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Collecting and Analyzing Smartphone (Survey) Data using the GESIS AppKit

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Julian Kohne, Mareike Wieland & Maximilian Haag

31. März 2025 | Workshop @ GOR Berlin

Introduction Round

Who are you?

- Your name
- Your role / background
- You experiences in mobile methods, smartphones as research tools, intensive-longitudinal data collections (like experience sampling method, momentary assessments), …
- Your main interest for today: Are you more team “I would like to know the big picture” or rather team “I have a specific project in mind and want to get started right away?”

About today

At the end of the workshop, you will have …

- An overview of mobile research designs
- Know for which designs you can use the GESIS AppKit
- Tested the GESIS AppKit for a research question of your choice, i.e.
  - got an account,
  - set up a project,
  - created questionnaires,
  - defined survey schedules ,
  - and gained an insight into the processing of the data.

Agenda & Schedule

13:30 – 13:45		Welcome & Intro
13:45 – 14:05		Setting the scene: Smartphones as research tool
14:05– 14:15		Introducing the GESIS AppKit
14:15 – 14:30		Developing your project / GESIS AppKit use case
14:30 – 14:45		Coffee Break
14:45 – 15:00		Live-Demo: How to use the GESIS AppKit
15:00 – 15:40		Implementing your project / today’s use case
15:40 – 15:50		Short Break
15:50 – 16:20		Working with GESIS AppKit data
16:20 – 16:30		Recap & Outlook

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Setting the Scene: Smartphones as Research Tool

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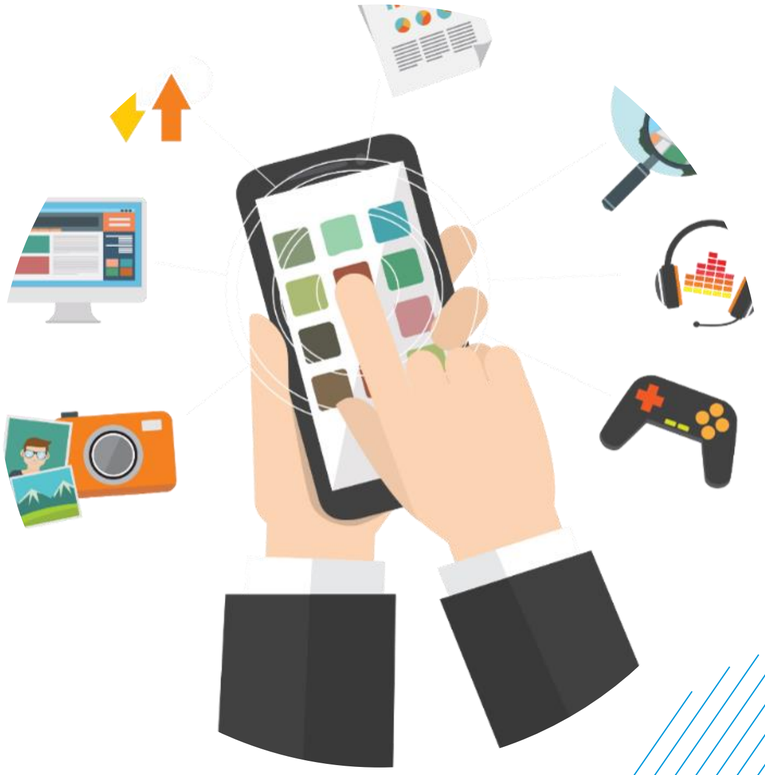
The Smartphone in the Social Sciences



Tool and data source

- Ubiquitous and personal companion in everyday life, “at hand” at almost every timepoint
- A large variety of use cases
  - Media usage
  - Interpersonal communication
  - Life organisation
  - Mobility
  - Images
  - Health

→ Subject of research and **research tool**!

The Smartphone in the Social Sciences

The Smartphone Psychology Manifesto

Perspectives on Psychological Science
7(3) 221–237

DOI: 10.1177/1745691612441215
http://pps.sagepub.com
SAGE

Geoffrey Miller
University of New Mexico, Albuquerque

Abstract

By 2025, when most of today's psychology undergraduates will be in their mid-30s, more than 5 billion people on our planet will be using ultra-broadband, sensor-rich smartphones far beyond the abilities of today's iPhones, Androids, and Blackberries. Although smartphones were not designed for psychological research, they can collect vast amounts of ecologically valid data, easily and quickly, from large global samples. If participants download the right "psych apps," smartphones can record where they are, what they are doing, and what they can see and hear and can run interactive surveys, tests, and experiments through touch screens and wireless connections to nearby screens, headsets, biosensors, and other peripherals. This article reviews previous behavioral research using mobile electronic devices, outlines what smartphones can do now and will be able to do in the near future, explains how a smartphone study could work practically given current technology (e.g., in studying ovulatory cycle effects on women's sexuality), discusses some limitations and challenges of smartphone research, and compares smartphones to other research methods. Smartphone research will require new skills in app development and data analysis and will raise tough new ethical issues, but smartphones could transform psychology even more profoundly than PCs and brain imaging did.

Keywords

mobile computing, telecommunications, digital sensors, GPS/GIS, behavioral informatics, human subjects/IRB issues

Data sources and research paradigms

Self-reports

- Mobile surveys
- Intensive-longitudinal surveys

Observations

- Mobile tracking
- Mobile sensing

Mobile self-reports (I)

Another mode for surveys

- High availability and prevalence
- **Sampling potentials**:
  - Hard-to-reach audiences (z. B. Sugie, 2018)
  - *Mobile only* (e.g., global south) or *Mobile first*
  - „Single Touchpoint“ for surveys
- Easy **data input**:
  - Using camera, taking screeshots, scan functions
  - Capturing audio data

Mobile self-reports (II)

Intensive longitudinal survey designs

- => Experience sampling, ecological momentary assessment, ambulatory assessment, diary style studies
- Intensive survey designs with several questionnaires per day, usually after push-notification
- The design is old, but took off with the dissemination of smartphones (Csikszentmihalyi & Larson, 2014)

→ From looking at stable differences between people to

→ ...fast-moving, intrapersonal dynamics

Intensive-longitudinal *survey* designs

The trait-paradigm

- The distinction between traits and states, situational and personality variables goes back to ancient Greece
- However, the investigation of trait-like, cross-situationally stable concepts was prevalent in all social sciences, especially public opinion research
  - (Political) attitudes, interest, efficacy, trust (in institutions), media trust
  - Big Five
  - Values

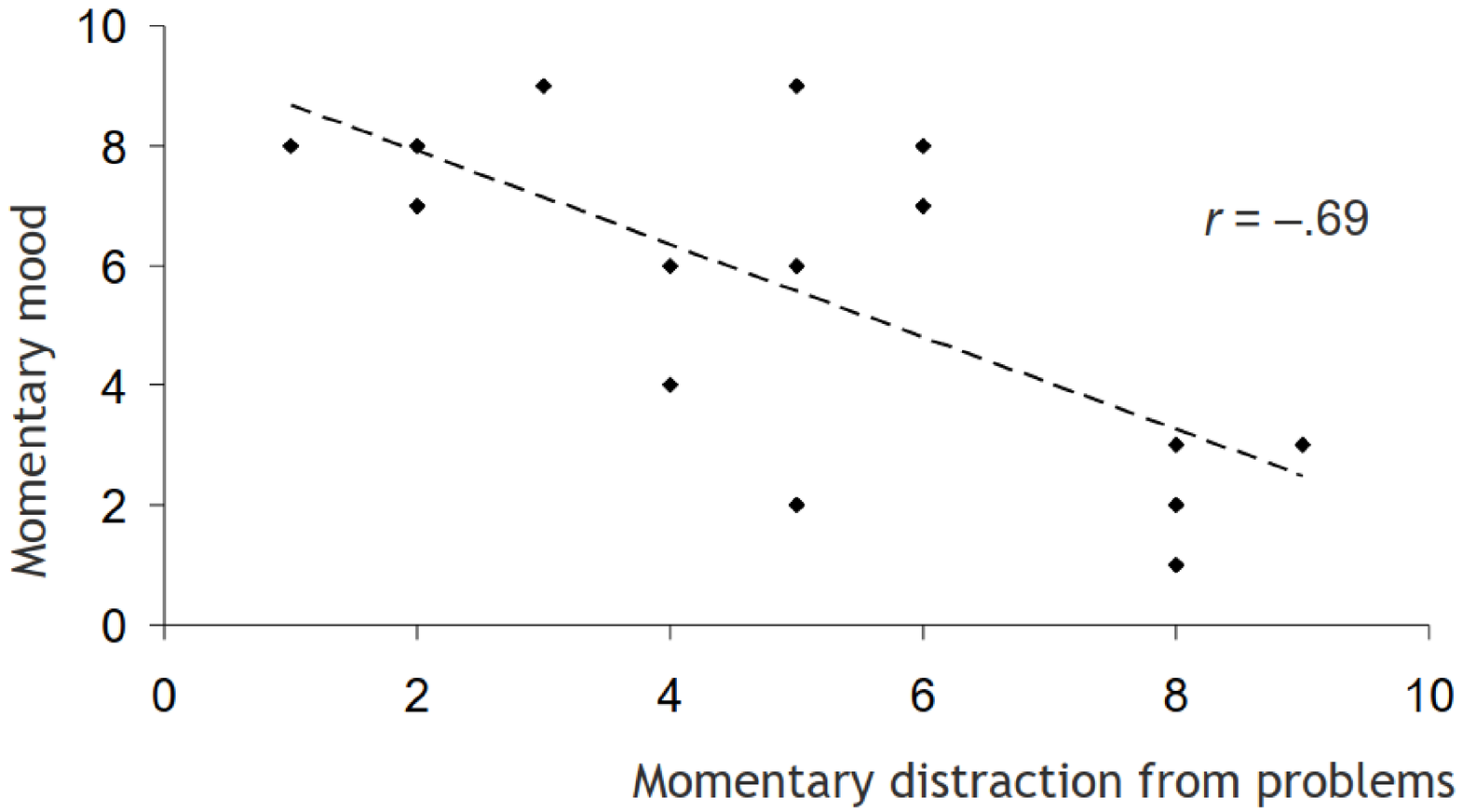
  → **Often low correlation with behaviour**

State variables and the situational vacuum

- State, dynamic variables
  - Mood, emotion, well-being
  - Attention, elaboration, information processing
  - Evaluations and perceptions of political candidates, parties, minorities
  - Salience of topics
  - Immediate reactions to media, media usage, interpersonal communication, family/social conflicts
  - (Habitual) behaviour

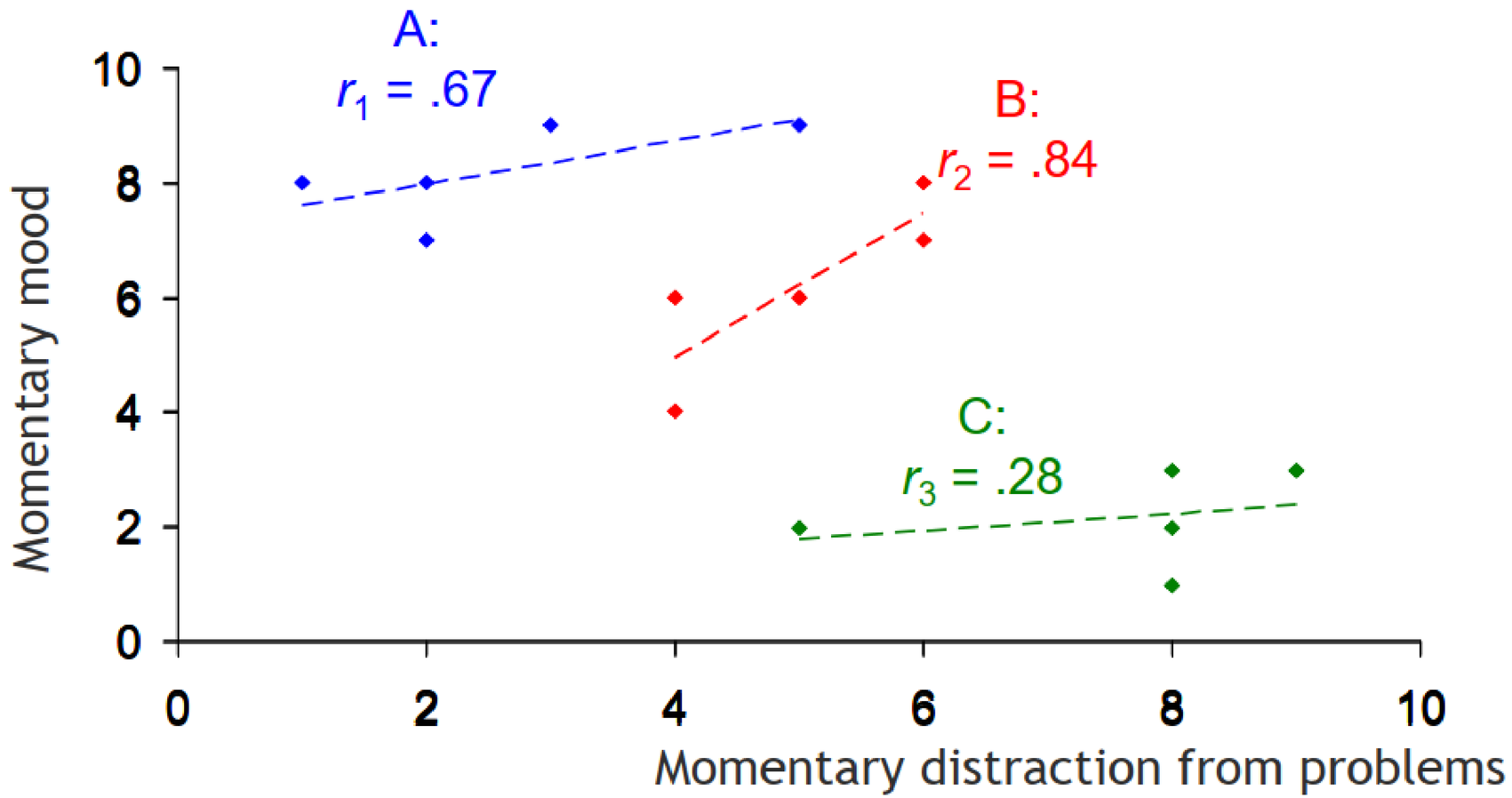
  → **Many of these variables cannot be measured with usual, retrospective survey designs!**

Within- und between-person Prozesse



Otto et al., 2019; Thomas et al., 2021, 2022

Within- und between-person processes



→ intensive longitudinal survey designs - via smartphone

Otto et al., 2019; Thomas et al., 2021, 2022

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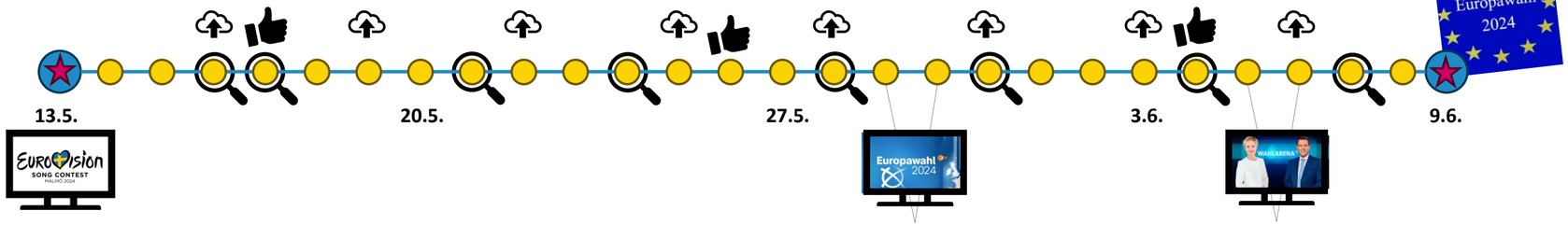
Study Example: Extensive mobile surveys

GESIS SMART

- Download the app from **Playstore** (iOS) or an apk-file and install on Smartphone (Android)
- **Login** via study code
- **Push-notification** when new questionnaires available



- Intro questionnaire after first login / exit questionnaire
- Daily questionnaire at fixed time
- Focus questionnaires (8x, fixed date and time)
- Image upload (repeating every 3rd day, starting day after signup, random time)
- Evaluation (3x, fixed date and time)
- TV events (5x, fixed date and time)

→ In total max. 52 surveys (*N*=7269; Range: 0-50 ; *M*=27, *SD*=13; Median: 34) over 4 weeks

Data sources and research paradigms

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- Intensive-longitudinal surveys

Observations

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- Mobile sensing

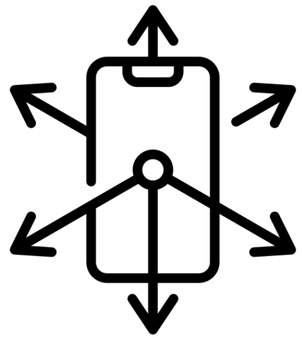
Mobile digital behavioral data

Mobile tracking/logging

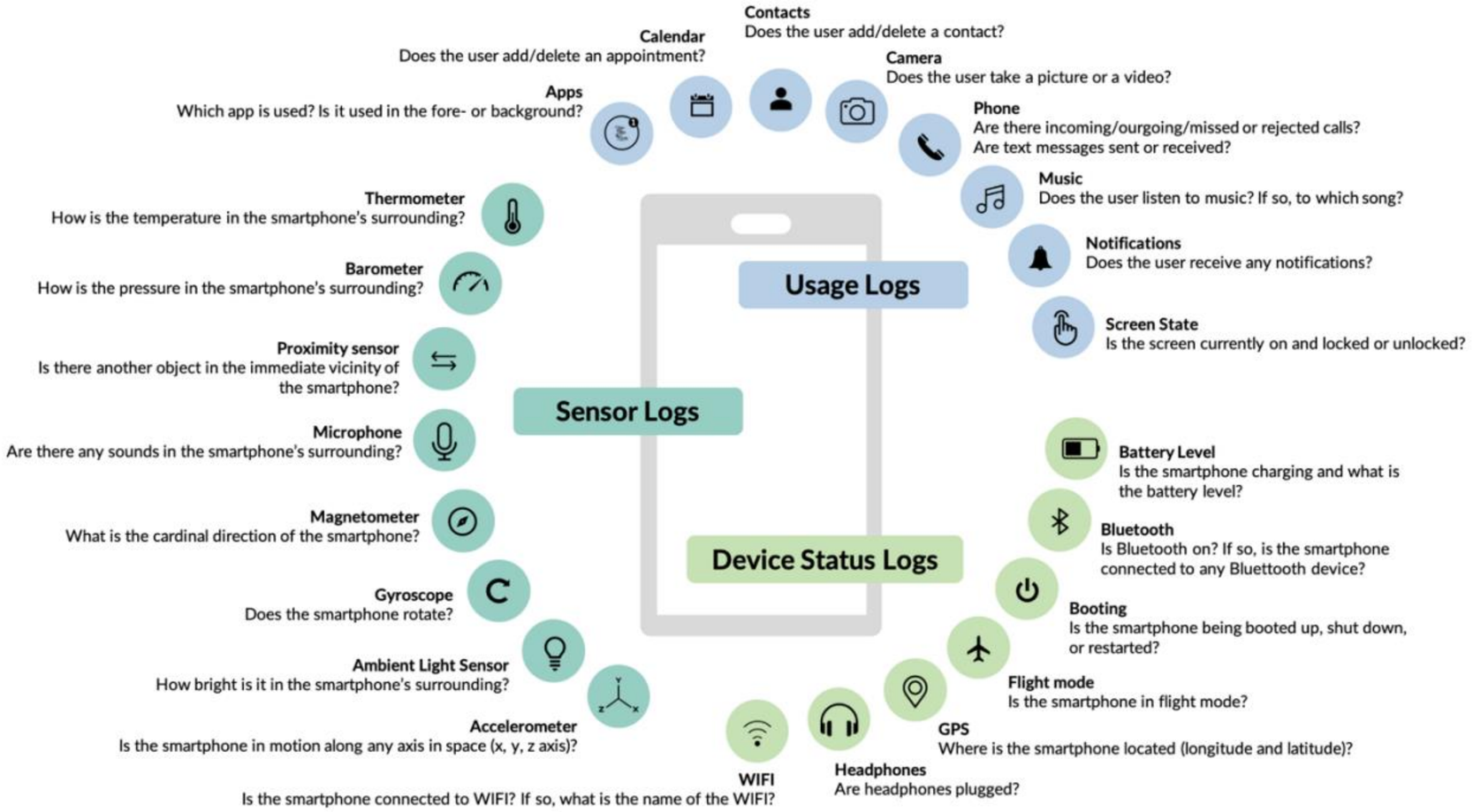
- Capturing information on and from the device itself
- E.g. device usage, app usage, battery levels
- E.g. in-app tracking: capturing the content and behaviours on the phone and in apps

Mobile sensing

- Uses sensors such as the accelerometer, thermometer, camera, to cover information *outside* of the device
- Location, Mobility, Acceleration & Orientation, Light, Temperature, Proximity, etc.
- Wearables and health sensors: Steps, movement, heart rate, sleep



Types of mobile digital behavioral data



Schoedel & Mehl (2023). Mobile Sensing Methods.

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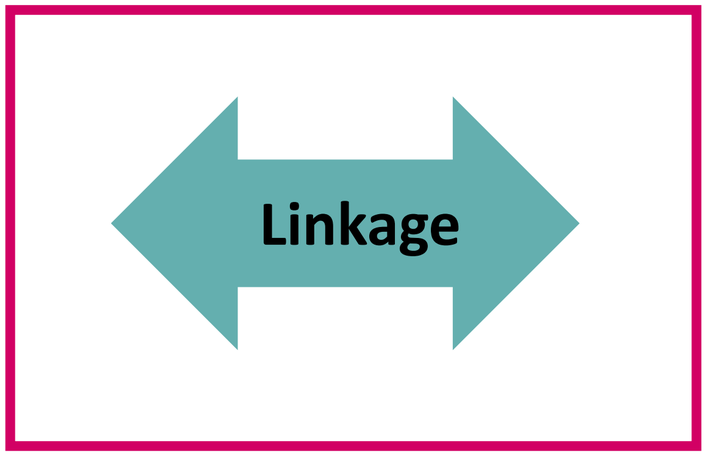
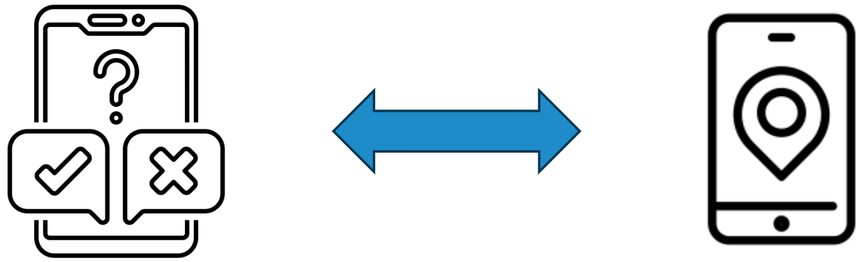


Linking mobile behavioral data and surveys

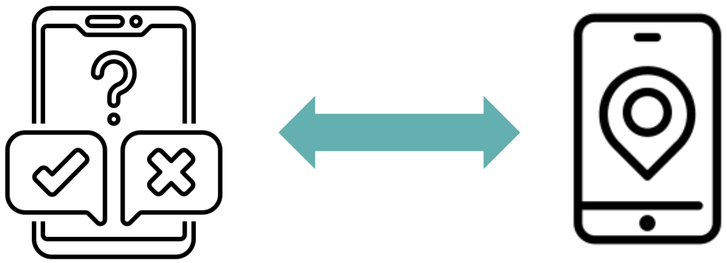
Parallel measurement, ex-post linkage

- Capturing digital behavioral data and survey data in parallel provides a valuable source for the Social Sciences (Stier et al., 2021)
- Mobile DBD provides passive measures of variables that are hard to remember (exact routes during the day) or come with a high burden
- Surveys can be used to capture demographics, personality variables, attitudes etc.

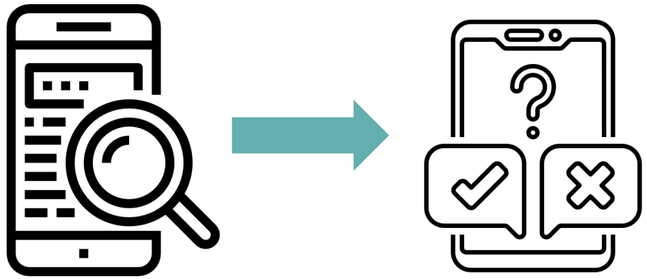


→ **Mobile surveys and (mobile) digital behavioral data are a „match-made-in heaven“**

Outlook: From linkage to integration



Parallel
measurement
+
subsequent
linkage



Concurrent
measurement
+
in-the-moment
integration

Recognizing and recording events

Manual event logging: Participants are instructed to recognize an event and actively enter it in the app when it occurs.

Randomized survey prompts: Surveys are sent out at random times. If the event occurred within a defined period, further questions about the event are asked.

Automated event detection + survey triggering: An event is technically detected and a survey is then automatically triggered.

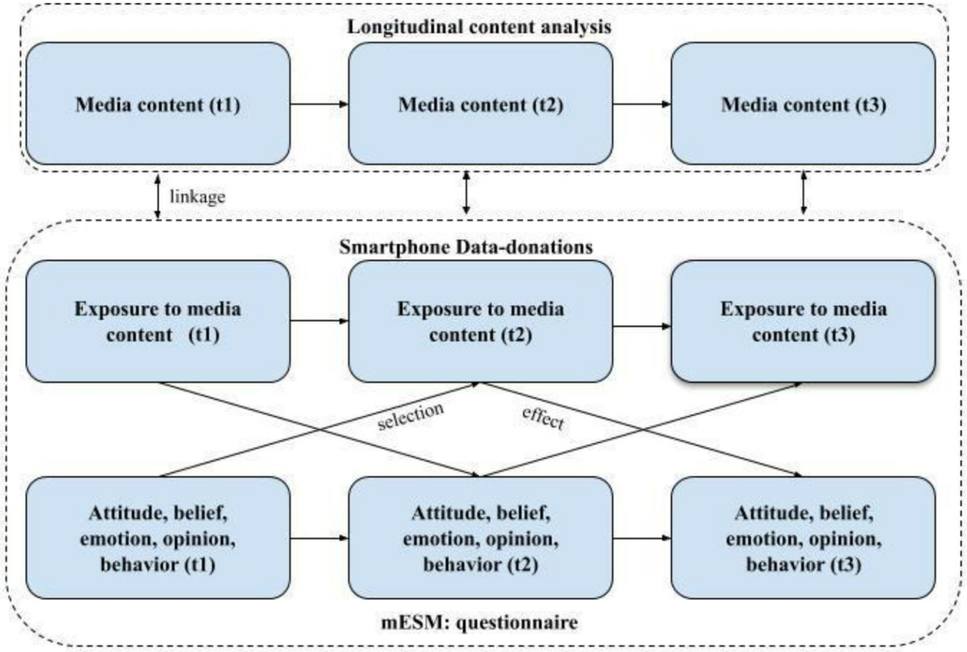
Manual Event Logging

Mobile Intensive Longitudinal Linkage Analysis (MILLA)

- **Event:** Exposure to news item
- **Event logging** takes place depending on participants' perception

Combines:

- Smartphone data donations (-> media content)
- with mobile experience sampling (-> immediate reactions to the content)
- with follow-up content analysis (-> media effects)



(Otto et al., 2021)

Linking on a situational level, but: Self-selection of events!

Randomized Survey Prompts

Sex differences in emotions

Event: social interaction

Event logging: after survey prompt, logging if a social interaction took place within 2 hours before the survey prompt

TABLE 2
Sex Differences in Momentary Emotion Ratings

	Main Effect (b_{01} from eqn 2)			*Average Effect* (b_{10} from eqn 5)			*Sex of Participant × Sex of Partner* (b_{11} from eqn 2)				
	Sex of Participant			*Sex of Partner*			*Male Participants*		*Female Participants*		
	M	*F*	*P*	*M*	*F*	*P*	*M*	*F*	*M*	*F*	*P*
Specific Emotions											
Happy	3.20	3.22	n.s.	3.20	3.26	n.s.	3.07	3.39	3.32	3.14	.001
Sad	1.47	1.57	n.s.	1.56	1.50	n.s.	1.45	1.51	1.67	1.49	.05
Nervous	1.69	1.61	n.s.	1.71	1.61	.10	1.69	1.72	1.73	1.51	.05
Surprised	2.29	2.39	n.s.	2.38	2.33	n.s.	2.22	2.40	2.55	2.36	.01
Angry	1.54	1.45	n.s.	1.55	1.45	.05	1.55	1.53	1.56	1.37	.10
Embarrassed	1.42	1.23	.07	1.33	1.32	n.s.	1.39	1.46	1.28	1.17	.05
Ashamed	1.29	1.14	.10	1.24	1.19	.10	1.29	1.29	1.20	1.10	.07
General Ratings											
Intensity	3.18	3.48	.02	3.38	3.40	n.s.	3.04	3.47	3.72	3.33	.001
Expression	2.87	3.33	.001	3.09	3.23	.07	2.71	3.18	3.47	3.29	.001

Note: M = male; F = female. Analyses reported for sex of participant are main effects (sex of participant was the only predictor in the regression model). Analyses reported for sex of partner are not main effects, but are the effects for the average individual (in regression equations with interaction terms in which the predictor variables have been centered, the lower-order regression coefficients are not main effects, but instead represent the effect of the predictor on the criterion at the mean of the other predictor variable).

Barrett et al., 1998

Linking on a situational level

Reduced delay between event and self-report

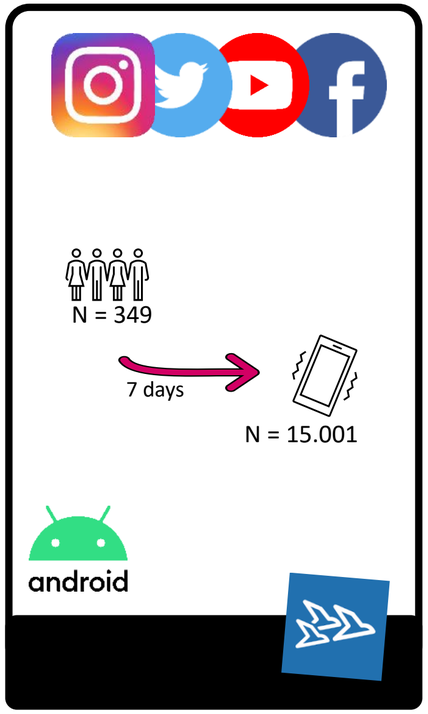
Reduced self-selection bias

Automated event detection and survey triggering

Mobile Experience Sampling
- Event-based triggering
- One week in March 2021

In-situ survey when a social media app
- has been closed
- has been used at least 15sec

Next in-situ survey
- max. 3 in 4 hours
- at least 30min “cool down”



Sample

- German speaking social media users (18 – 54y.)
- Online Access Panel (quota-based)
- Men and higher educatio und höher Gebildete leicht überrepräsentiert
- Android only (!)

+ Linkage in-situ
+ No self-selection bias in event sampling
- Complex design decisions with many trade-offs
- Technically demanding

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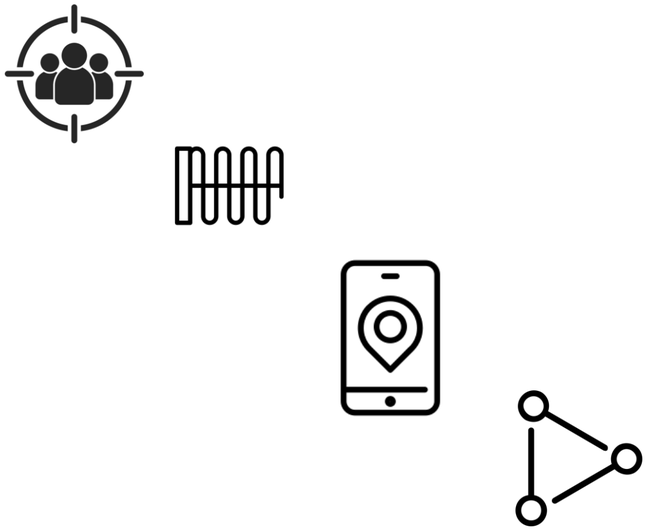
Short Summary

The manifold use cases for smartphones in the social sciences



- Mode for survey taking
- Intensive-longitudinal survey designs
  - Situational, state-like variables, immediate reactions, within-person processes
- Mobile tracking and sensing
  - Parallel linkage of (mobile) DBD and (mobile) surveys
  - In-the-moment integration

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Introducing the GESIS AppKit

A mobile infrastructure for social science research

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GESIS AppKit: A Service with two pillars

Research Software

- The GESIS AppKit is a research software comprising:
  - A web interface for administering the studies
  - Mobile apps to be installed by study participants for data collection
- Researchers
  - receive their own account (Terms of Use)
  - are responsible for data processing and authorize GESIS to process personal data (AVV)
- Use is free of charge for non-commercial research

Community Hub

The GESIS AppKit is a service for the research community

- We offer training on the tool and methodological trainings
- We advise on study design (for a fee if necessary)
- We provide a central point of contact for researchers working on these topics to exchange findings on methodology and data quality
- We evaluate needs and pool resources to contribute to sustainable research software development in the field

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Mission statement

We aim at making smartphones as research tool accessible!

- **Fine-grained data collection**: The GESIS AppKit enables researchers to use smartphones for both active (self-reports) and passive (digital traces, sensor data) data collection at high granularity
- **Low technical threshold:** No programming skills or advanced technical knowledge (e.g., server management) required
- **Researcher independence**: Researchers have full autonomy over study design, content, and sample management.
- Software aligns with **open-source principles**:
  - Available as SaaS [and for on-premise installation]
  - Supports independent extensions and development
  - Community actively involved in development processes

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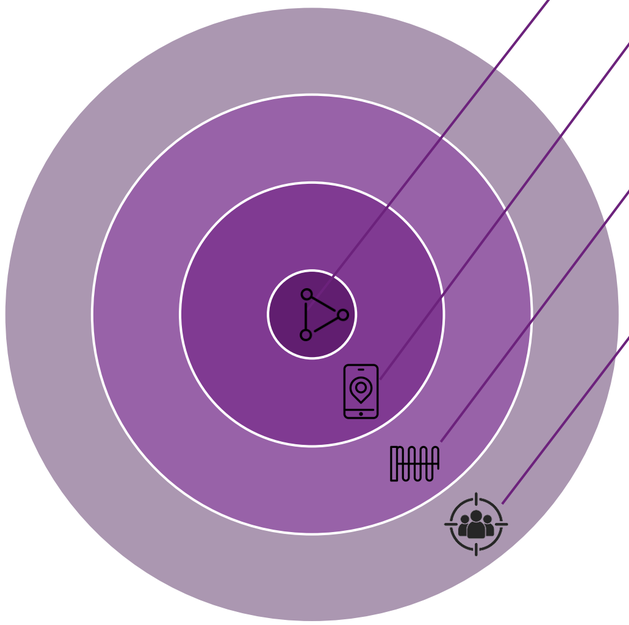
Current status and future developments



Integrated DBD and self-reports

Mobile logging/sensing (passive collection, DBD)

Intensive longitudinal designs (active collection, self-reports)

Mobile surveys

✓ Future music — e.g., Scrolling newsfeeds study

✓ To be implemented in 2025

✓ Ready to use — e.g., Emotionality study

✓ Ready to use — e.g., European Elections study

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Web Interface “GESIS AppKit”

Create surveys

Different item types
Simple survey flow
Bundling of items

Schedule surveys

Define complex time-based schedules
or push now
Send group-wise or to all participants

Generate login codes

General codes
Personal codes

Monitor participants

Keep an eye on who signed up

Setting up the project

Customize appearance, In-app texts
Provide privacy related information

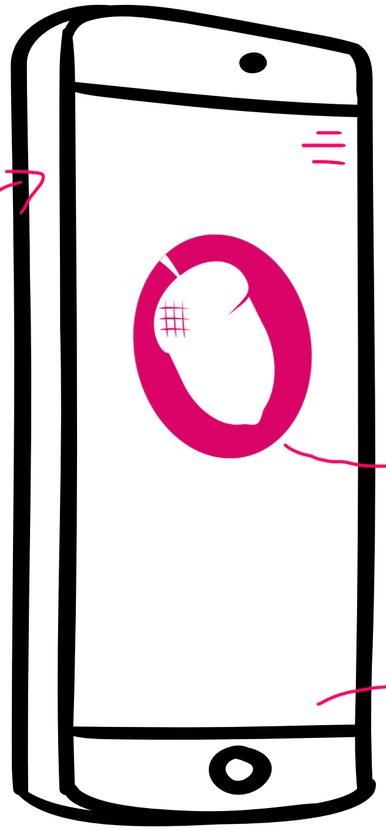
Export data

Mobile App “GESIS SMART”

GET IT ON Google Play

Download on the App Store

- Install the app



- Sign into a project via login code
- Give informed consent

- See your app ID
  Select language
  Log out

- Receive surveys via central inbox
  Get notified if new survey is available
  Answer surveys in the app

- Learn more about the app and the research project (and who is responsible for data processing)

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Develop your own project

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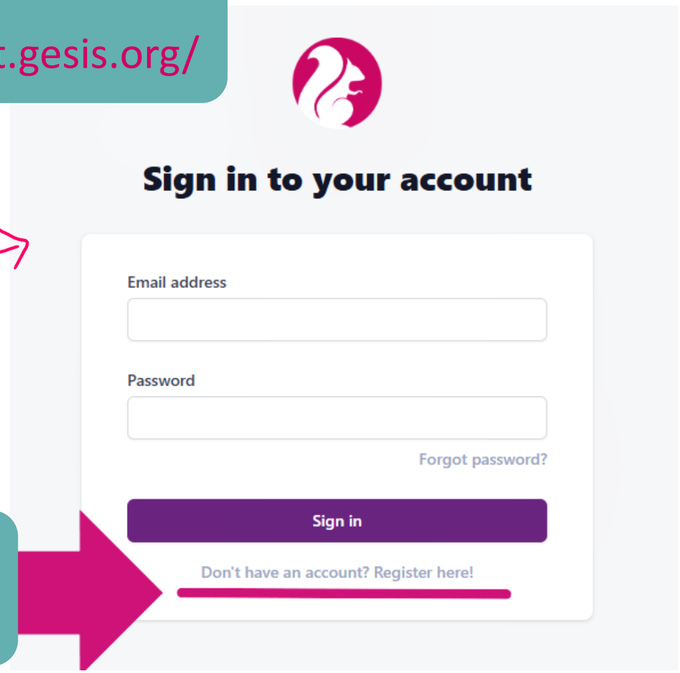
What to do within the next 15 minutes:

Define your use case

- Clear and simple research question
- Think about 3 to 4 survey questions
- Initial ideas for the design (single or repeated surveys, linking to event?)

Get your own account!

Go to
https://admin.appkit.gesis.org/



Register as a user

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Showcase: GESIS AppKit Tool Demo

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Implementing your project

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What to do within the next 60 minutes:

Log in

- Confirm registration
- Set your own password
- Go to https://admin.appkit.gesis.org/
- Log in ☺

Set up study

- Fill in in-app texts and privacy information
- Create survey items
- Schedule your survey(s)
- Create login code(s)
- Download GESIS SMART app from store
- Test your study

GESIS AppKit manual
https://www.gesis.org/gesis-appkit/ressources

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Working with GESIS AppKit data

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Recap & Outlook

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Outlook

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Stay informed

- We're constantly developing new features and updating the AppKit
- To stay informed, you can subscribe to our mailing list:

https://lists.gesis.org/mailman/listinfo/gesis-appkit

Get involved

- Do you need new features that are not on our feature list?
- Become a cooperation partner with a joint third-party project

https://www.gesis.org/en/gesis-appkit/about-appkit/cooperations

Get Support

- Do you want to implement a complex ESM study and need support in study design, data processing, or analysis?
- GESIS offers support as a service, either as consulting or through joint projects

https://www.gesis.org/beratung/beratung-zu-digitalen-verhaltensdaten

Check our other Services

- Are you interested in other data types such as surveys, webtracking, webscraping or API-harvesting?
- GESIS offers a wide range of services for survey data and digital behavioral data

https://www.gesis.org/institut/ueber-uns/digitale-verhaltensdaten

Thank your for choosing GESIS AppKit today

Team GESIS AppKit

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