Inter-Individual Differences in Within-Person Process Parameters as Predictors of Future Behavior

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Quantitative Research Methods

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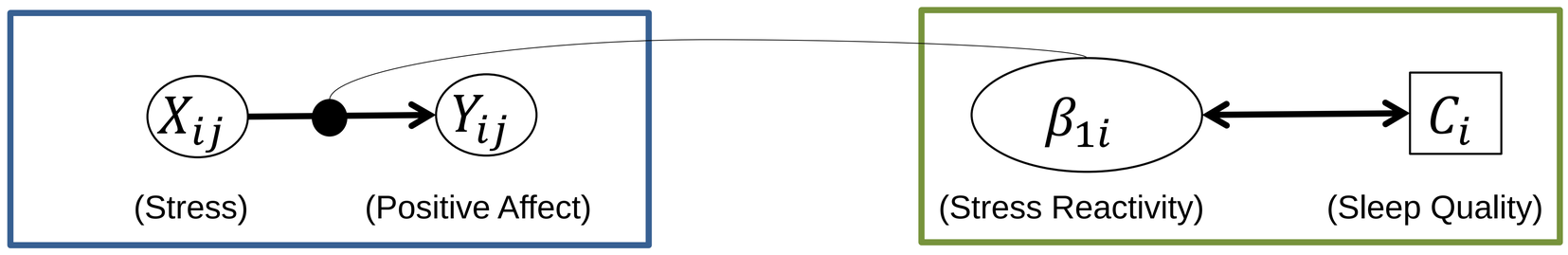
Within-person process parameters describe processes unfolding across time within persons and can be assessed in intensive longitudinal designs in real-time and real-life (Bolger et al., 2003). Typically these data are analyzed by multilevel modeling (Raudenbush & Bryk, 2002) which allows for modeling inter-individual differences in within-person processes as random slopes. The current research asks whether we can use these inter-individual differences to predict future behavior.

Level 1:

$$Y_{ij} = \beta_{0i} + \beta_{1i}(X_{ij}) + \varepsilon_{ij}$$

Level 2:

$$\beta_{0i} = \gamma_{00} + \upsilon_{0i}$$
$$\beta_{1i} = \gamma_{10} + \upsilon_{1i}$$



Inter-individual differences in within-person processes are represented as Var(υ_{1i}). Under typical assumptions made in MLM, the estimation of the random slopes is affected by the reliability of the within-person association of X and Y. The estimate for the individual regression slope for person *i* (β_{1i}) is shrunk towards the overall regression slope (γ_{10}). The less reliable the association between X and Y within person *i* is, the more β_{1i} is shrunk towards γ_{10}. Factors affecting this reliability should be

- Reliability of X (relX)
- Level-1 residual variance / Variance in Y not accounted for by X (Var(ε))
- The number of measurements per person (t)

Prediction of an external criterion (C) boils down (in the most simple case) to a bivariate correlation. The Power to detect this association should be affected by

- Reliability of β_{1i}
- Sample size (N)
- True correlation of β_{1i} and criterion (ρ)

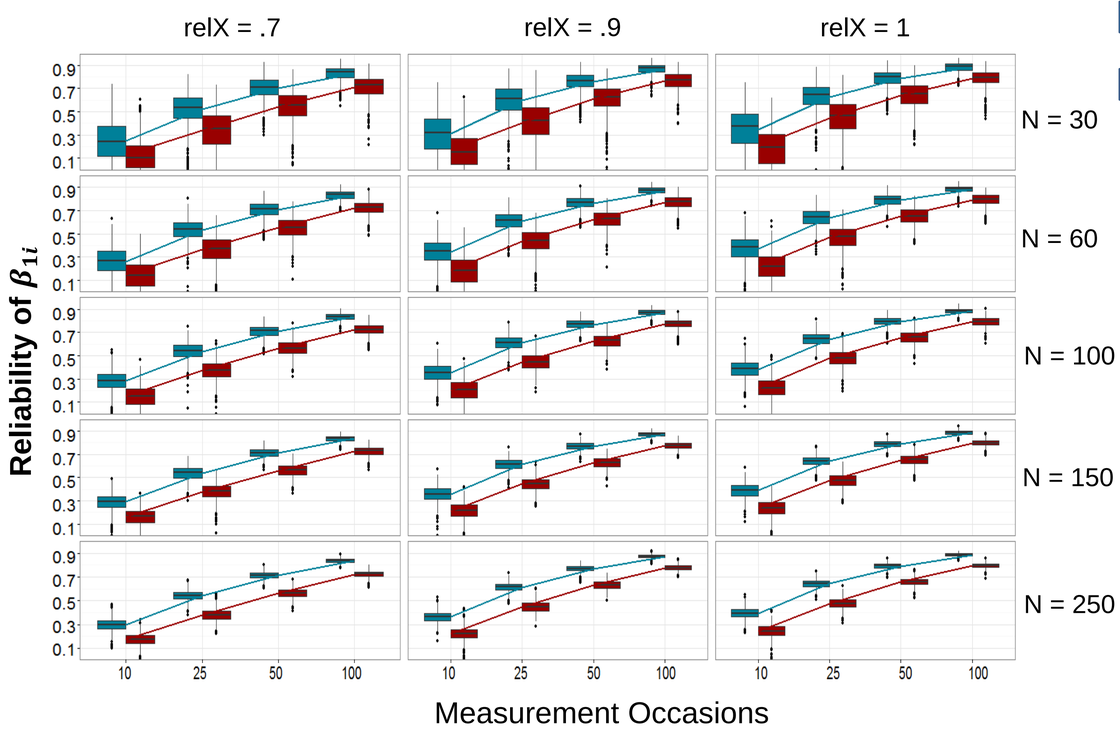
Simulation Study
300 data sets per condition

Independent Variables

- N: 30, 60, 100, 150, 250
- t: 10, 25, 50, 100
- relX: .7, .9, 1
- Var(ε): .5, 1
- ρ: .10, .30, .50

Dependent Variables

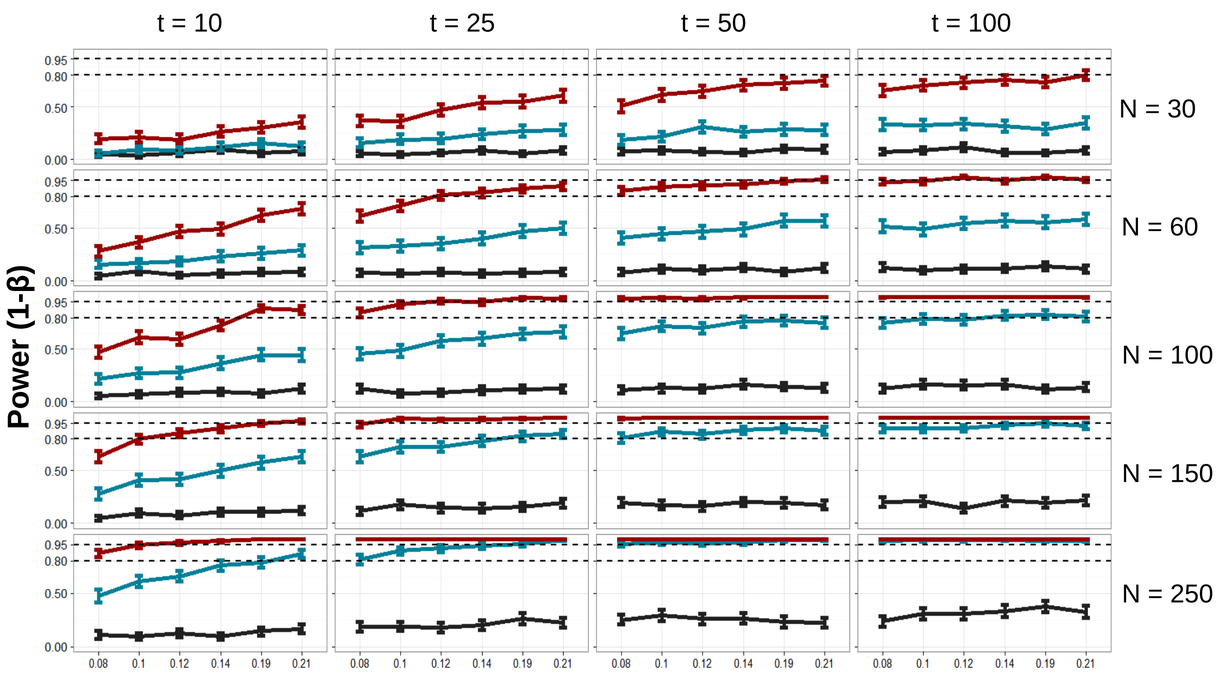
- Reliability of β_{1i} (squared correlation between estimate and true score)
- Power to detect correlation of β_{1i} and criterion



	η^2_p
t	.88
Var(ε)	.50
relX	.20
t x Var(ε)	.05
t x relX	.01

Table 1. Strongest effects on reliability in a 5 (N) x 4 (t) x 3 (relX) x 2 (Var(ε)) ANOVA.

As expected, the effect of the number of participants on the reliability of β_{1i} was negligible (η^2_p = .001).



Level-1 R^2 refers to the explained within-person variance (see Xu, 2003) and is computed as:

$$R^2 = \frac{relX * .13}{\mathrm{Var}(\varepsilon) + .13}$$

Conclusion

- The number of measurement occasions and within-person R^2 determine the largest part of the reliability of assessing inter-individual differences in within-person processes. The number of participants hardly impacts on theses estimates.
- All factors (number of measurement occasions, within-person R^2, number of participants) affect the power to detect associations of inter-individual differences in within-person processes with a continuous external criterion

Recommendations

- For individual (person-level) diagnostics, (a) a very large amount of repeated measurements (100) and (b) a well-fitting model with high Level-1 R^2 (.20) are required.
- If the focus is on group-level effects (correlation with external criterion), these requirements can be compensated for by increasing the number of participants

Bolger, N., Davis, A., & Rafaeli, E. (2003). Diary methods: Capturing life as it is lived. *Annual Review of Psychology, 54*(1), 579–616.
Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks: Sage Publications.
Xu, R. (2003). Measuring explained variation in linear mixed effects models. *Statistics in Medicine, 22*(22), 3527–3541.

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