Person- or situation-specific? Factors explaining convergent validity and discrepancy between self-report and digital trace of smartphone use

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The data described/study is from the project „Research of Excellence on Digital Technologies and Wellbeing CZ.02.01.01/00/22_008/0004583“ which is co-financed by the European Union.

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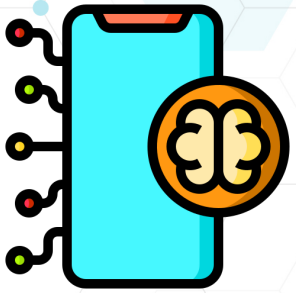
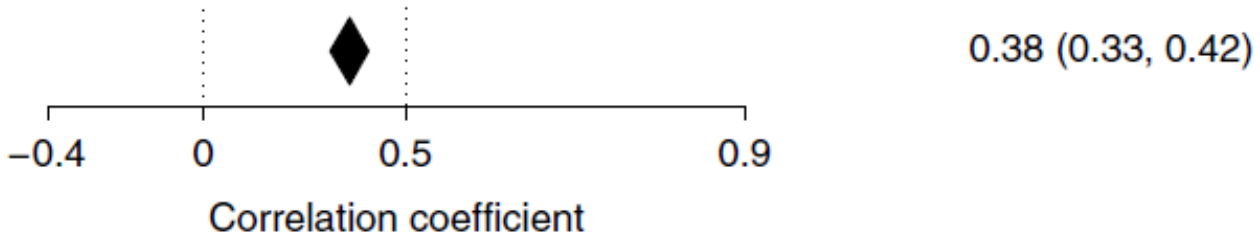
MINISTRY OF EDUCATION, YOUTH AND SPORTS

DigiWELL

Introduction



- Majority of digital media effects research has been based on self-reported estimates (Dienlin & Johannes, 2020)
- Accuracy and validity of self-reported measures of digital media use has been recently questioned (Parry et al., 2021)

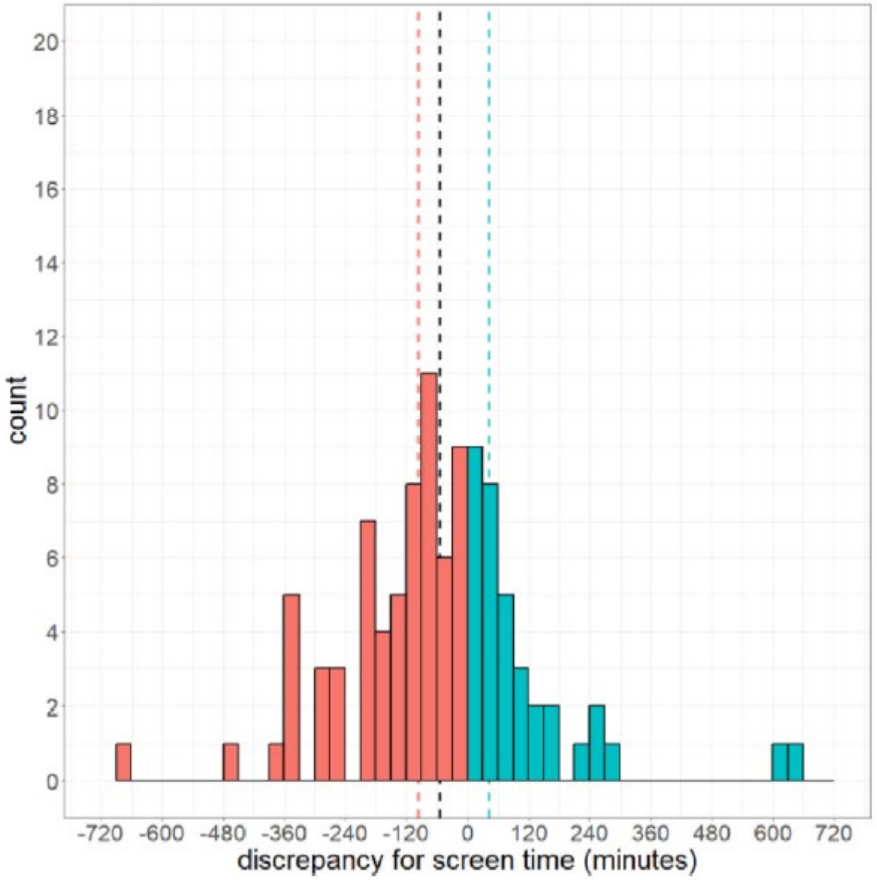


- Innacuracy often related to central variables in question (e.g., media use itself, well-being) (Araujo et al., 2017; Sewall et al., 2020)

Introduction

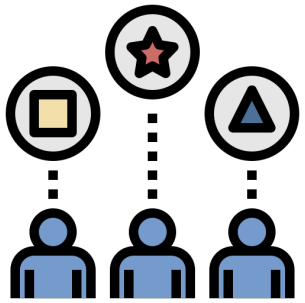
Tkaczyk et al., 2024

- Our recent study on adolescent sample follows the trend
  - between r = .40
  - within r = .29
  - mean discrepancy = −32 mins
  - discrepancy ICC = .56



Introduction

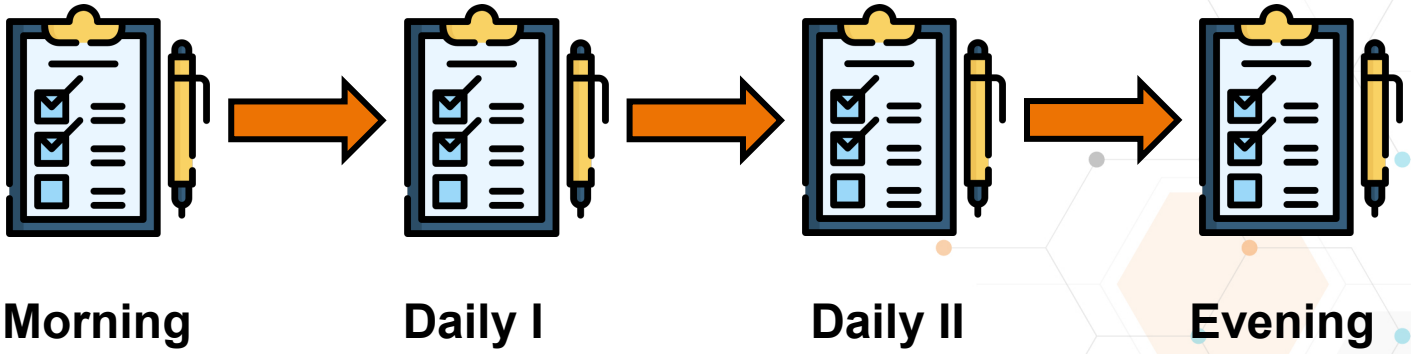
- To adress the limitations of prior research, we examined potentialy relevant factors that may affect:
  - Convergent validity
  - Discrepancy



Between-person	Within-person
Overall smartphone use	
Mobile control self-efficacy	
Screen time fragmentation	Screen time fragmentation
Overall compliance	Daily compliance
	Weekend vs. weekdays
	Day of study

Methods

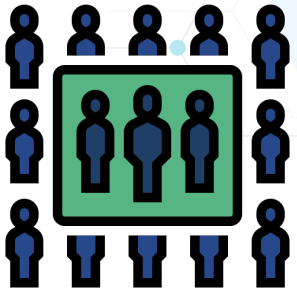
- **Experience sampling method (ESM)**
  - 14 days – 4 surveys per day
    - Semi-random time frames
  - Digital trace of smartphone use (every second)
  - Custom built smarphone app



- Self-reported smartphone use assessed in **evening surveys**:

  "For how long you were using your smartphone (including phone-calls, being-online, playing games, listening to music, etc.) during the day (up to this questionnaire). Enter the hours and minutes (e.g. enter 5.5 hours as 05:30)."

Methods



- **Sample – N = 132**, 58 % boys, 13 to 17 y. o., Czech
  - 812 daily observations
  - overall compliance rate: 72%

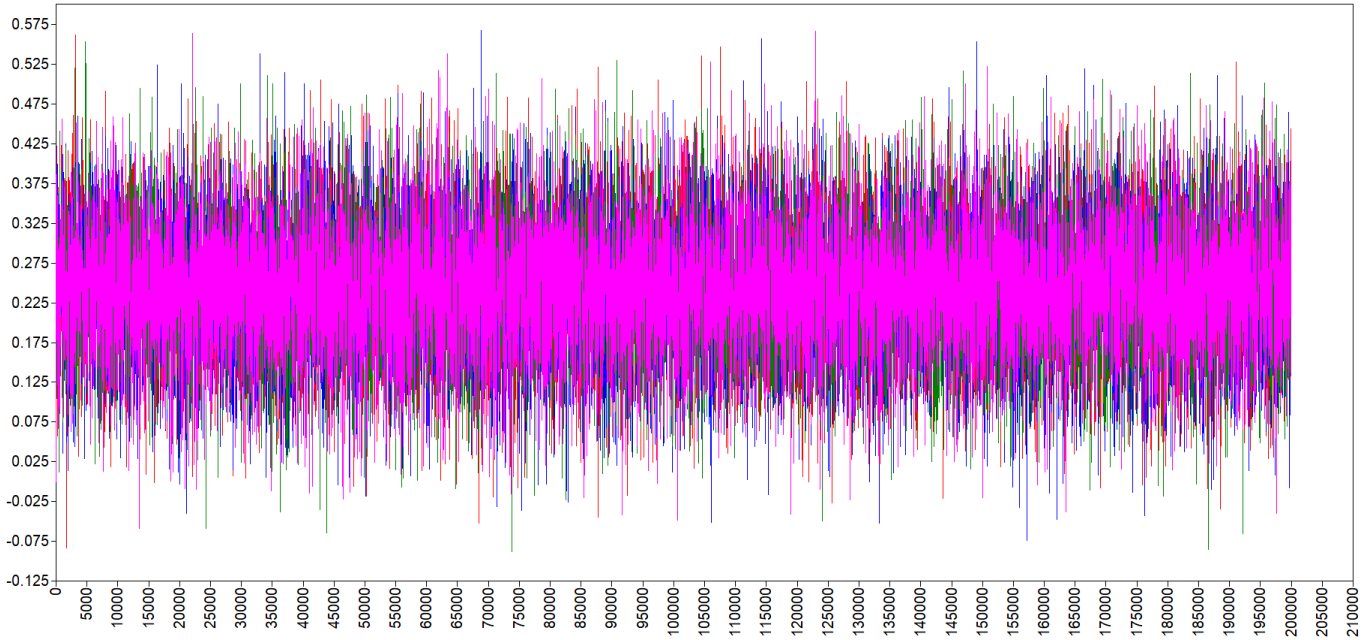
- Study part of the larger research project (EXPRO) (Elavsky et al., 2022)
  - four measurement bursts (per 14 days)
  - we used data from the third burst

Analysis

- We built two **multilevel linear models**:
  - **Convergent validity model**
    - Validity: digital trace → self-report
    - Within-person level interactions
    - Cross-level interactions: predictors → random slope (validity)
    - Random intercept and random slope terms (with cov)
  - **Discrepancy model**
    - Discrepancy = | digital trace – self-report |
    - Main effects without interactions
    - Random intercept and random slope terms (with cov)
    - Robustness check using complementary model with log-transformed discrepancy

Analysis

- Bayesian estimation in Mplus
  - MCMC, Gibbs sampling
  - 4 chains, 200k iterations
  - Default priors: $\beta, \tau \sim N(0, \infty)$; $\psi \sim IW(0, -3)$ or $IG(-1, 0)$



Results

Overall smartphone use

- Positive relationship with discrepancy (β = .25)
- Heavy smartphone users tend to underestimate their usage more severely than lighter users (Sewall et al., 2020)

Mobile control self-efficacy

- No non-negligible effect

Results

Smartphone use fragmentation

- Measured by **time per interaction**
  - TPI = screen time / # interactions
- Less within-person fragmentation related to more discrepancy (β = .18)
- Opposite to our hypothesis and prior evidence

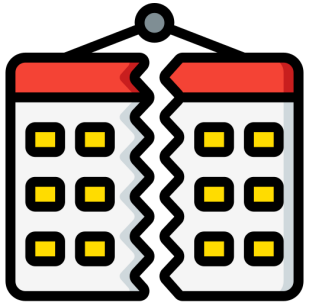
Compliance with the study protocol

- Undirect measure of the motivation to participate
- No non-negligible effects on either between or within-person level

Results

Weekend vs. weekdays

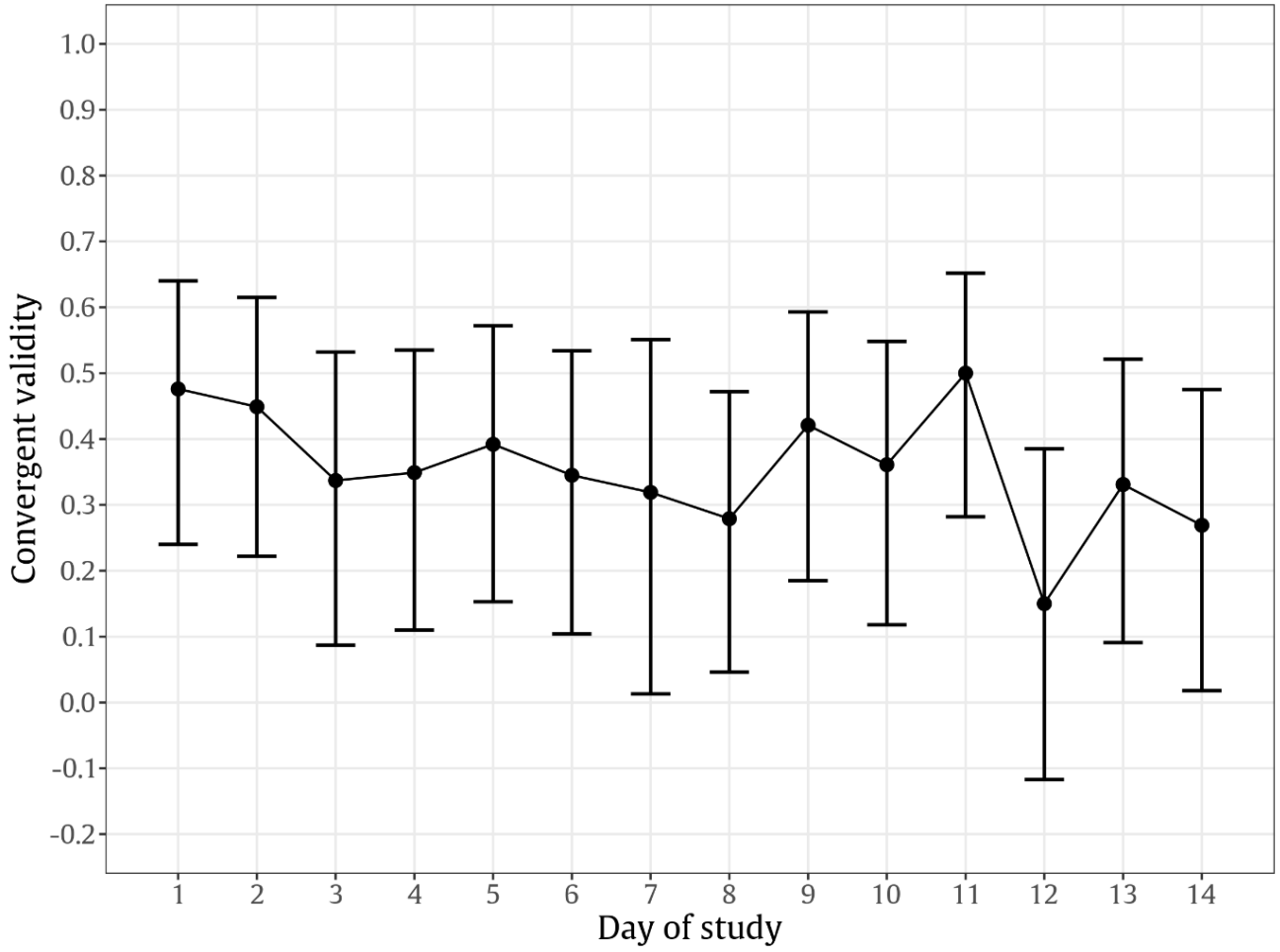
- No non-negligible effects



Day of study

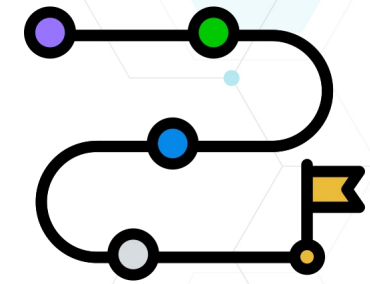
- Two concurrent hypotheses
  - learning effect and fatigue effect (Verbeij et al., 2021)
- Decreasing convergent validity with increasing days ($\beta = -.07$)
  - Suggesting fatigue effect

Results


Convergent validity
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Day of study

Conclusions

- The nuanced daily variations underscore the complexity of measuring digital behavior
- highlighting the importance of context in the understanding of self-reported smartphone use
- These findings are particularly relevant for future research designs on the effects of digital media use



Limitations

- Digital trace data are not „objective“ or exact measure of smarthphone use behavior – measurement error
- Low power for between-person effects
- Limited generalizability

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