Marburg University

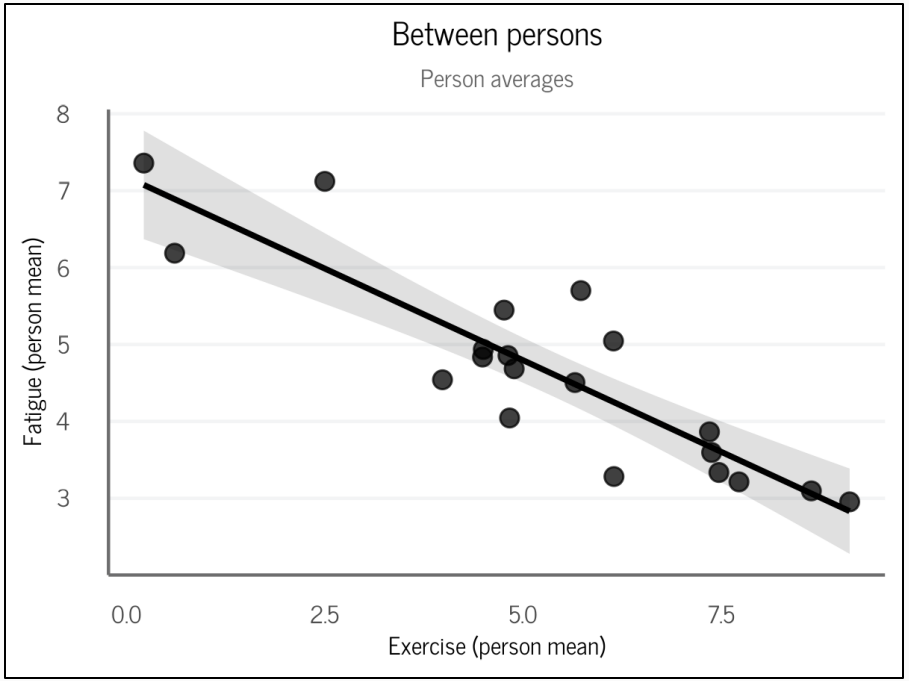
Introducing openESM

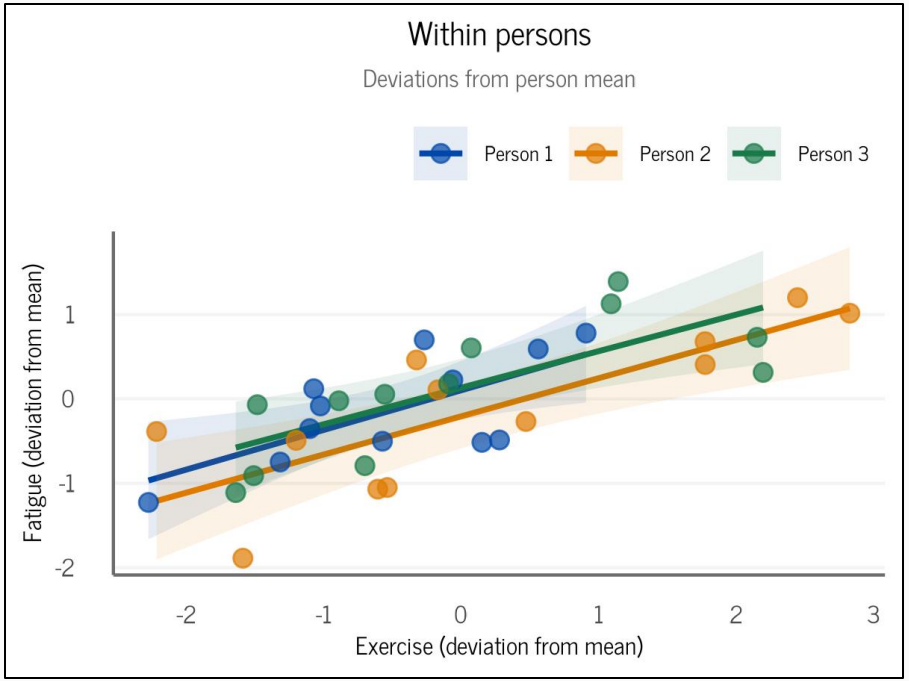


Psych #rstats Club · April 2026

Björn Siepe Department of Psychology, Philipps-Universität Marburg

Why Time Series Data?

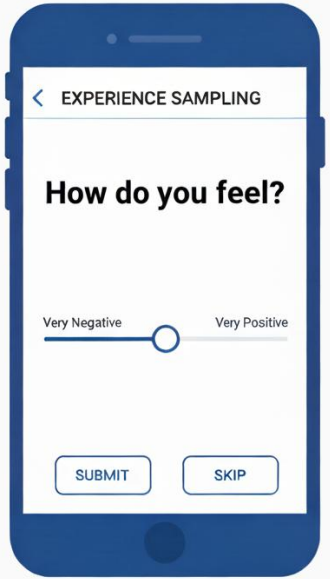




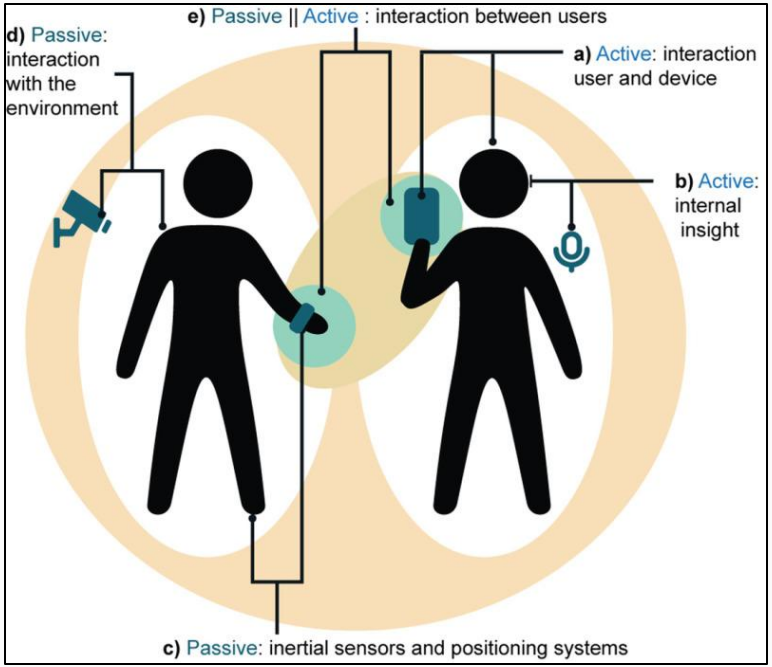
Within-person perspective is aligned with many psychological theories (Molenaar, 2004; Hamaker, 2012)

Experience Sampling Data

“Active” self-report data



“Passive” sensor data



ESM: Interdisciplinary

Biological Psychiatry: Cognitive Neuroscience and Neuroimaging
Volume 8, Issue 8, August 2023, Pages 841-851



Archival Report

Accurate Prediction of Momentary Cognition From Intensive Longitudinal Data

Zoë W. Hawks [a b], Roger Strong [a b], Laneé Jung [a], Emorie D. Beck [c], Eliza J. Passell [a], Elizabeth Grinspoon [a], Shifali Singh [a b], Madelyn R. Frumkin [d], Martin Sliwinski [e], Laura T. Germine [a b]

Article | Open access | Published: 15 October 2024

Everyday helping is associated with enhanced mood but greater stress when it is more effortful

Ekaterina Pronizius, Paul A. G. Forbes, Anja C. Feneberg, Bianca Miculescu, Urs M. Nater, Giulio Piperno, Giorgia Silani, Ana Stijovic & Claus Lamm

Scientific Reports **14**, Article number: 24120 (2024) | Cite this article

Moments that Matter? On the Complexity of using Triggers Based on Skin Conductance to Sample Arousing Events within an Experience Sampling Framework

Sjoerd van Halem, Eeske van Roekel, [...], and Jaap Denissen (+2) View all authors and affiliations

Volume 34, Issue 5 | https://doi.org/10.1002/per.2252

Workplace Stress in Real Time

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

Luca Menghini, Massimiliano Pastore und Cristian Balducci

ESM: Interdisciplinary

JOURNAL ARTICLE

A Little Autonomy Support Goes a Long Way: Daily Autonomy-Supportive Parenting, Child Well-Being, Parental Need Fulfillment, and Change in Child, Family, and Parent Adjustment Across the Adaptation to the COVID-19 Pandemic

Andreas B Neubauer, Andrea Schmidt, Andrea C Kramer, Florian Schmiedek
Author Notes

Child Development, Volume 92, Issue 5, September/October 2021, Pages 1679–1697,
https://doi.org/10.1111/cdev.13515
Published: 27 September 2021

ELSEVIER

Body Image
Volume 35, December 2020, Pages 181-191



Body Positivity (#BoPo) in everyday life: An ecological momentary assessment study showing potential benefits to individuals' body image and emotional wellbeing

Alicia Stevens, Scott Griffiths

Mobile Health Daily Life Monitoring for Parkinson Disease: Development and Validation of Ecological Momentary Assessments

Jeroen Habets[1]; Margot Heijmans[1]; Christian Herff[1]; Claudia Simons[2, 3]; Albert FG Leentjens[2]; Yasin Temel[1]; Mark Kuijf[4]; Pieter Kubben[1, 5]

Pooled and person-specific machine learning models for predicting future alcohol consumption, craving, and wanting to drink: A demonstration of parallel utility.

©REQUEST PERMISSIONS

Soyster, P. D., Ashlock, L., & Fisher, A. J. (2022). Pooled and person-specific machine learning models for predicting future alcohol consumption, craving, and wanting to drink: A demonstration of parallel utility. *Psychology of Addictive Behaviors, 36*(3), 296–306. https://doi.org/10.1037/adb0000666

ESM: Data are scarce

What does a typical ESM study look like?



How many individuals?

136.6

participants on average



How many timepoints?

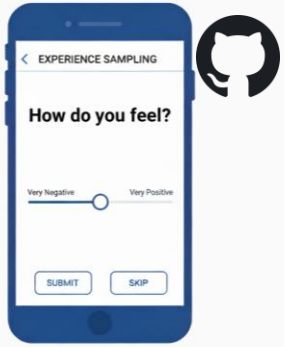
51.51

observations per person

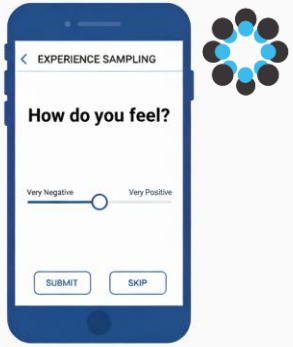
What if we could use data from multiple studies?



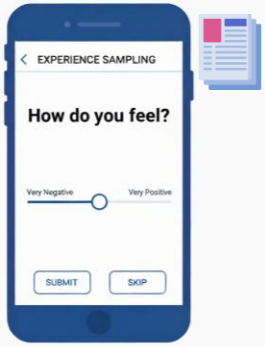
N = 150
Affect



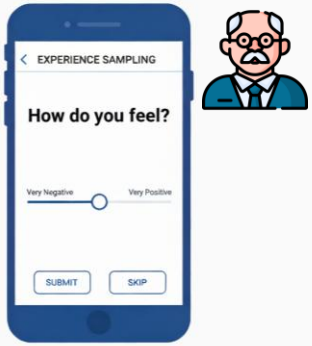
N = 79
Personality



N = 243
Depression



N = 104
Life Events

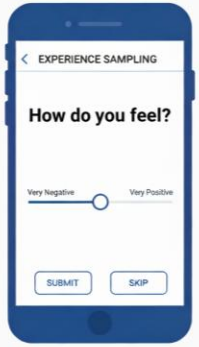


N = 150
Work Stress





N = 150
Affect





N = 79
Personality





N = 243
Depression





N = 104
Life Events





N = 150
Work Stress

Introducing openESM

60 datasets · >16,000 participants · >740,000 observations

Data: At least 20 individuals, 20 time points, 2 self-report items

and packages for easier access



Substantive Research

Test theories across contexts



Design Research

Improve measurement choices

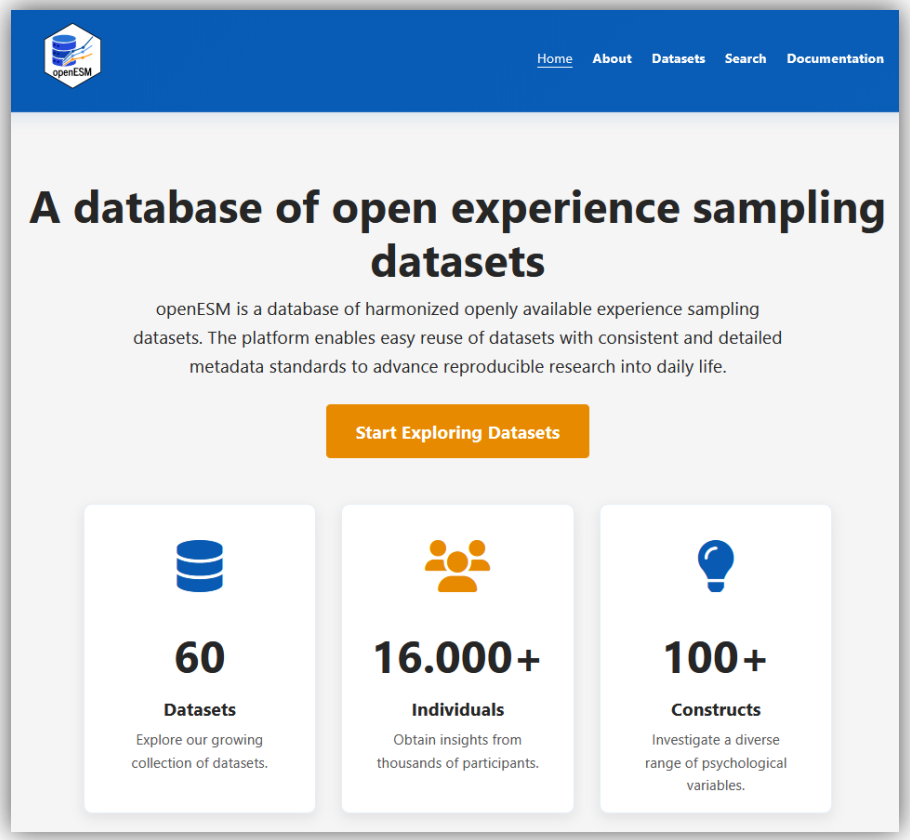


Statistical Methods

Benchmark and develop methods

Logos: R & Python Software Foundations

Live Demo


openESM
Home
About
Datasets
Search
Documentation
A database of open experience sampling datasets
openESM is a database of harmonized openly available experience sampling datasets. The platform enables easy reuse of datasets with consistent and detailed metadata standards to advance reproducible research into daily life.
Start Exploring Datasets
60
Datasets
Explore our growing collection of datasets.
16.000+
Individuals
Obtain insights from thousands of participants.
100+
Constructs
Investigate a diverse range of psychological variables.

Live Demo



```r
# install and load package
install.packages("openesm")
library(openesm)

# get overview over data
list_datasets()

# download specific datasets
df_lists <- get_dataset(c("0001", "0004"))

# get citation
cite(df_lists[[1]])

# get additional notes
notes(df_lists[[1]])
```



```python
# install and load package
pip install openesm
import openesm

# get overview over data
openesm.list_datasets()

# download specific datasets
df_lists = openesm.get_dataset(["0001",
"0004"])

# citation for first dataset
df_list["0001"].cite()

# additional notes
df_list["0001"].notes()
```

Design Process



1. Cleaning

Harmonized NAs, removed redundant columns

E.g., standardized ID, beep, day



2. Harmonization

Same variable names for same questions

E.g., "depressed" across datasets

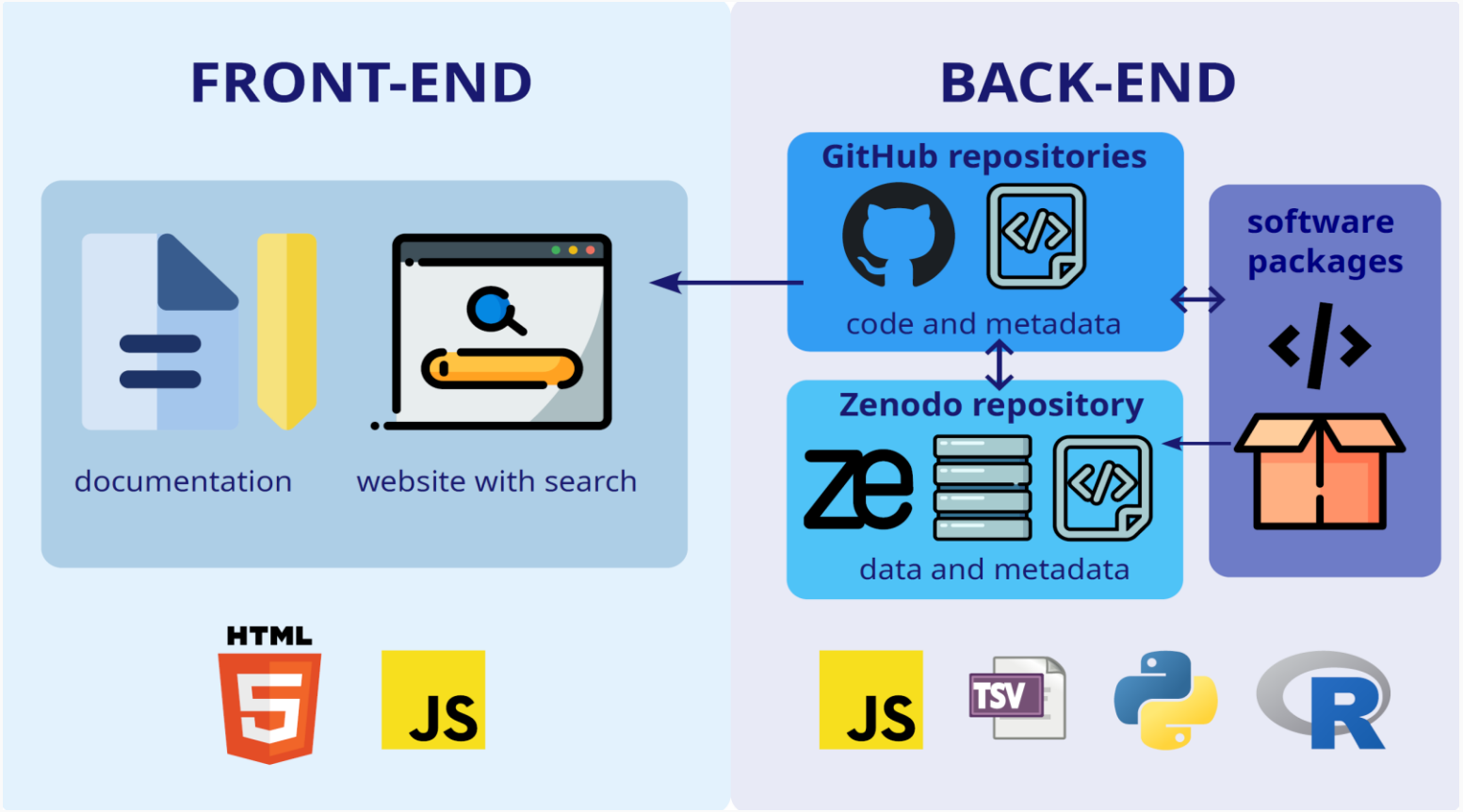


3. Annotation

Hierarchical construct tags for each item

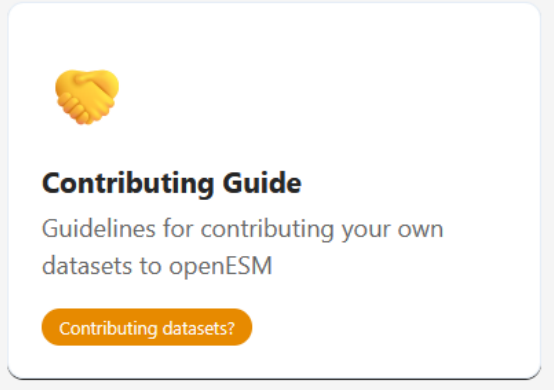
E.g., "angry" → anger, negative affect, affect

Architecture

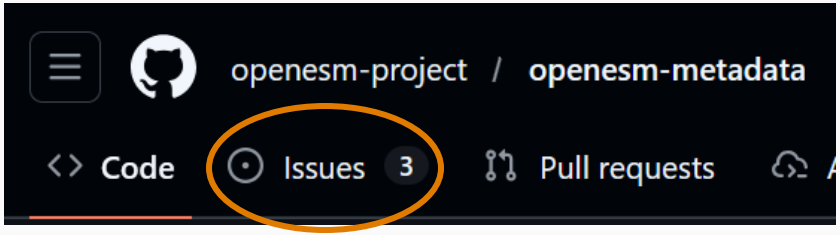


Contributing Data

1. Read Contributing Guide



2. Open GitHub Issue

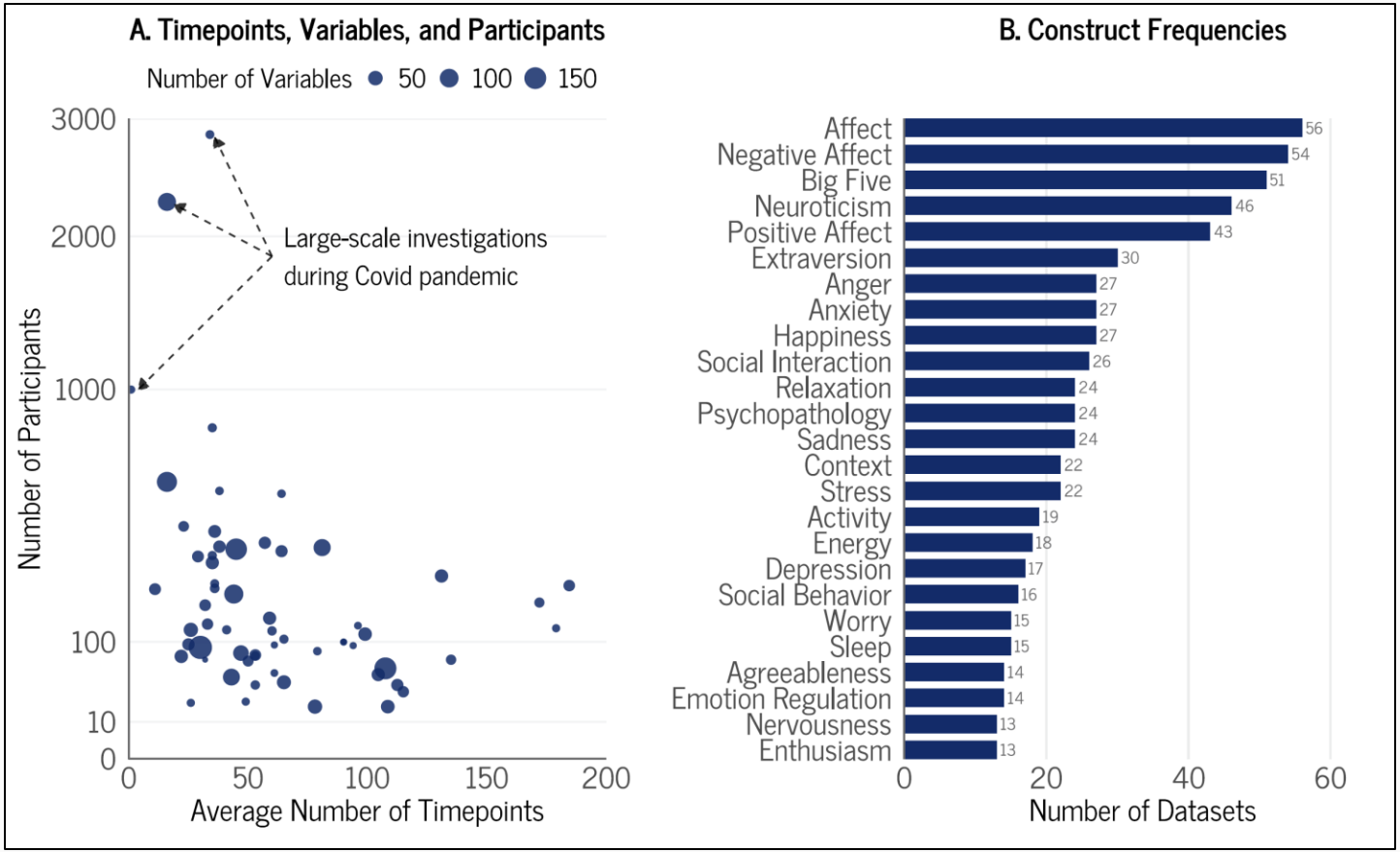


Example:

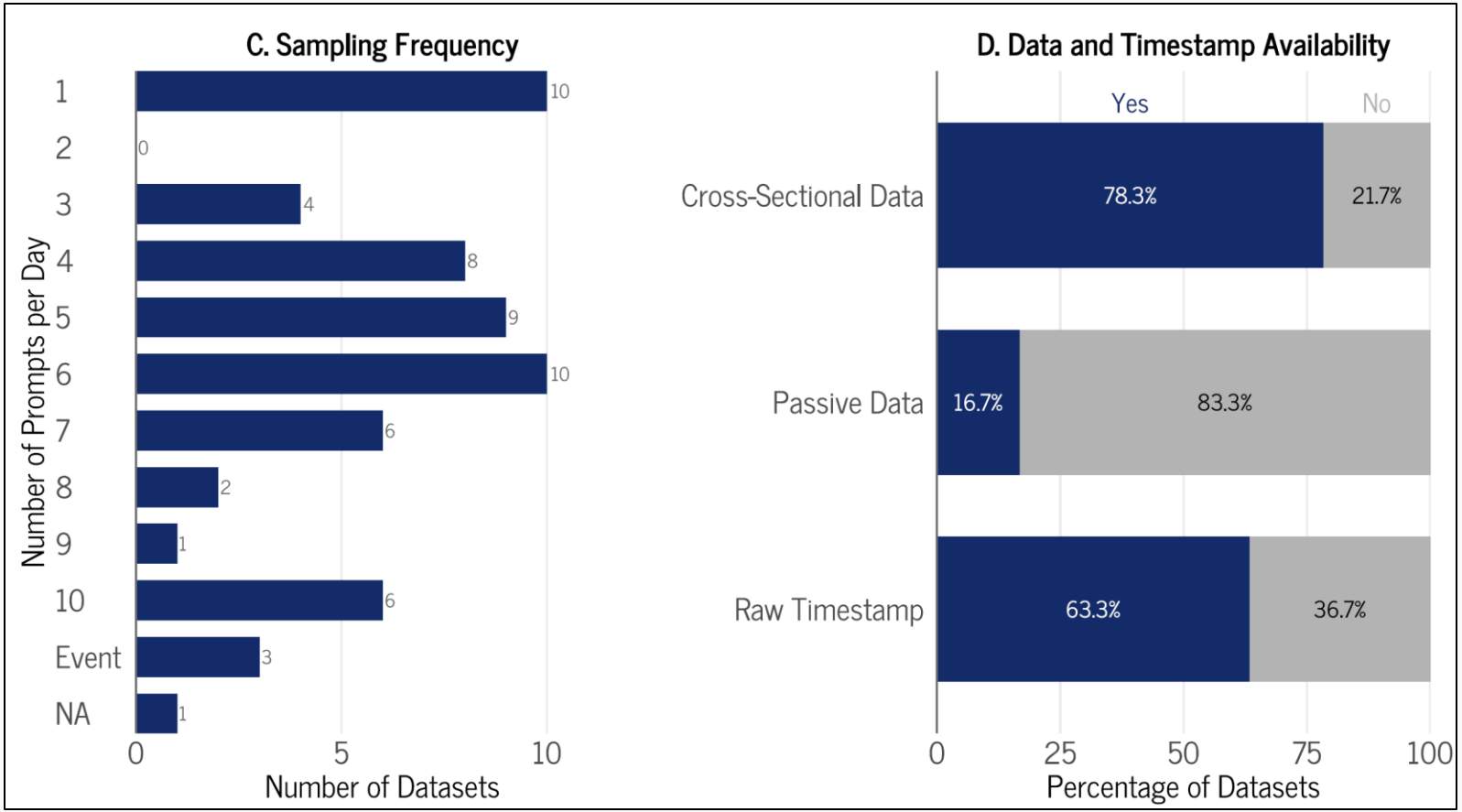
Proposal to Contribute 30-Day Gaming and Well-Being Daily Diary Dataset (n=443 with 20+ completions) #2

Open

What's inside



What's inside



Example Analysis

RESEARCH QUESTION

Does high positive affect co-occur with low negative affect within persons?



DATA

39 datasets · 8,456 individuals · ~529K observations



HETEROGENEITY

How strongly do participants differ?
How much does the effect vary across samples?



ANALYSIS

Within-person momentary correlations: multi-level meta-analysis quantifying effect size and between-person / between-sample heterogeneity
Additional sensitivity analyses

Meta-Analysis with ESM

Idea:

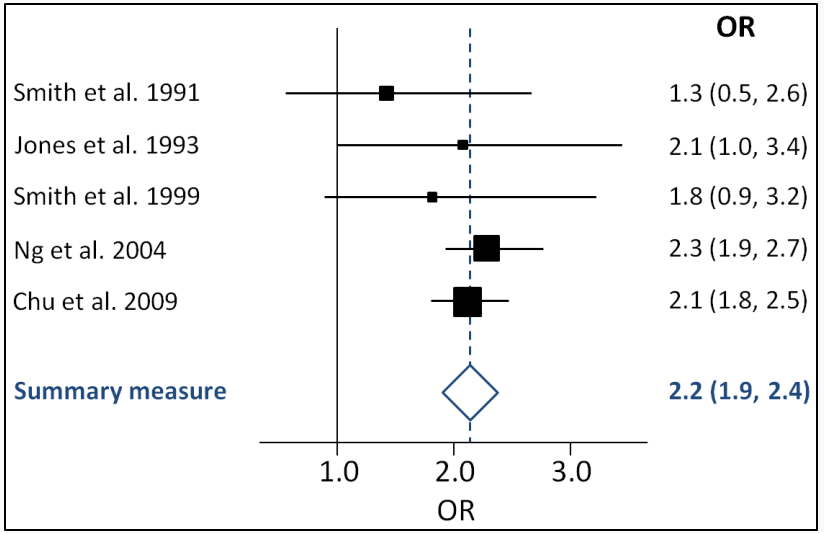
Quantitative synthesis of effects across multiple studies

Effects:

- Typical: Cohen's *d*, SMD, correlations, regression coefficients, odds ratios,...
- ESM: Correlations, regression coefficients (per person, per dataset)

Multilevel:

- Typical: Multiple outcomes per study
- ESM: Each participant has their own effect



Forest Plot: Gellier (CC-BY SA 3.0)

Example Analysis – Live Illustration

```r
meta_model <- metafor::rma.mv(
  # correlations
  yi = effect_sizes$yi,
  # variances of the correlations
  V = effect_sizes$vi,
  data = effect_sizes,
  # nesting structure
  random = ~ 1 | dataset_id/id,
  method = "REML",
  # naming convention
  slab = author_year_unique,
  # speed-up
  sparse = TRUE
)
```

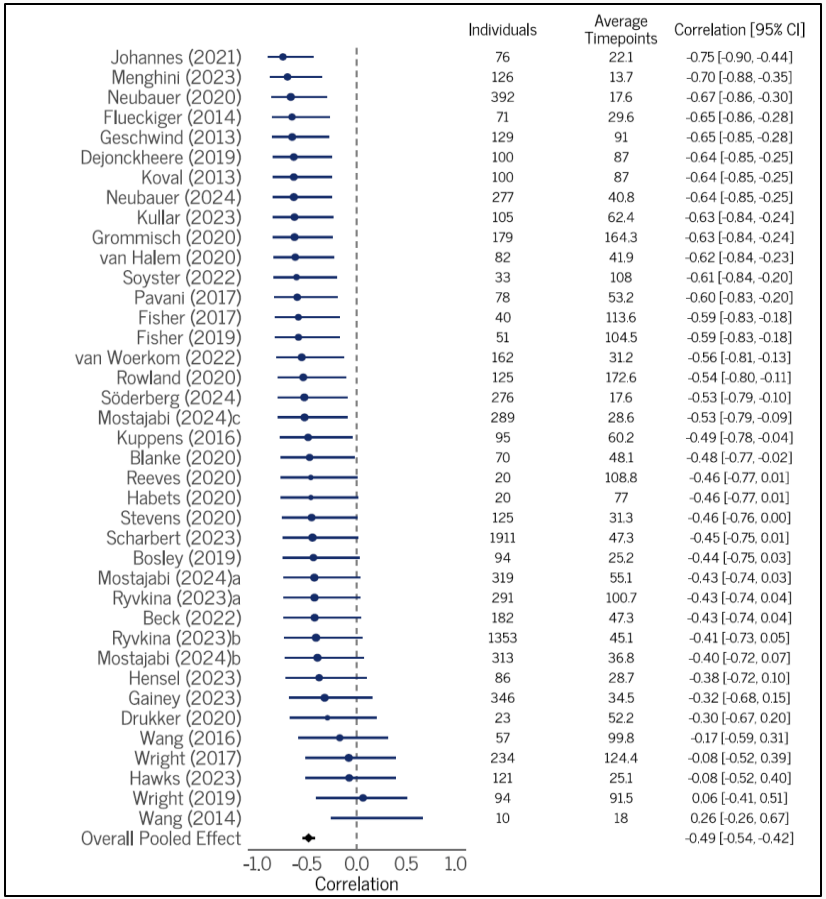
Example Analysis

Pooled r = -0.49
[95% CI: -0.54, -0.42]

- Considerable heterogeneity across participants and samples

More prompts/day → stronger negative correlation

Stable across 12 preprocessing and modeling choices



Next Steps



Community

Involve researchers, expand data diversity



Data & Metadata

Extend coverage and documentation



Software

Add benchmarking and filtering tools

Goal: Turn openESM into a continuously evolving community resource for cumulative ESM research

Collaborators



Anabel Büchner



Eiko Fried



Yong Zhang



Matthias Kloft



Daniel Heck



Jonas Haslbeck

Thank You!

https://openesmdata.org

bjoernsiepe+openesm@gmail.com

https://bsiepe.github.io

bsiepe.bsky.social

Slides & Preprint

References

Hamaker, E. L. (2012). Why researchers should think "within-person": A paradigmatic rationale. In M. R. Mehl & T. S. Conner (Eds.), Handbook of research methods for studying daily life (pp. 43–61). The Guilford Press.

Harrer, M., Cuijpers, P., Furukawa, T.A., & Ebert, D.D. (2021). Doing Meta-Analysis with R: A Hands-On Guide. Boca Raton, FL and London: Chapman & Hall/CRC Press. ISBN 978-0-367-61007-4.

Molenaar, P. C. (2004). A manifesto on psychology as idiographic science: Bringing the person back into scientific psychology, this time forever. Measurement, 2(4), 201-218. https://doi.org/10.1207/s15366359mea0204_1

Mondragón-González, S.L., Burguière, E., N'diaye, K. (2023). Mobile Devices, Connected Objects, and Sensors. In: Colliot, O. (eds) Machine Learning for Brain Disorders. Neuromethods, vol 197. Humana, New York, NY. https://doi.org/10.1007/978-1-0716-3195-9_12

Wrzus, C., & Neubauer, A. B. (2023). Ecological Momentary Assessment: A Meta-Analysis on Designs, Samples, and Compliance Across Research Fields. Assessment, 30(3), 825-846. https://doi.org/10.1177/10731911211067538

Resources

- All icons either from PowerPoint or fontawesome
  - https://fontawesome.com/icons/bluesky
- Python Software Foundation. (n.d.). *The Python logo*. https://www.python.org/community/logos/ (PSF Trademark Policy)
- R Foundation for Statistical Computing. (2016). *R logo*. https://www.r-project.org/logo/ (CC-BY SA 4.0)
- Von James Grellier – Own Work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=10253357
- Carbon (https://carbon.now.sh/) for pretty code screenshots