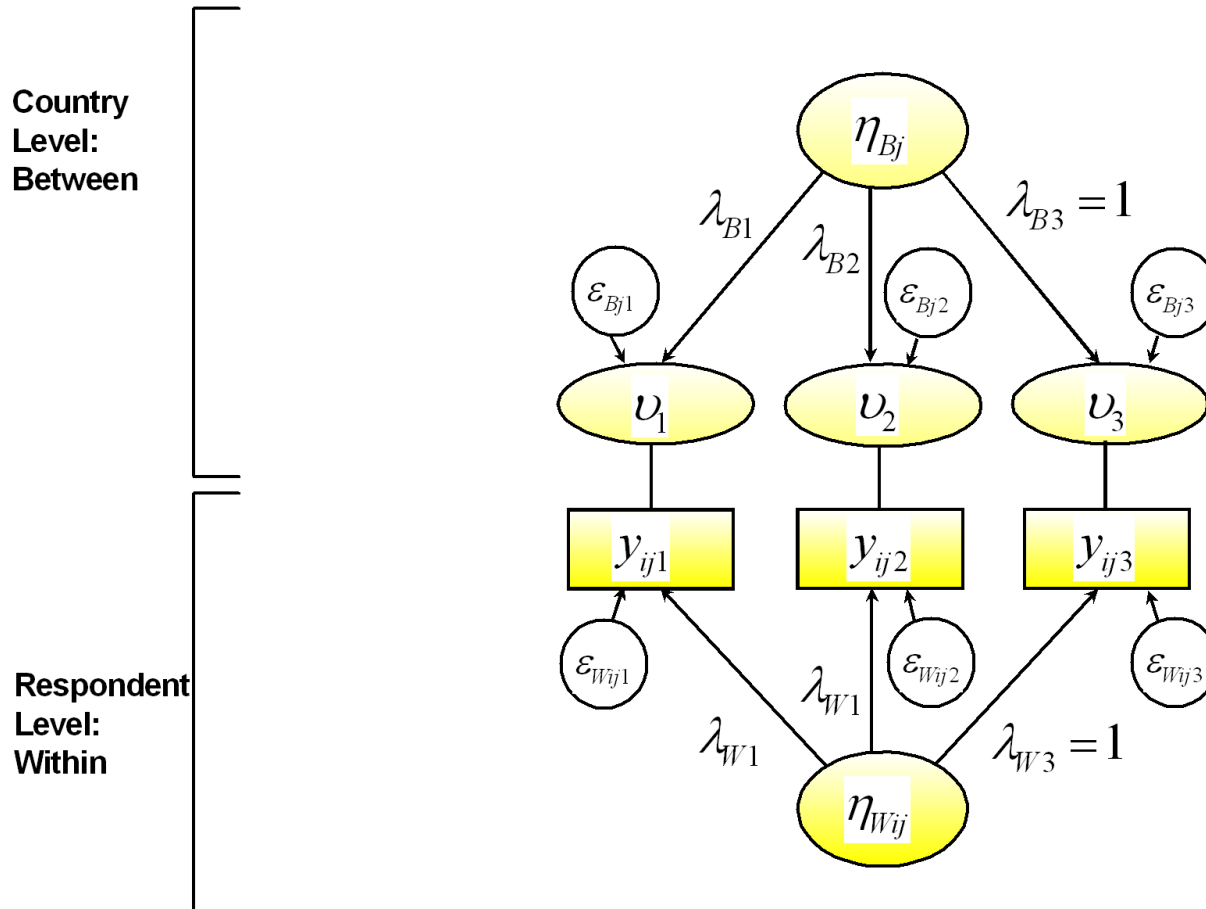
Empirical illustration

Two-level CFA: Respondent Level:

$$y_{ijk} = \alpha_{jk} + \lambda_{wk} \cdot \eta_{wij} + \varepsilon_{wijk}$$

Country Level:

$$\alpha_{jk} = u_k + \lambda_{Bk} \cdot \eta_{Bj} + \varepsilon_{Bjk}$$



Empirical illustration

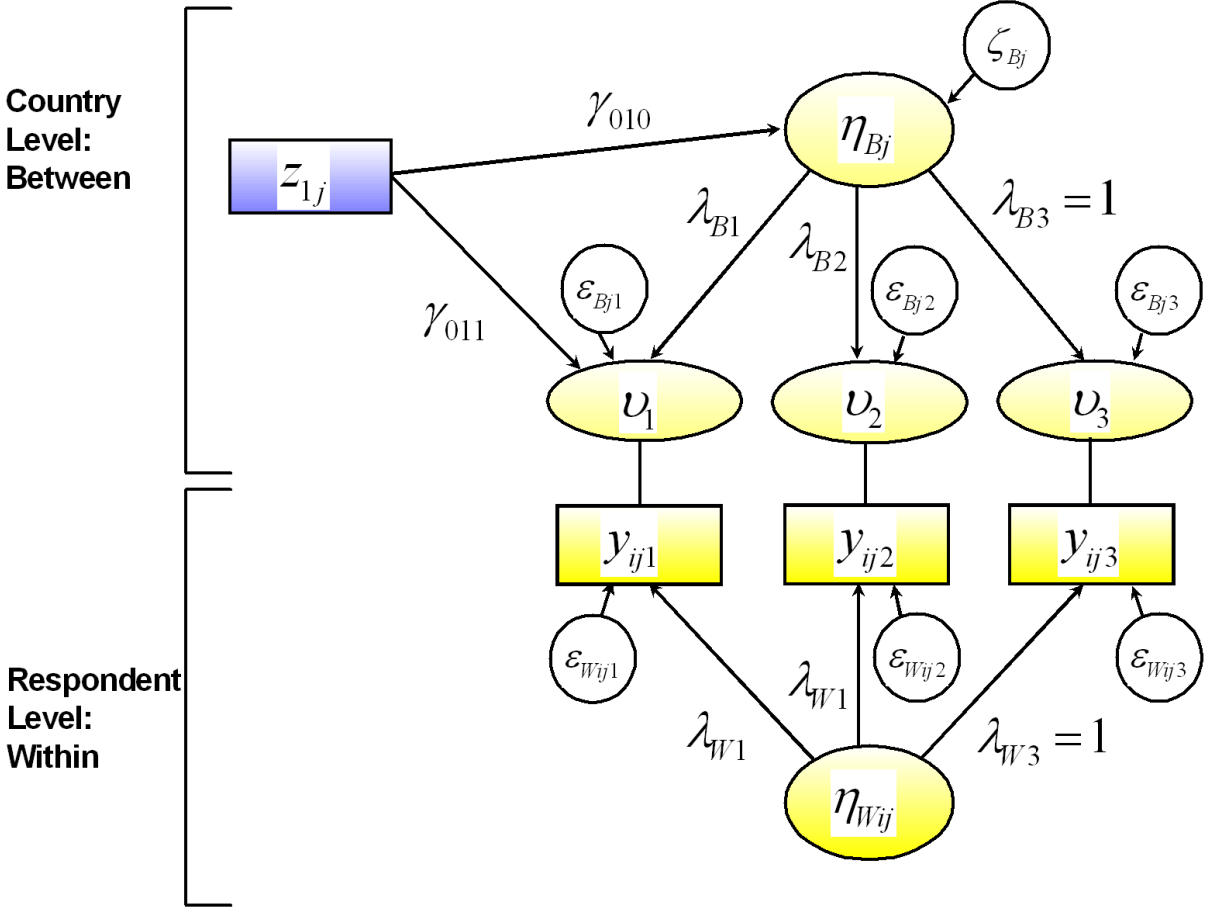
Two-level SEM: Respondent Level:

$$y_{ijk} = \alpha_{jk} + \lambda_{wk} \cdot \eta_{w_{ij}} + \varepsilon_{w_{ijk}}$$

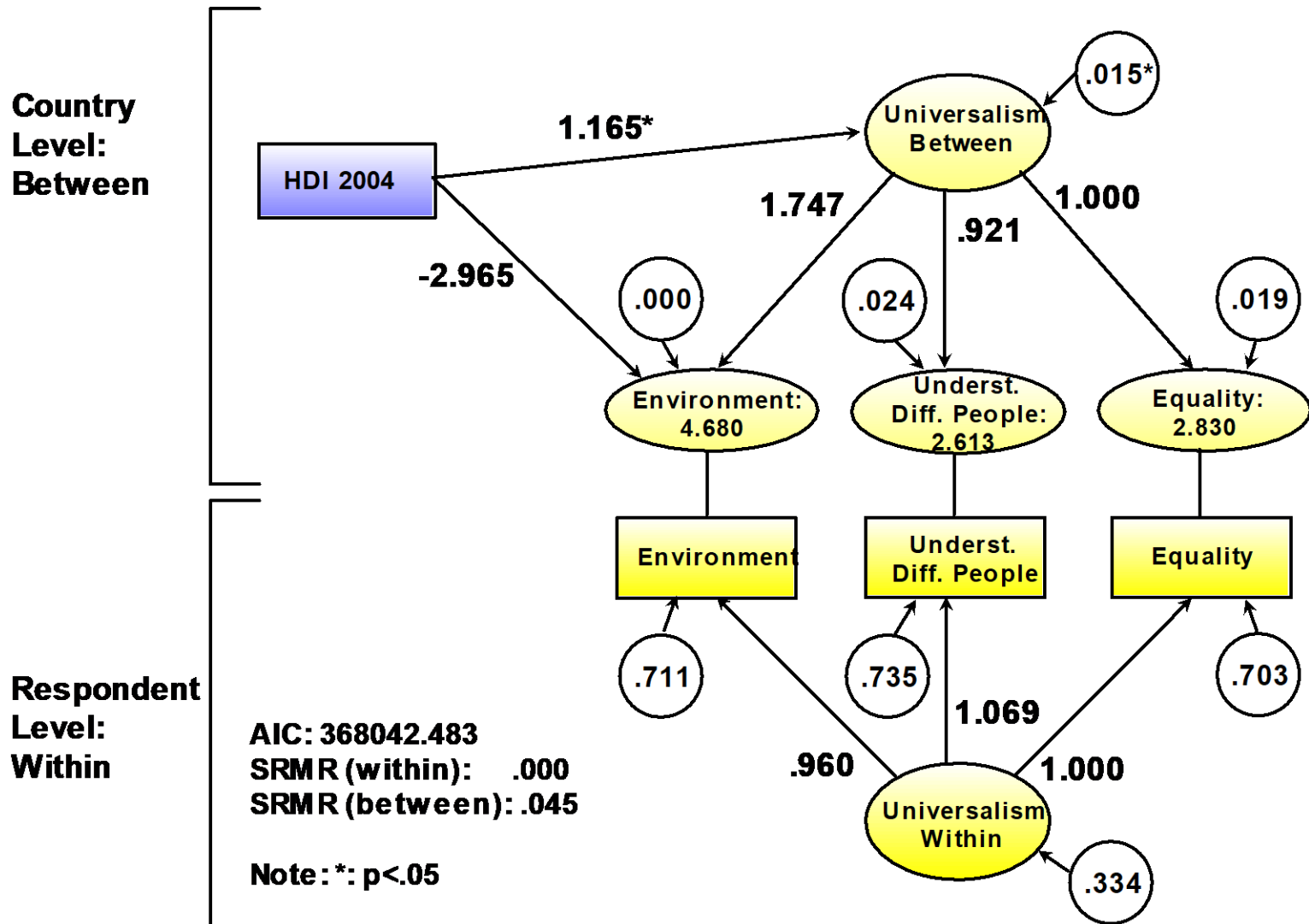
Country Level:

$$\alpha_{jk} = u_k + \lambda_{Bk} \cdot \eta_{Bj} + \sum_{l=1}^L \sum_{k=1}^K \gamma_{0lk} \cdot z_{lj} + \varepsilon_{Bjk}$$

$$\eta_{Bj} = \mu_B + \sum_{l=1}^L \gamma_{0l0} \cdot z_{lj} + \zeta_{Bj}$$



Two-Level Structural Equation Model (Data source: ESS2, 2004-5)



- **Station 1: Measurement invariance of values in the ESS**
- **Station 2: Maybe the measurement invariance method is too strict?**
- **How about testing for approximate measurement invariance?**
- **Station 3: Reflection on further problems that came up in the analysis**
- **Station 4: Schwartz's refined theory of basic human values**
- **Station 5: Exact and approximate measurement invariance of the refined theory - Summary of results, much better**
- **Station 6: Examining the hierarchical structure**
- **Station 7: What to do when there is no invariance? Explaining it!**

A summary:

Measurement invariance in the social sciences: Historical development, methodological challenges, state of the art, and future perspectives (2022).

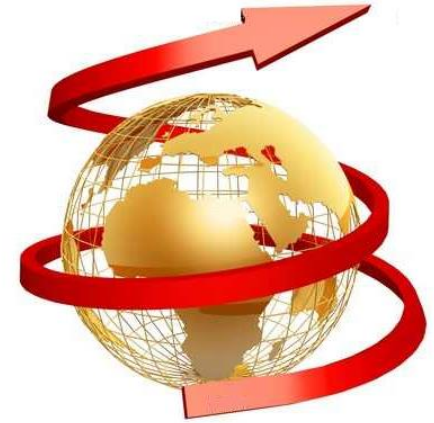
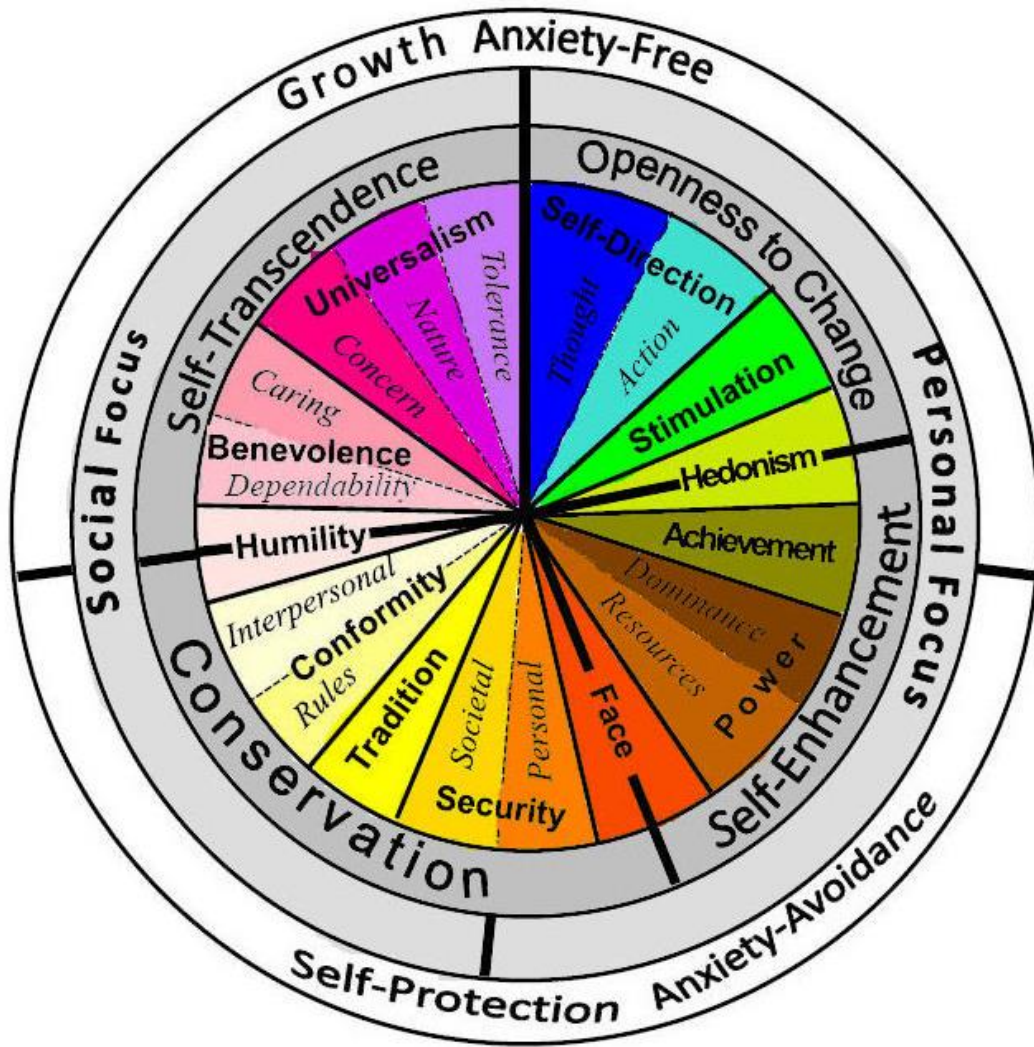
Leitgöb, H., D. Seddig, T. Asparouhov, D. Behr, E. Davidov, K. De Roover, S. Jak, K. Meitinger, N. Menold, B. Muthén, M. Rudnev, P. Schmidt and R. van de Schoot. *Social Science Research* 110. DOI: [10.1016/j.ssresearch.2022.102805](https://doi.org/10.1016/j.ssresearch.2022.102805)

A controversy:

Welzel, C., Brunkert, L., Kruse, S., & Inglehart, R. F. (2023). Non-invariance? An Overstated Problem With Misconceived Causes. *Sociological Methods & Research*, 52(3), 1368–1400. <https://doi.org/10.1177/0049124121995521>

And an answer:

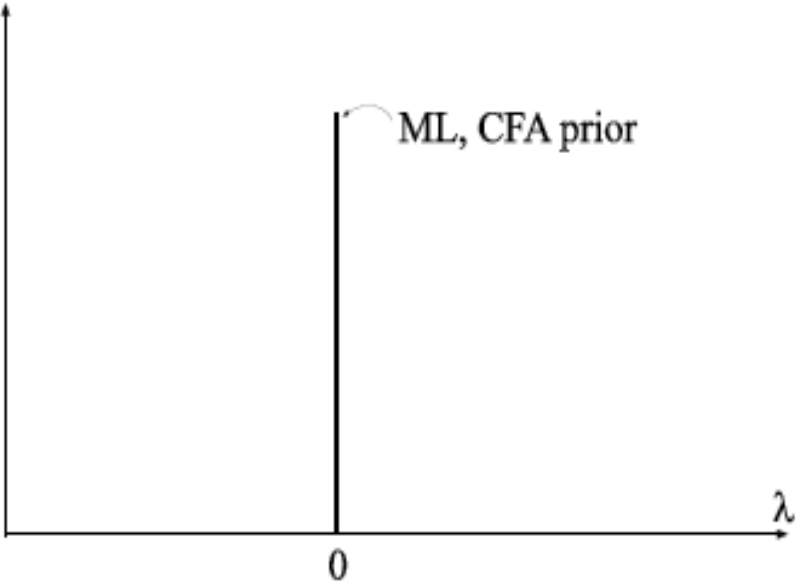
Why measurement invariance is important in comparative research. A response to Welzel et al. (2021) (2022). Meuleman, B., T. Żółtak, A. Pokropek, E. Davidov, B. Muthén, D. Oberski, J. Billiet and P. Schmidt. *Sociological Methods and Research*. DOI: [10.1177/00491241221091755](https://doi.org/10.1177/00491241221091755)



*Thank you
for taking the walk
together!*

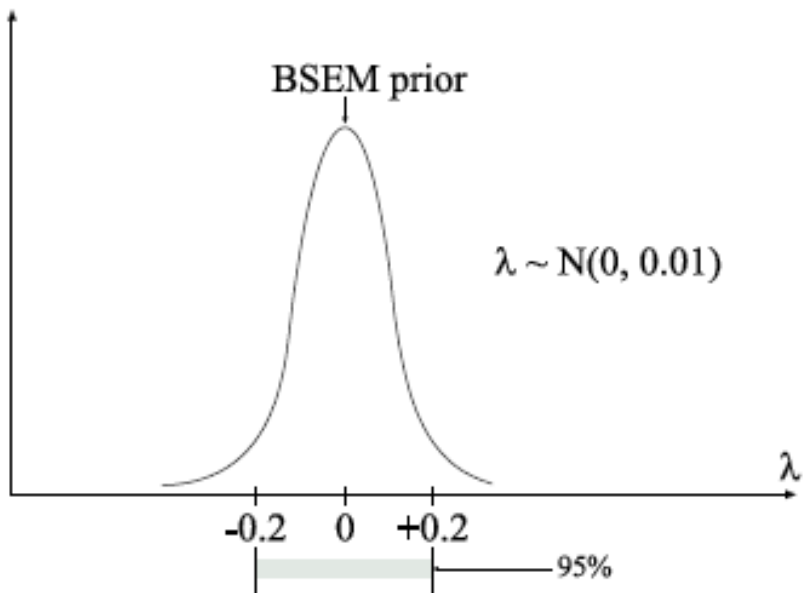
Comparison of exact and approximate approaches to MI

(Van de Schoot et al., 2013; Muthén & Asparouhov, 2012)



exact zero

a very strong informative prior (like a constraint in ML)
(with a mean and a variance of zero)



approximate zero

zero-mean and small-variance (.01)
with 95% of the variation of the
loading or intercept difference

Results of the approximate measurement invariance of values in the ESS

Step 1

Testing for full approximate measurement invariance (mean = 0, variance = .05) in the 1st round of the ESS for each higher order value separately.

Step 2

Identifying items with deviating parameters (loadings and intercepts significantly different from those in other groups).

Step 3

Testing for partial approximate measurement invariance (releasing deviating parameters identified in step 2).

Step 4

Replication in rounds 2-6

ESS Data

	1st round	2nd round	3rd round	4th round	5th round	6th round
Belgium	1819	1734	1767	1704	1674	1809
Denmark	1457	1457	1451	1554	1548	1610
Finland	1758	1692	1645	1898	1638	2142
Germany	2785	2800	2828	2697	2943	2910
Hungary	1564	1407	1409	1388	1404	1919
Ireland	1838	1139	1582	1682	2295	2498
Netherlands	2301	1824	1814	1693	1754	1788
Norway	1806	1543	1533	1374	1518	1598
Poland	1982	1621	1629	1544	1675	1818
Portugal	1417	1987	2117	2220	2035	2062
Slovenia	1390	1297	1329	1172	1238	1159
Spain	1638	1544	1802	2520	1862	1820
Sweden	1677	1663	1585	1539	1457	1799
Switzerland	2009	2084	1758	1764	1467	1453
United Kingdom	1748	1806	2301	2230	2315	2212

N = 274,447

**15 countries
that took
part in all**

6 rounds

Results

	PPP	95% Credibility Interval
Self-enhancement across ALL countries:		
1st Round of ESS	.178	-29.290 – 82.959
2nd Round of ESS	.089	-17.906 – 94.001
3rd Round of ESS	.035	-4.388 – 108.102
4rd Round of ESS	.096	-19.130 – 92.985
5th Round of ESS	.014	<i>6.500 – 118.831</i>
6th Round of ESS	.001	<i>33.790 – 145.481</i>

Conclusion:

Scalar measurement invariance established in all countries!

Cieciuch, J., Davidov, E., Algesheimer, R., Schmidt, P. (2018). Testing for approximate measurement invariance of human values in the European Social Survey. *Sociological Methods & Research*, 47(4), 665-686

Results

	PPP	95% Credibility Interval
Openness (without hedonism) across ALL countries:		
1st Round of ESS	.001	<i>37.312 – 149.885</i>
2nd Round of ESS	.035	<i>-4.253 – 107.713</i>
3rd Round of ESS	.059	<i>-11.201 – 100.421</i>
4rd Round of ESS	.014	<i>7.054 – 119.765</i>
5th Round of ESS	.051	<i>-9.382 – 103.396</i>
6th Round of ESS	.102	<i>-19.736 – 92.334</i>

Conclusion:

Scalar measurement invariance established in all countries!

Cieciuch, J., Davidov, E., Algesheimer, R., Schmidt, P. (2018). Testing for approximate measurement invariance of human values in the European Social Survey. *Sociological Methods & Research*, 47(4), 665-686

Results

	PPP	95% Credibility Interval
Self-transcendence across ALL countries:		
1st Round of ESS	.000	72.03 – 204.32
2nd Round of ESS	.000	100.93 – 231.49
3rd Round of ESS	.000	192.84 – 323.78
4rd Round of ESS	.000	141.69 – 272.43
5th Round of ESS	.000	206.22 – 337.59
6th Round of ESS	.000	218.25 – 349.08

Conclusion:

Scalar measurement invariance NOT established across all countries!

Cieciuch, J., Davidov, E., Algesheimer, R., Schmidt, P. (2018). Testing for approximate measurement invariance of human values in the European Social Survey. *Sociological Methods & Research*, 47(4), 665-686

Results

	PPP	95% Credibility Interval
Self-transcendence in 12 countries:		
Belgium, Finland, Germany, Ireland, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, United Kingdom		
1st Round of ESS	.508	-50.05 – 49.46
2nd Round of ESS	.419	-45.17 – 55.39
3rd Round of ESS	.326	-38.57 – 61.99
4rd Round of ESS	.419	-45.13 – 55.07
5th Round of ESS	.273	-34.72 – 65.34
6th Round of ESS	.505	-48.32 – 47.27

Conclusion:

Scalar measurement invariance across 12 countries established!

Cieciuch, J., Davidov, E., Algesheimer, R., Schmidt, P. (2018). Testing for approximate measurement invariance of human values in the European Social Survey. *Sociological Methods & Research*, 47(4), 665-686

Results

	PPP	95% Credibility Interval
Conservation across ALL countries:		
1st Round of ESS	.000	268.70 – 419.12
2nd Round of ESS	.000	188.11 – 339.10
3rd Round of ESS	.000	159.55 – 310.56
4rd Round of ESS	.000	232.02 – 383.11
5th Round of ESS	.000	263.83 – 413.27
6th Round of ESS	.000	205.24 – 356.04

Conclusion:

Scalar measurement invariance NOT established across all countries!

Cieciuch, J., Davidov, E., Algesheimer, R., Schmidt, P. (2018). Testing for approximate measurement invariance of human values in the European Social Survey. *Sociological Methods & Research*, 47(4), 665-686

Results

	PPP	95% Credibility Interval
Conservation in 10 countries:		
Belgium, Finland, Germany, Ireland, Netherlands, Poland, Portugal, Switzerland, United Kingdom, Slovenia		
1st Round of ESS	.173	-23.70 – 67.94
2nd Round of ESS	.131	-19.20 – 72.09
3rd Round of ESS	.135	-20.07 – 71.09
4rd Round of ESS	.097	-15.76 – 75.66
5th Round of ESS	.176	-23.61 – 66.82
6th Round of ESS	.067	-10.68 – 80.66

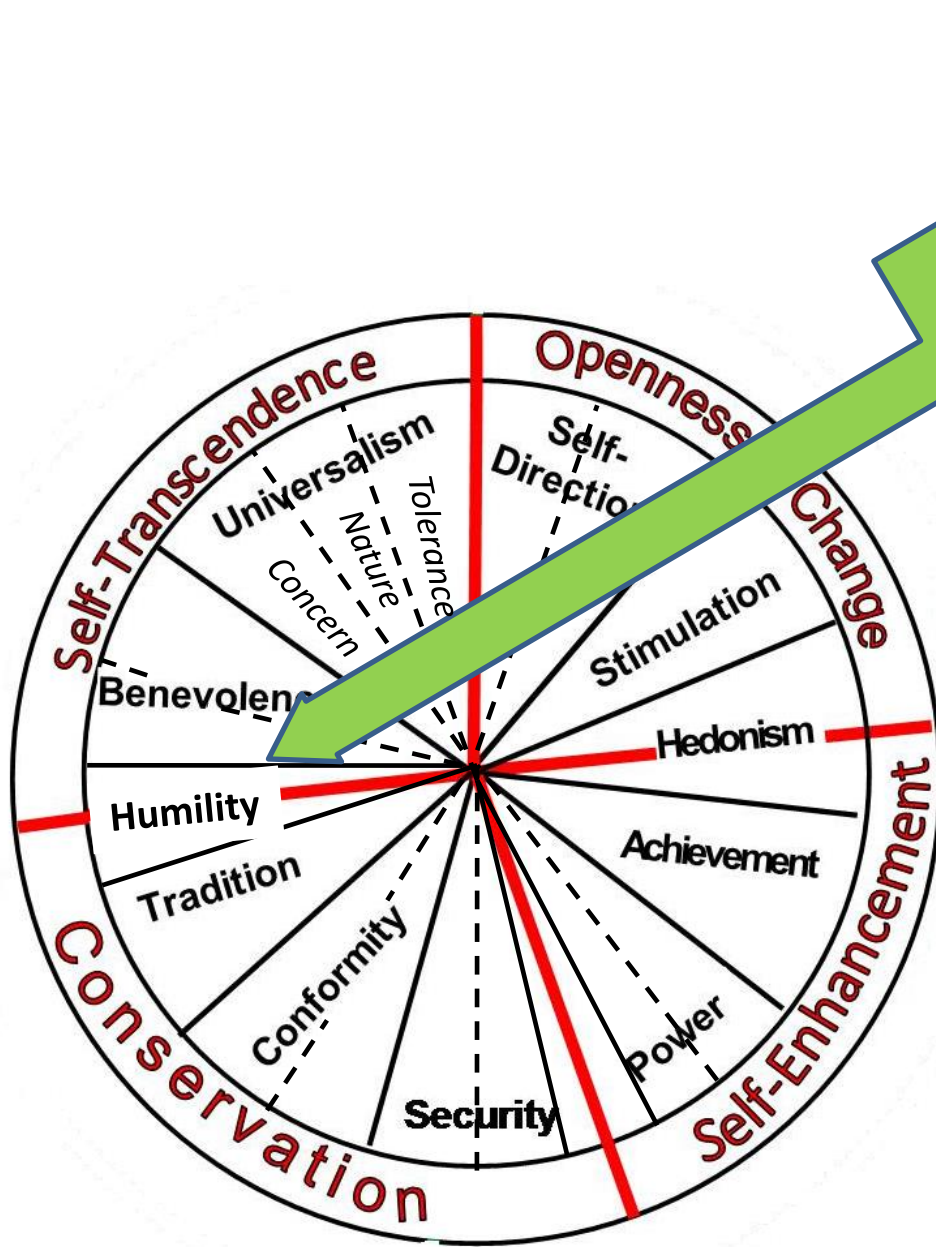
Conclusion:

Scalar measurement invariance across 10 countries established!

Cieciuch, J., Davidov, E., Algesheimer, R., Schmidt, P. (2018). Testing for approximate measurement invariance of human values in the European Social Survey. *Sociological Methods & Research*, 47(4), 665-686

Portrait Values Questionnaire

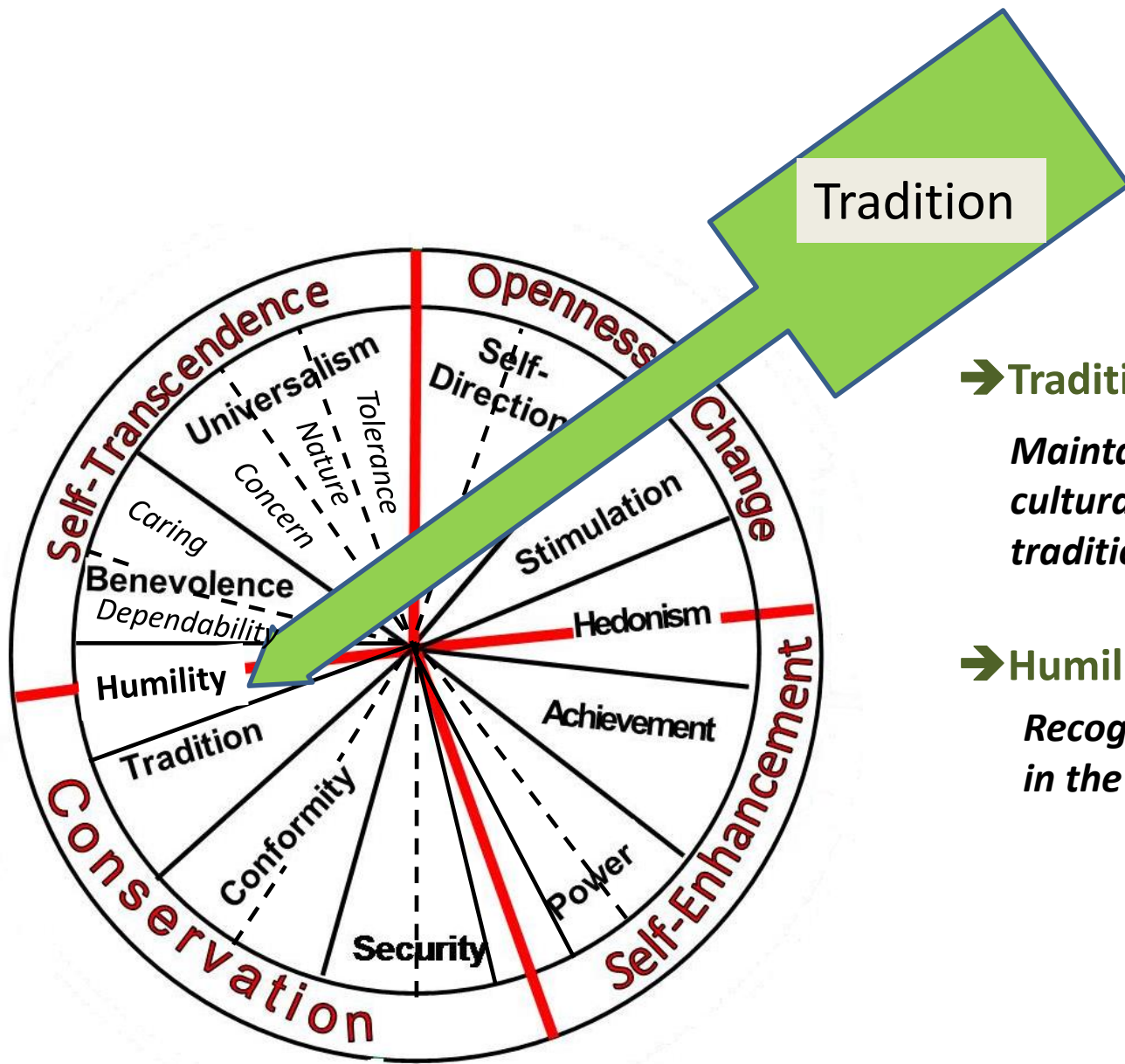
- **57** items
- each value measured by a set of **three** items, **without** double barring
- items: verbal portraits of different people
(their goals, aspiration, what they find important)
- question: How much like you is this person?
- answers:
 - 1- Not like me at all
 - 2 - Not like me
 - 3 - A little like me
 - 4 - Some-what like me
 - 5 - Like me
 - 6 - Very much like me



Benevolence

➔ **Benevolence -Dependability**
Being a reliable and trustworthy member of the ingroup

➔ **Benevolence-Caring**
Devotion to the welfare of ingroup members



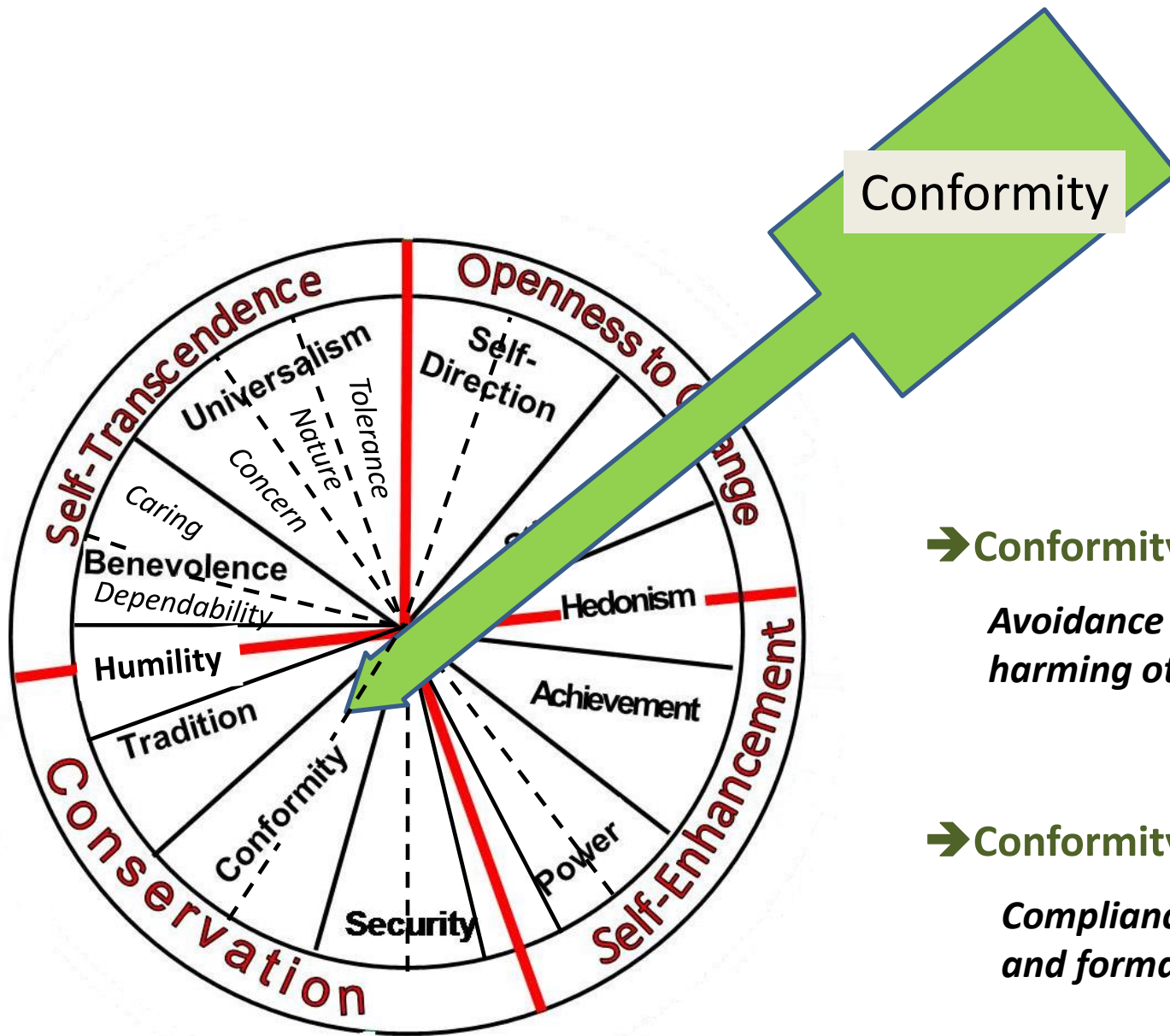
Tradition

→ Tradition

Maintaining and preserving cultural, family or religious traditions

→ Humility

Recognizing one's insignificance in the larger scheme of things



Conformity

➔ **Conformity-Interpersonal**

Avoidance of upsetting or harming other people

➔ **Conformity-Rules**

Compliance with rules, laws, and formal obligations



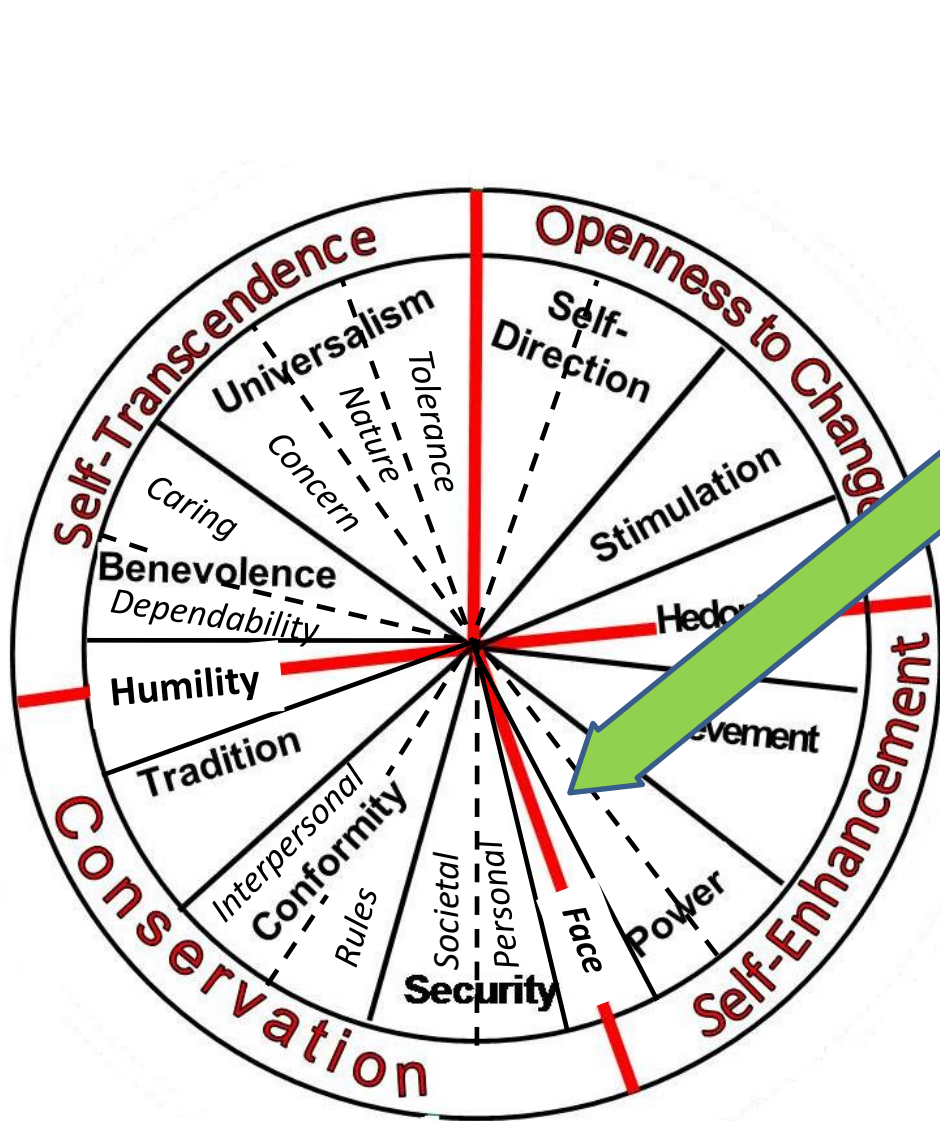
Security

➔ **Security-Societal**

Safety and stability in the wider society

➔ **Security-Personal**

Safety in one's immediate environment



Power

→ Face

Security and power through maintaining one's public image and avoiding humiliation

→ Power-Resources

Power through control of material and social resources

→ Power-Dominance

Power through exercising control over people



Self-Direction

➔ **Self-Direction-Thought**

Freedom to cultivate one's own ideas and abilities

➔ **Self-Direction-Action**

Freedom to determine one's own action

- **Advantages of the refined theory:**
- **Better understanding of the value structure**
- **Higher level of measurement invariance – more appropriate for cross-cultural studies**

- **full or partial scalar invariance**
- **was supported for 10 values across nearly all countries**
- (with a few exceptions for single countries noted above):
- benevolence caring,
- universalism tolerance,
- universalism concern,
- universalism nature,
- hedonism,
- power dominance,
- power resources,
- security personal,
- security societal,
- self-direction thought

Station 6: Results of bayesian analysis of MI

EXAMPLE

Significant differences from priors

DIFFERENCE OUTPUT

	Average	Std. Dev.	Deviations from the Mean				
1	4.589	0.061	NU1_1 0.000	NU2_1 0.042	NU3_1 0.059	NU4_1 -0.196*	NU5_1 0.010
			NU6_1 -0.053	NU7_1 0.046	NU8_1 0.091		
2	4.769	0.070	NU1_2 -0.073	NU2_2 -0.024	NU3_2 0.025	NU4_2 0.063	NU5_2 0.048
			NU6_2 -0.095	NU7_2 0.013	NU8_2 0.051		
3	4.831	0.073	NU1_3 0.070	NU2_3 -0.006	NU3_3 -0.059	NU4_3 0.104*	NU5_3 -0.043
			NU6_3 0.139*	NU7_3 -0.054	NU8_3 -0.151*		
4	0.572	0.047	LAM1_1 -0.015	LAM2_1 -0.076	LAM3_1 -0.020	LAM4_1 0.007	LAM5_1 -0.009
			LAM6_1 0.035	LAM7_1 0.086	LAM8_1 -0.011		
5	0.663	0.054	LAM1_2 0.062	LAM2_2 0.016	LAM3_2 -0.002	LAM4_2 -0.012	LAM5_2 0.005
			LAM6_2 -0.004	LAM7_2 -0.033	LAM8_2 -0.036		
6	0.715	0.059	LAM1_3 -0.064	LAM2_3 0.024	LAM3_3 0.010	LAM4_3 -0.010	LAM5_3 -0.003
			LAM6_3 -0.047	LAM7_3 -0.062	LAM8_3 0.148*		

MODEL FIT INFORMATION

Number of Free Parameters

86

Bayesian Posterior Predictive Checking using Chi-Square

95% Confidence Interval for the Difference Between the Observed and the Replicated Chi-Square Values

-20.530

46.013

Posterior Predictive P-Value

0.241

ok

Information Criterion

Deviance (DIC)

26091.570

Estimated number of paramete

59.995

Bayesian (BIC)

26658.398

In 4th group (New Zealand) intercepts of first and third item significantly differ from priors = **lack of scalar invariance in New Zealand**

In 6th group (Portugal) and in 8th group (Germany) intercept of third item significantly differs from priors = **partial scalar invariance in Portugal and Germany**

In 8th group (Germany) loading of third item significantly differs from priors = **partial metric invariance in Germany**

Results of the AMI bayesian analysis were also very good and similar

EXAMPLE

Universalism-Concern

	metric	scalar
MGCFA – ML	Full metric for all 8 countries	fully invariant for many countries partial for New Zealand and Portugal, noninvariant for Germany
Bayesian	Full metric for 7 countries partial for Germany	fully invariant for many countries partial for Portugal and Germany noninvariane for New Zealand

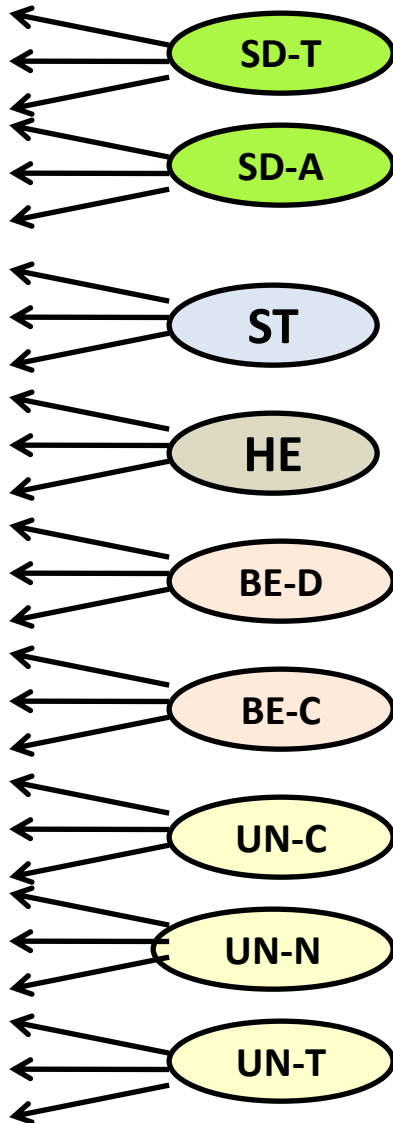
Results very similar

Comparing results of an exact versus an approximate (Bayesian) measurement invariance test: A cross-country illustration with a new scale to measure 19 human values (2014). Cieciuch, J., E. Davidov, P. Schmidt, R. Algesheimer and S.H. Schwartz.

Confirmatory Factor Analysis

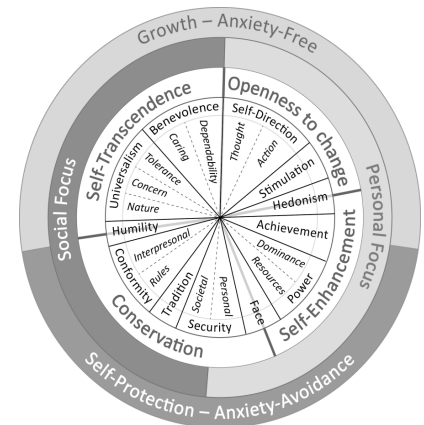
- I. Sample
- II. CFA with CF
- III. 2nd order CFA
- IV. 3rd order CFA

Openness – Self-transcendence



6pt scale

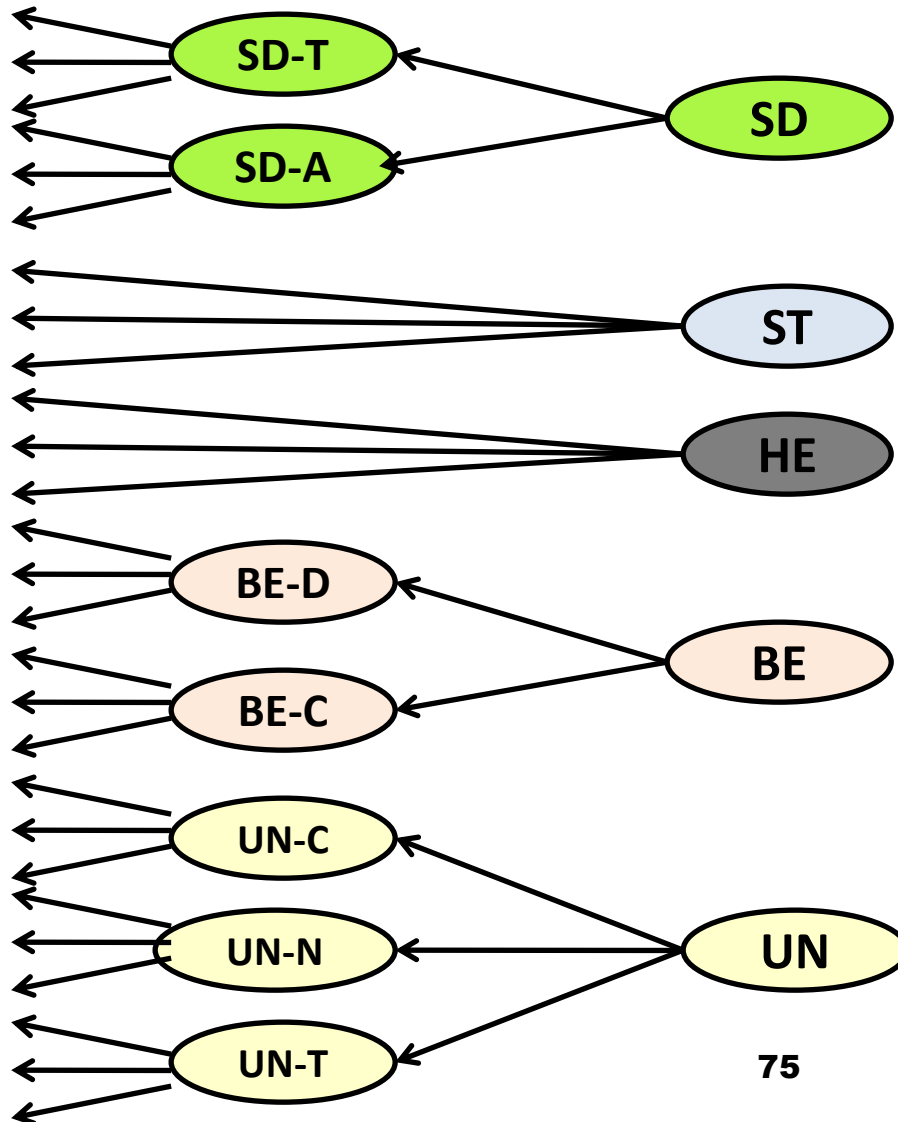
CFI=.936
RMSEA=.048
SRMR=.033



2nd order Confirmatory Factor Analysis

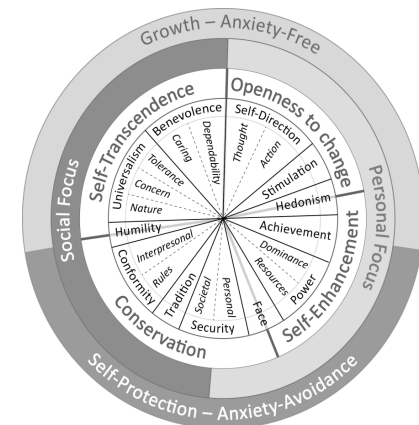
- I. Sample
- II. CFA with CF
- III. 2nd order CFA
- IV. 3rd order CFA

Openness – Self-transcendence

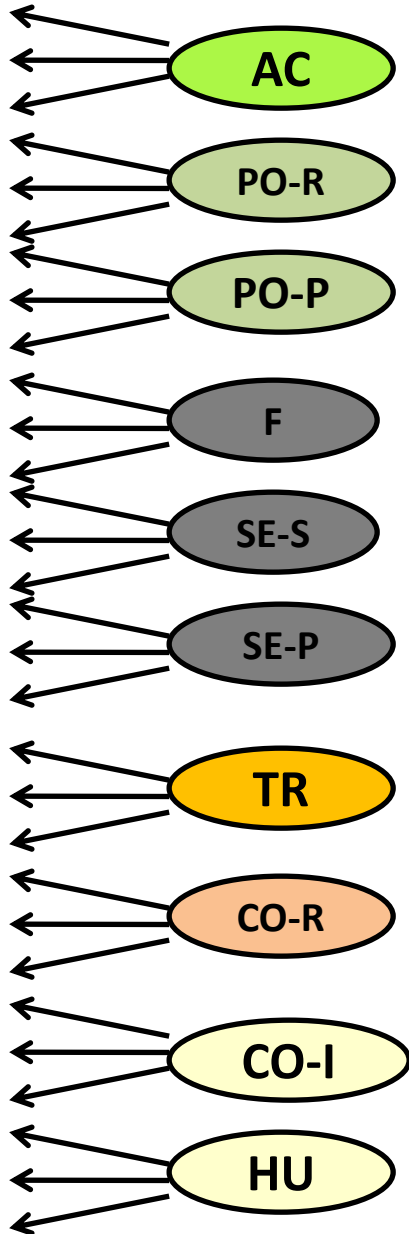


75

CFI=.921
RMSEA=.051
SRMR=.040



Conservation – Self-enhancement

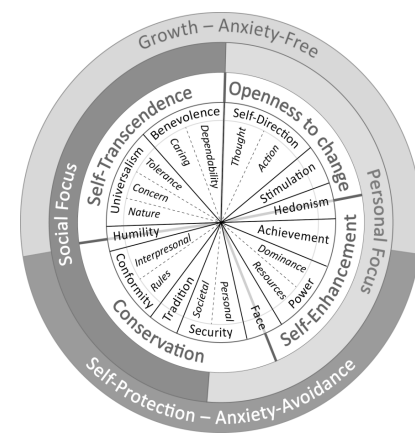


Confirmatory Factor Analysis

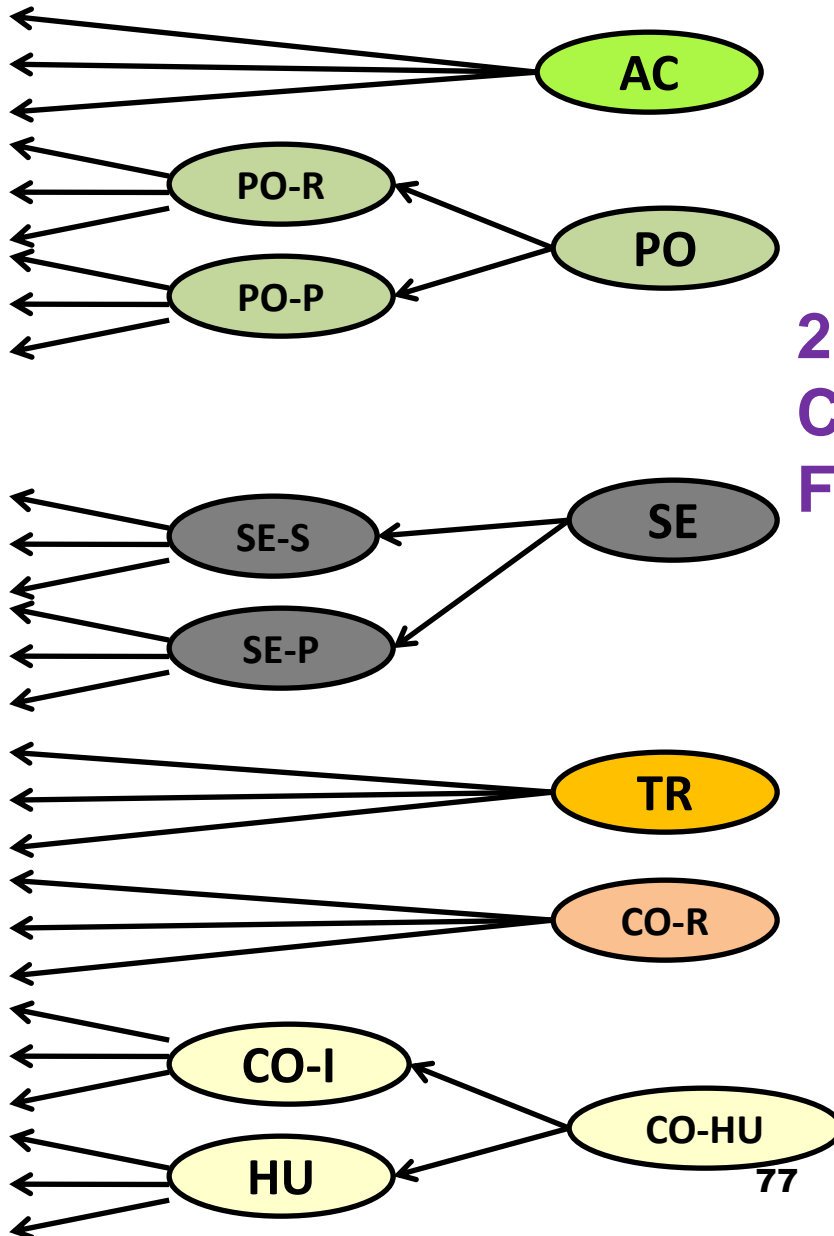
- I. Sample
- II. CFA with CF
- III. 2nd order CFA
- IV. 3rd order CFA

6pt scale

CFI=.944
RMSEA=.049
SRMR=.035



Conservation – Self-enhancement

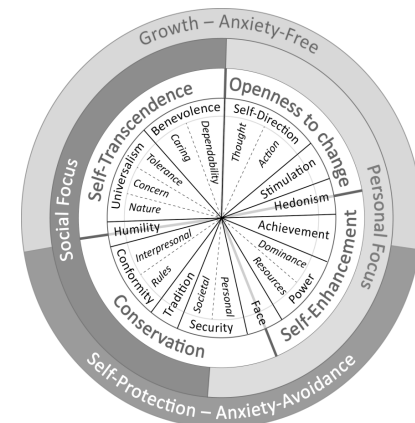


6pt scale

2nd order
Confirmatory
Factor Analysis

- I. Sample
- II. CFA with CF
- III. 2nd order CFA
- IV. 3rd order CFA

CFI=.922
RMSEA=.054
SRMR=.048



Usefulness of Distinctions

- Is it worthwhile to make all 19 distinctions?
 - Does every value have significantly different associations from all the others?
 - Most problematic: pairs of adjacent values
- Adjacent values on continuum—share motivational goals
 - Expect them to have similar associations
 - Compare correlations with variables that capture their distinctiveness

Values Compared Correlations		# Samples as predicted	Distinguishing Variables
SDT .30	SDA .23	15	Mastery Index: My goal in school/job is: to learn as much as possible/completely master material
.14	.09	14	I follow politics closely and form opinions on many issues.
SDA .27	ST .19	12	The right to individual freedom is inviolable, it has to be maintained at all costs
-.15	-.31	14	Age: Stimulation drops more with age than Self-Direction—Action does
ST .06	HE .15	15	It's hard to get ahead in life without lots of money
.07	-.02	15	I follow politics closely and form opinions on many issues.

Values Compared		# Samples as predicted	Distinguishing Variables
Correlations			
HE .13	AC .37	15	Approach Index: In my school/work: I strive to do well compared to others/ my goal is to perform better than others
.10	.30	15	Prove Index: In my school/job: I strive to have others think well of my work/my goal is to have a good reputation
AC .37	POD .31	13	Approach Index
.30	.19	14	Prove Index
POD .22	POR .38	14	It's hard to get ahead in life without lots of money
.11	-.03	15	I follow politics closely and form opinions on many issues. 80

Values Compared Correlations		# Samples as predicted	Distinguishing Variables
POR -.05	FAC .11	15	It's terribly wrong to pay cash with no receipt to avoid taxes
.38	.22	15	It's hard to get ahead in life without lots of money
FAC .21	SEP .35	14	The police should have more powers so they can protect us against crime
.27	.38	14	A person's family should be the main priority in life
SEP .18	SES .30	15	In your life, how important are voluntary organizations?
.41	.32	15	In choosing job, how important is a high income?

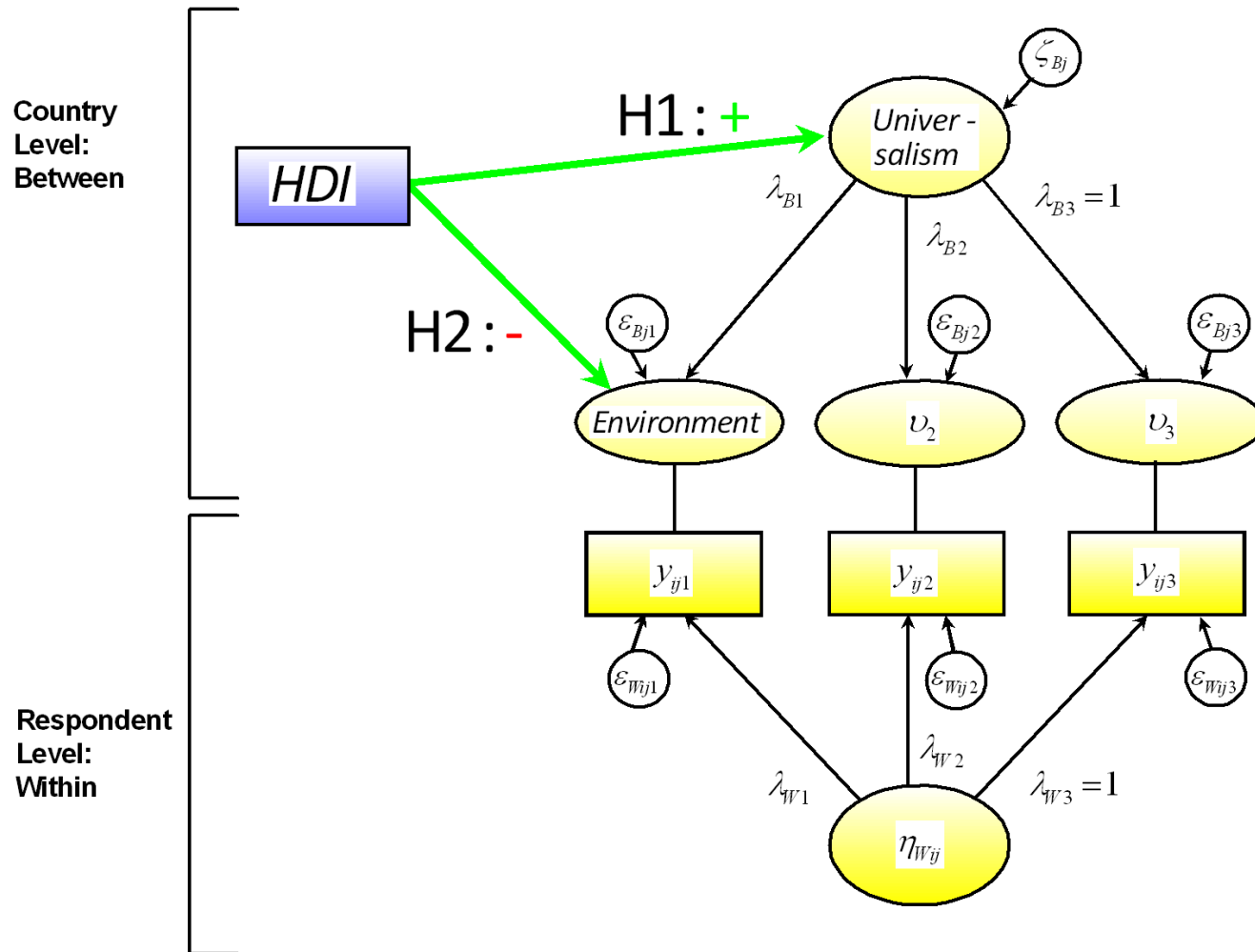
Values Compared		# Samples as predicted	Distinguishing Variables
Correlations			
SES .40	TR .60	15	In your life, how important is religion?
.14	.05	15	The right to individual freedom is inviolable, it has to be maintained at all costs
TR .21	COR .29	14	It's terribly wrong to pay cash with no receipt to avoid taxes
.46	.28	14	Apart from religious services, how often do you pray?
COR .28	COI .12	15	The police should have more powers so they can protect us against crime
.02	.11	13	We should not try to impose own views on people who disagree with us

Values Compared		# Samples as predicted	Distinguishing Variables
Correlations			
COI .07	HUM .25	13	It's terribly wrong to lie to avoid making person angry with me
.04	-.09	15	It's hard to get ahead in life without lots of money
HUM .06	UNN .22	15	I follow politics closely and form opinions on many issues.
.29	.07	15	A person's family should be the main priority in life
UNN .21	UNC .30	12/13	Immigrants should be given same rights as everyone else
.09	.17	15	We should not try to impose our own views on people who disagree with us

Values Compared		# Samples as predicted	Distinguishing Variables
Correlations			
UNC .23	UNT .12	14	The government should reduce differences in income levels
.15	.07	14	A person's family should be the main priority in life
UNT .24	BEC .05	13/13	People who come here from other countries make this better place to live
.12	.00	15	Homosexuals should have the same rights as married couples
BEC -.06	BED -.17	14	Age: Benevolence—Dependability drops more with age than Benevolence—Concern does
.28	.20	13	A person's family should be the main priority in life 84

Values Compared Correlations		# Samples as predicted	Distinguishing Variables
BED .26	SDT .36	14	In choosing a job, how important would it be that the job enable you to use your own initiative?
.08	.14	15	I follow politics closely and form opinions on many issues.
TR -.31	HUM -.02	15	Homosexuals should have the same rights as married couples
.60	.32	15	In your life, how important is religion?
BEC .08	UNC .23	15	The government should reduce differences in income levels
.09	.30	13/13	Immigrants should be given same rights as everyone else

Theoretical expectations:



- ML SEM is a rather **straightforward** technique to **explain variation in an item's intercept** (extensions see Schlüter and Meuleman 2018).
- Although ML SEM does not provide a resolution to the problem of noninvariance, it is a **useful tool for the diagnosis of the causes**.
- Diagnosis and systematic identification of the sources of item bias are an essential step before measurement scales can be improved for cross-cultural analysis.

Artur Pokropek, Eldad Davidov & Peter Schmidt (2019): A Monte Carlo Simulation Study to Assess The Appropriateness of Traditional and Newer Approaches to Test for Measurement Invariance, Structural Equation Modeling

- Design and Major Message
- results of simulations for 804 conditions (Sample Size, factor loadings, Amount of bias etc.)
- gave rise to more than 300,000 individual estimations.
- guidance for applied researchers facing partial
- and approximate MI.
-
- Even large deviations from strict MI may allow precise
- estimations and meaningful comparisons of both means
- and path coefficients.
-
- Using appropriate models, both
- group rankings as well regression coefficients of structural
- equation models could be correctly recovered under specific
- conditions.
-

- PARTIAL MEASUREMENT INVARIANCE(PMI).
-
-
- Although one could choose a different bias size, we chose a realistic noninvariance bias.
-
- Indeed, robustness checks suggested that lowering the sample size to
- 1,000 and/or increasing the partial noninvariance bias
- from 0.2 to 0.3 essentially did not alter the results.
-
- For generating data, we used highly reliable scales with factor
- loadings between 0.65 and 0.85—in real survey data, factor
- loadings may range between 0.35 and 1.0.
-

- BAYESIAN SEM(BSEM)
- Convergence rates for BSEM models with
- relatively high priors (0.01 and 0.05) were low.
-
- Robustness checks analyzing different convergence
- criteria provided virtually the same conclusions
- as those presented in the paper.

- more strict convergence criteria produced better convergence rates
- but computational time grew exponentially, stretching the time of model estimation into weeks.

- Partial Scalar Invariance and alignment
- PMI models may be rather effective to recover
- both path coefficients and latent means when many or
- even most items are noninvariant.

- The alignment procedure is recommended for recovering latent means:
- cases where there are only few noninvariant parameters and many groups($g > 5$).