New evidence on response styles time stability in online surveys: use of IRTree models

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Response styles

- Response styles (RS):
  - Systematic tendency to respond regardless of trait level and items' content

(Cronbach, 1946; Khorramdel & von Davier, 2014; Paulhus, 1991)

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Response styles

Response styles

- many „styles" known (Van Vaerenbergh & Thomas, 2013):

Type	Definition	Respondent's use of a 7-point rating scale[a]
ARS	Tendency to agree with items regardless of content, only the highest response categories are used	○○○○●●●
DARS	Tendency to disagree with items regardless of content, only the lowest response categories are used	●●●○○○○
MRS	Tendency to use the middle response category of a rating scale, regardless of content	○○○●○○○
ERS	Tendency to use the highest and lowest response categories of a rating scale	●○○○○○●
MLRS	Tendency to avoid the highest and lowest response categories of a rating scale. This is the complement of ERS	○●●●●●○

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Consequences of response styles

- Inflated or deflated scores (Park & Wu, 2019; Paulhus, 1991)
- Spurious correlations (Jeon & DeBoeck, 2019; Park & Wu, 2019)
- Reliability and dimensionality distortion, validity threat (Adams et al., 2019; Baumgartner & Steenkamp, 2001; De Jong et al., 2008; Khorramdel & von Davier, 2014; van Rosmalen et al., 2010)
- Threat for cross-group comparisons (He & van de Vijver, 2015; Khorramdel et al., 2017; Ulitzsch et al., 2023)
- Distortion of growth/time change estimates (Ames & Leventhal, 2021; Soland & Kuhfeld, 2021)

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Response styles time-stability

- **Why time-stability is an important topic?**
- Trait vs. State discussion
  - Insight to RS:
    - interpretations
    - mechanisms
    - covariates
    - prevention techniques
- Enables to measure true change of the trait of interest

(Bachman & O'Malley, 1983; Billiet & Davidov, 2008)

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State-of-the-art

- **Response styles:**
- content-independent
- trait-like
- stable across measurement occasions over short and long periods of time
- stable across measurement instruments (scales) within measurement occasion

(Austin et al., 2006; Jin & Wang, 2014; Weijters et al., 2010; Wetzel et al., 2013)

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Response styles time-stability – how to measure it?

- **Older ways have a number of shortcomings:**

- confound trait and style (Bolt & Newton, 2011)
- need additional items (Weijters et al., 2010)
- do not offer item-level analysis (Wetzel et al., 2016)
- do not offer separate latent trait for RS (e.g. mixture IRT, random threshold) (Khorramdel et al., 2019; Ulitzsch et al., 2022)
- ignores ordinal nature of rating scales (e.g. MNRM)

(review: Ames, 2022)

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But…

The research lacuna

- very few time-stability research that uses new measurement methods (e.g. IRTrees!) (Ames, 2022)
- cross-scale time-stability is scarcely researched at all (with the use of IRTrees or MNRMs or without) (Ames & Leventhal, 2021a, 2021b; Soland & Kuhfeld, 2021)
- cross-format time-stability also scarcely researched (Ames, 2022)
- time-stability covariates rarely investigated (Ames & Myers, 2020)

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Research aims

- Estimate RS time stability with IRTrees models
- Investigate cross-scale RS time stability
- Research potential covariates of RS time stability

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IRTrees

- **IRTree models**
- (attempt to) represent multi-stage decision processes
- with a series of dichotomous steps with IRT-modelled probability attached to each of the steps (nodes)
- capable of modeling many traits in one model (e.g. ERS, MRS, TOI)
- flexible with regard to item format (4-, 5, 7-point rating scale, etc.)

(Bockenholt, 2012, 2017; Khorramdel & von Davier, 2014; Plieninger, 2021 Plieninger & Meiser, 2014; Thissen-Roe & Thissen, 2013)

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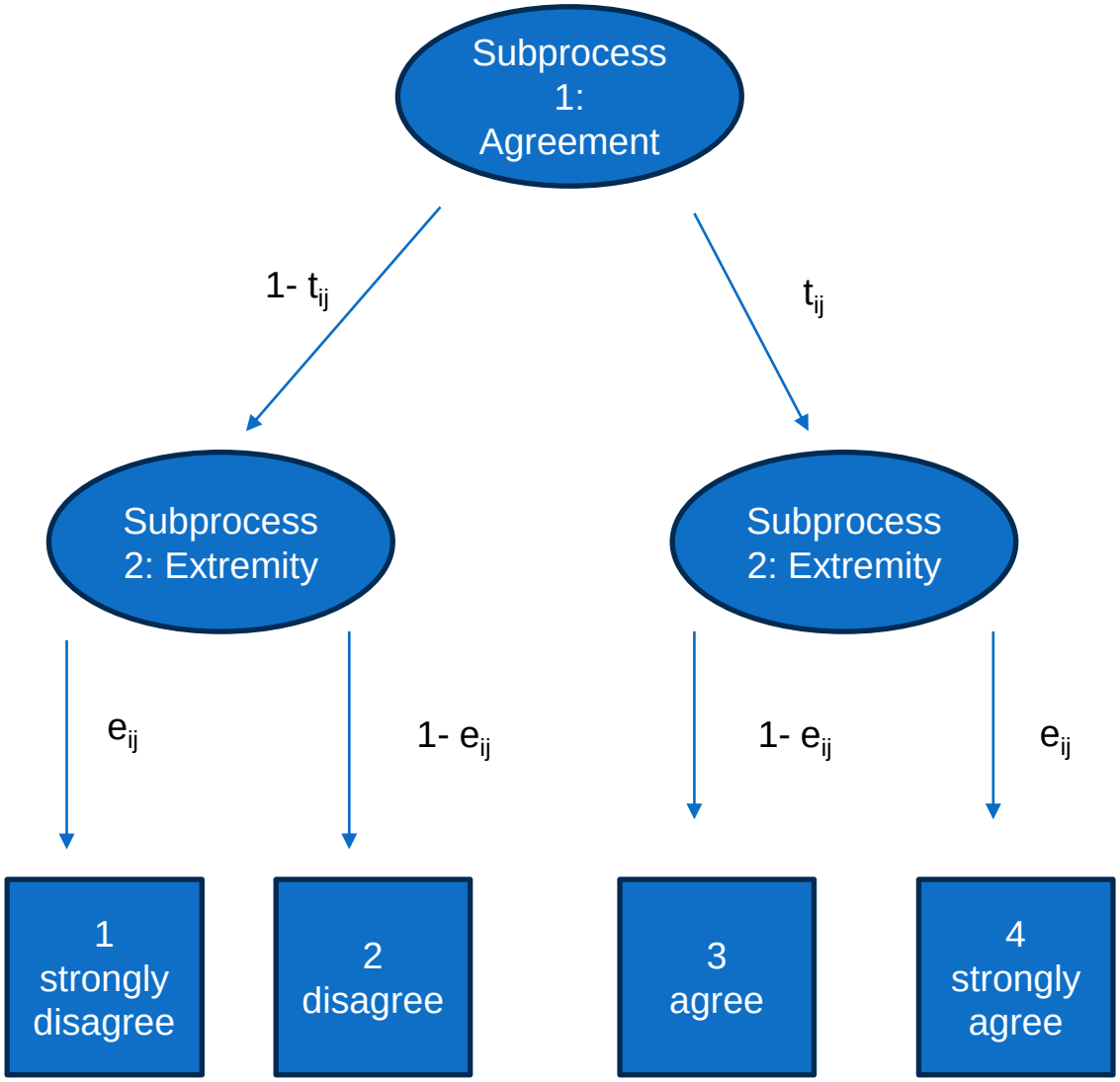
IRTrees



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Method

Participants	Scales (all 4-point agreement type)	Number of items
N = 401	Vaccination attitudes	10
Web survey	Reading competence	3
Opt-in panel	Reading difficulty	3
Quota-based sample	Reading joy	11

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Method

- Measurement occasions: two, separated by 2 weeks
- Model specification
  - item parameters invariant across time points (Ames & Leventhal, 2021)
  - mean and variance fixed at t=1, estimated freely at t>1
  - informative priors for item parameters, uninformed priors for trait distribution
  - General ERS vs Scale-Specific ERS

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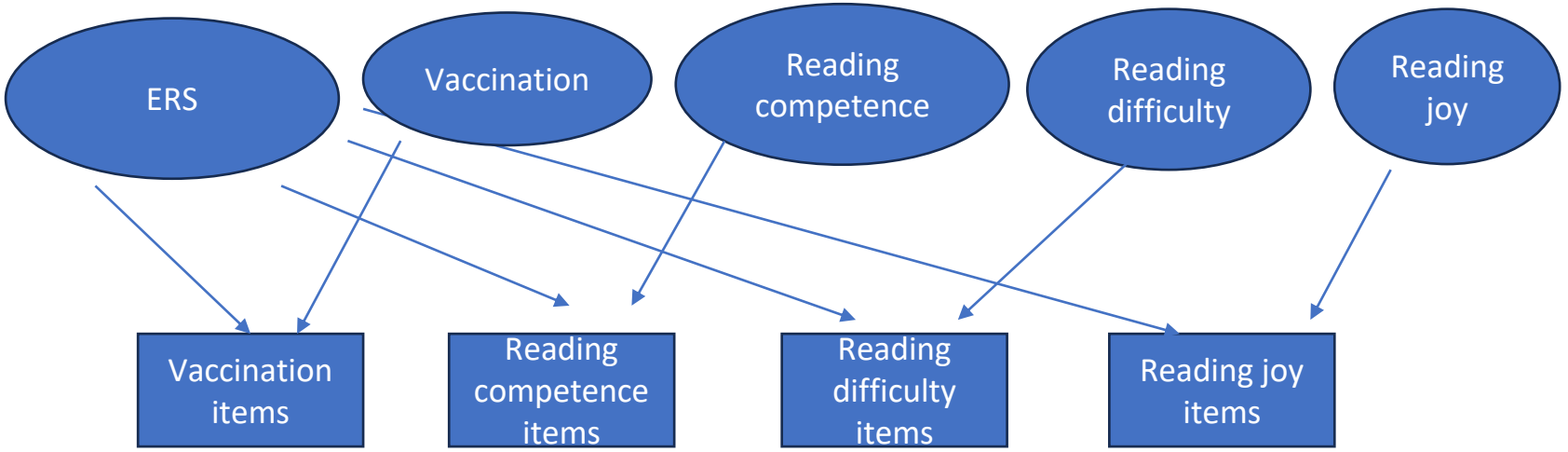
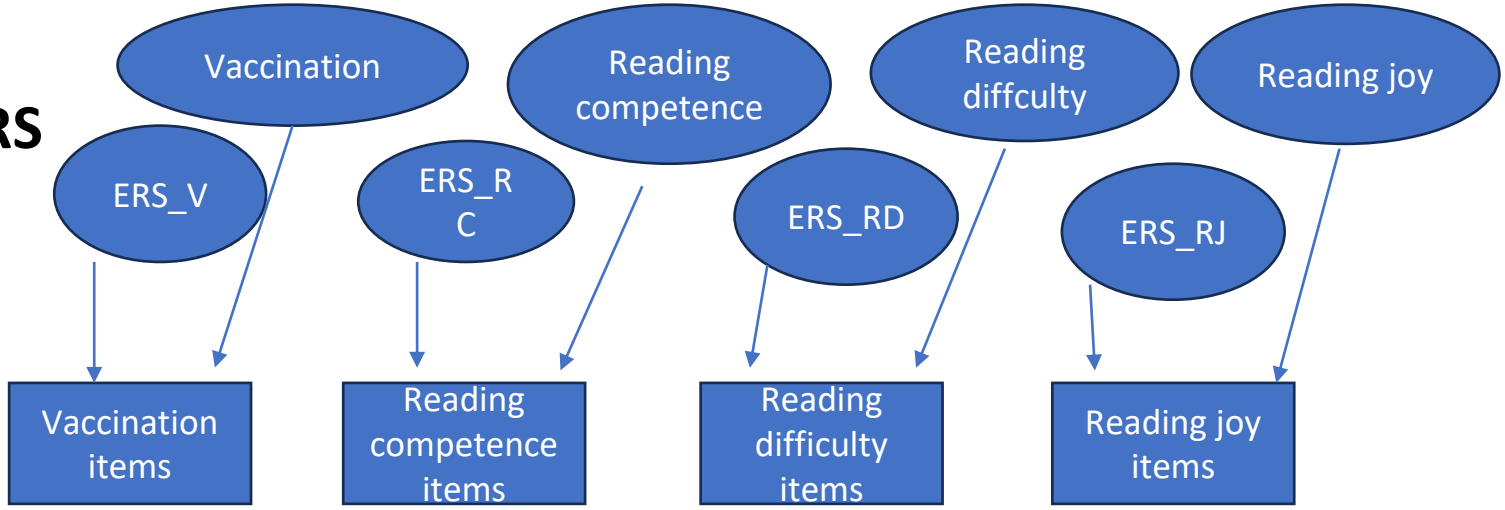
Model 1: General ERS



Model 2: Scale-specific ERS



Data overview

- **Covariates:**
  - Gender
  - Survey experience (number of surveys participated in last year, date of joining the panel)
  - Age (below 30, 31-39, over 39)
  - Education (self-report, higher vs. non-higher)
  - Condition – neutral vs. distraction

Results

- Scale-specific ERS model better fitted the data*
- High inter-measurement ERS correlation – ca. 0.77
- High inter-scale ERS correlation - |0.44 – 0.83|
- Negligible changes in trait and ERS means
- Slight increase of trait and ERS variances

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Variable	ERS-controlled (IRTree)	No control (SGRM)
Vaccination – mean change	0	0
Vaccination – variance retest	1.00*	0.99*
Vaccination – variance of change	0.25*	0.34*
Reading competence – mean change	0	0
Reading competence – variance retest	1.16*	1.11*
Reading competence – variance of change	0.21*	0.28*
Reading difficulty – mean change	0	0
Reading difficulty – variance retest	1.26*	1.22*
Reading difficulty – variance of change	0.40*	0.38*
Reading joy - mean	0.23*	0.15*
Reading joy – variance retest	1.30*	1.16*
Reading joy – variance of change	0.60*	0.56*

ERS	Condition	Female	Education	Age	Interviews	Months in panel
ERS_V	-	-	0.24*	-	-	-
ERS_RC	-	0.23*	0.23*	-	-	-
ERS_RD	- 0.35*	0.32*	-0.23*	-	-	-
ERS_RJOY	-	-	0.38*	-	-	-
ERS_V change	- 0.44*	-	-	-	-	-
ERS_RC change	-	-	-	-	-	-
ERS_RD change	-	-	-	- 0.35 *	-	-
ERS_RJOY change	-0.53*	-	-	-	-	-

Discussion

- Hard to disentangle ERS and trait of interest – RS is assumed symmetric (which probably is not the case)
- Need for new models for skewed trait distributions?
- Covariates have only a limited relation with ERS
- Similar pattern of relations to traits of interest
- Negligible effect of RS control on latent change indicators.

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Limitations

- Small numer of participants (only ca. 400 is it enough?) – simulation study says YES
- Short period of time between measurement occasions (only 2 weeks)
- Checked only for 4-point rating scale
- Only ERS modelled

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Future directions

- More simulation studies to understand LIRTrees models better
- More studies on covariates (format, time gap, scale content, scale length, RS type, participant characteristics)
- Investigate consequences for ignoring RS in trait change studies (mean, variance, test-retest)
- Research individual trajectories (trait and RS shifts)

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Thank you !

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