

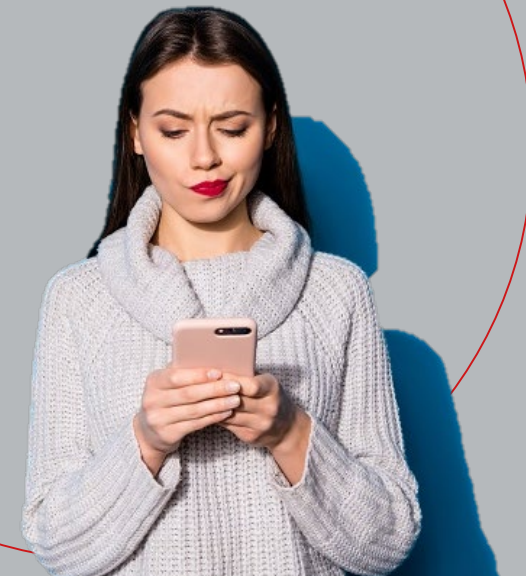
## Strengthen Digital Sovereignty of Smartphone Users:

### Evaluation Results of a Tailored Analysis Tool for App Behavior

Open Identity Summit 2024, June 21<sup>st</sup>

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## PANDERAM project

The project aimed to **strengthen users' sovereignty and choices** when using **smartphones and smartphone apps**. To this end, the actual **handling** of their own **data was made visible and assessable**. At the same time, users **were provided with alternatives and options**, enabling them to improve their own security and data protection.

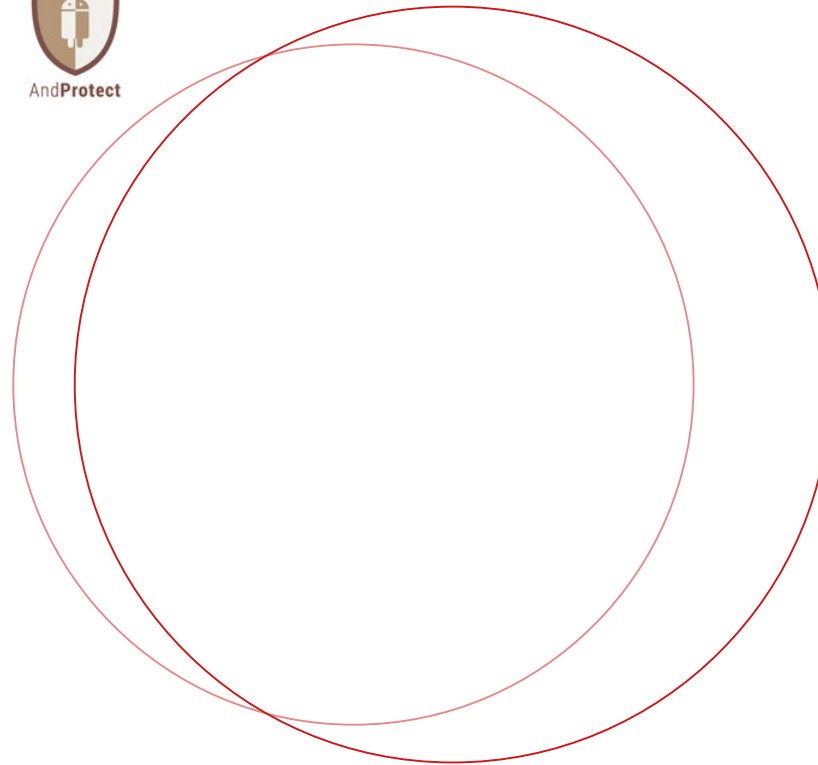


user-centered design and tailoring of a tool

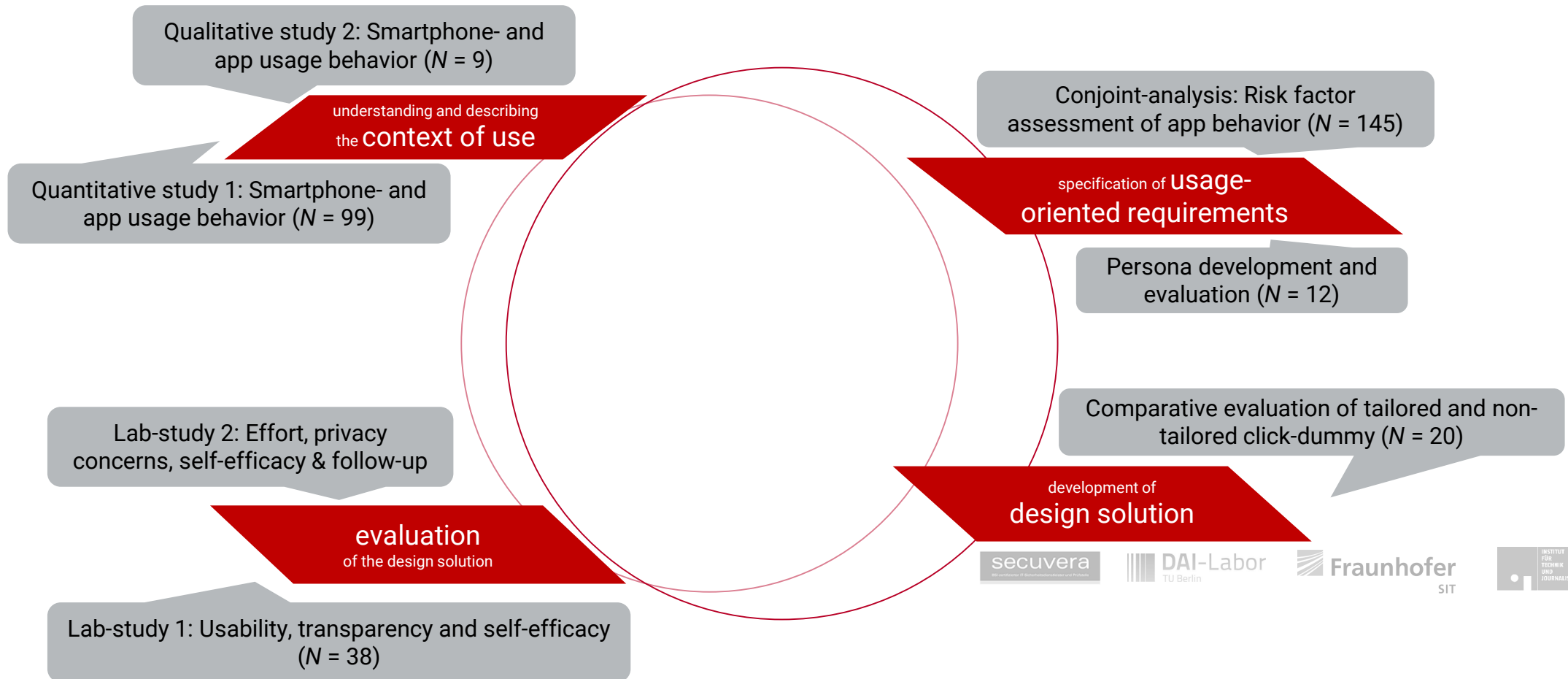
# PANDERAM project: User centered design process

user centered design guidelines for tools that analyze app behavior

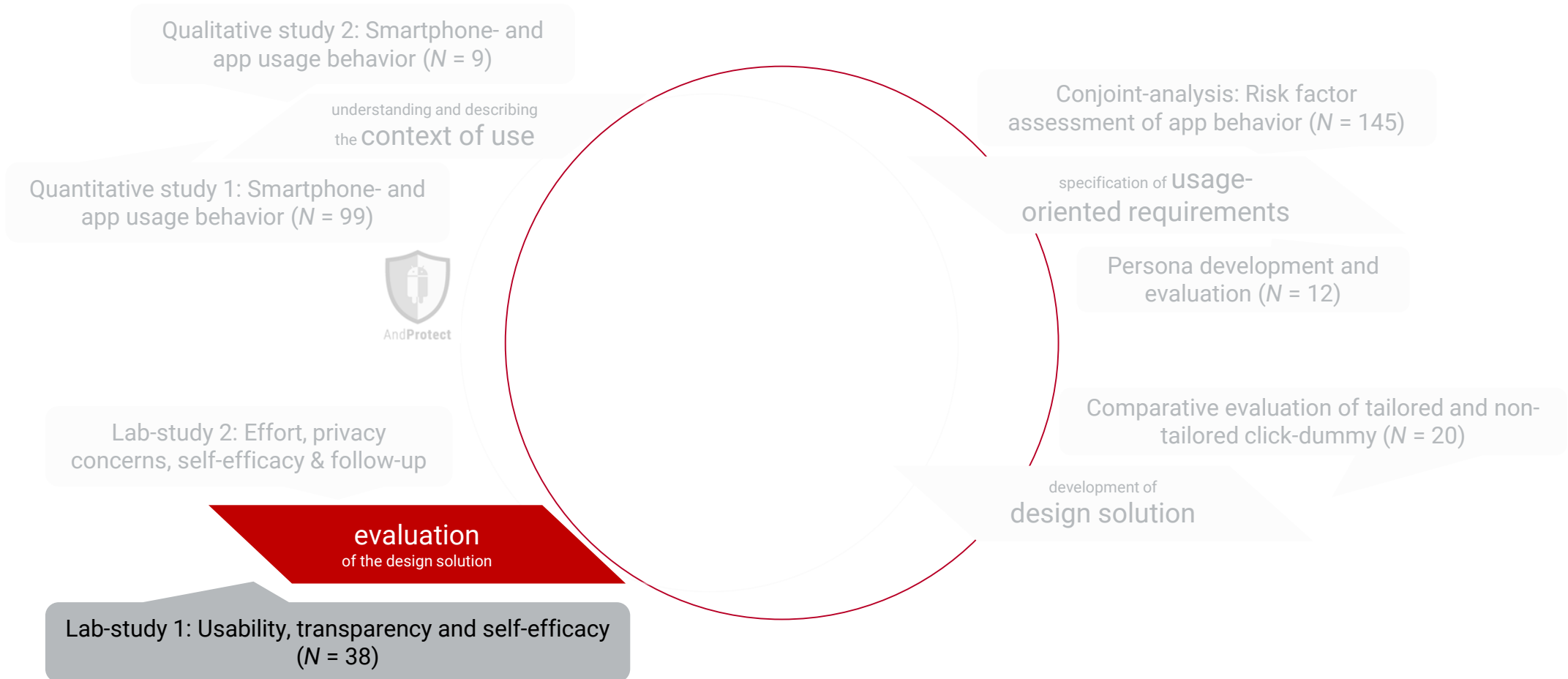
Döbelt, S. et al.: Clearing the Hurdles:  
How to Design Privacy Nudges for Mobile  
Application Users.



# PANDERAM project: User centered design process



# PANDERAM project: User centered design process



## App prototype

### Aim

- Enhance accessibility of information about app behavior (third parties, data access and permissions, data transfer, coding)
- Comprehensible risk assessment to encourage privacy prevention
- Offer options for action
  - Tailoring for different behavioral stages

### Implementation

- Consolidated results of static and dynamic analyses



- Numerical and colored risk score with explanation



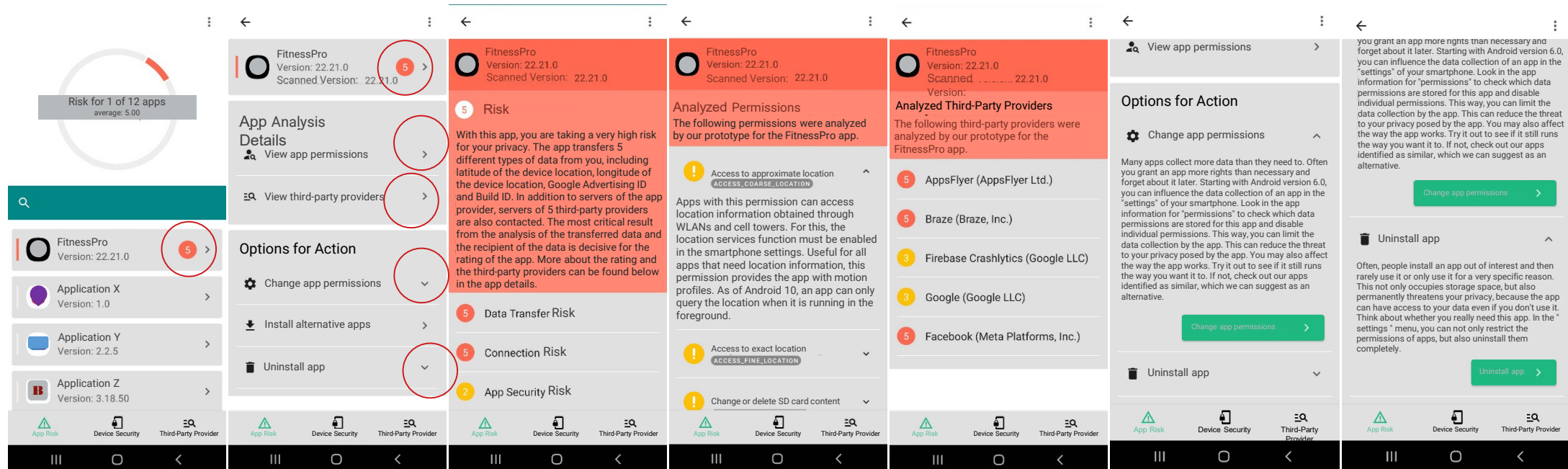
- Display of granted permissions and options to change them or uninstall apps, listing of app alternatives



- Different text descriptions for options for action focusing either on describing the problem itself or the possible effects of alternative settings

# App prototype

## User interface



## Research questions & hypotheses for the prototype

RQ1: How usable and transparent is it?

H1: The prototype is evaluated as above-average usable and transparent.

RQ2: Can it increase self-efficacy regarding data protection and privacy preservation of smartphone app users?

H2: Self-efficacy regarding data protection and privacy preservation is higher after interaction with the prototype than before.

exploratory RQ3: On which aspects of UX does the congruent tailoring to the behavioral stage have a positive impact?



## Study design

Independent variables:

- H1 Interaction with our prototype (“intervention”)
- H2 Time of measurement (before T1 and after T2 the “intervention”)
- RQ3 Behavioral congruent and incongruent condition

Dependent variables:

- H1 Usability (SUS; Brooke, 1996; Rummel et al., 2013) & transparency (SIPAS; Schrills et al., 2021) evaluation
- H2 Repeated self-assessment of self-efficacy (SWE; Schwarzer & Jerusalem, 2003)
- RQ3 User experience ratings (UEQ; Laugwitz et al., 2008)

## Sample

$N = 38$  (26 female)

- 24 years old ( $M = 23.95$ ;  $SD = 5.03$ ; min = 18.00, max = 41.00)
- Majority (92%) third semester students, of which are psychology (69%) students
- Less tech-savvy but more smartphone affine than comparison samples

Yes, it is a student-sample...  
And yes, this sample limits the  
external validity.

But, everything that lowers external increases internal validity.

Probability, that existing effects will be detected, increases.

Also, the rather large sample size (in terms of usability tests) limits the probability of undetected issues.

# Procedure

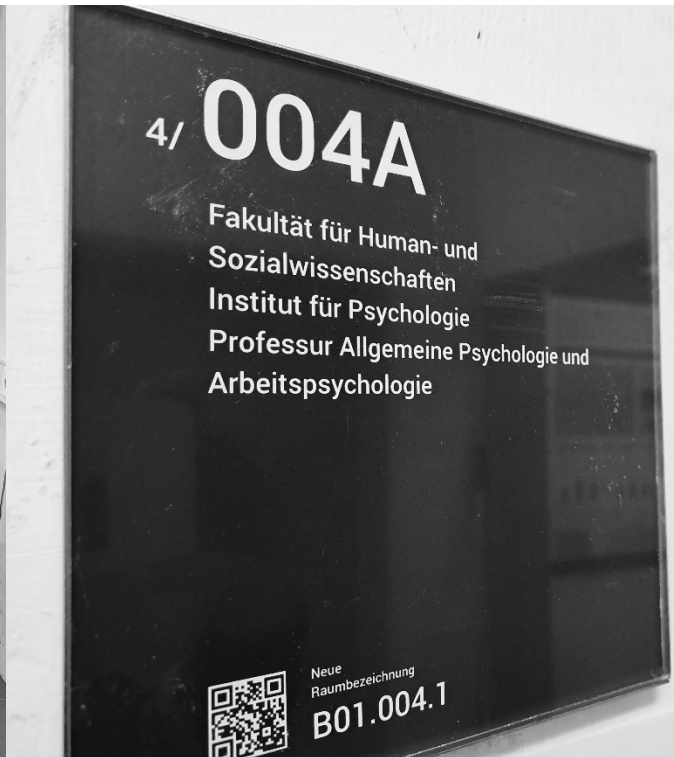
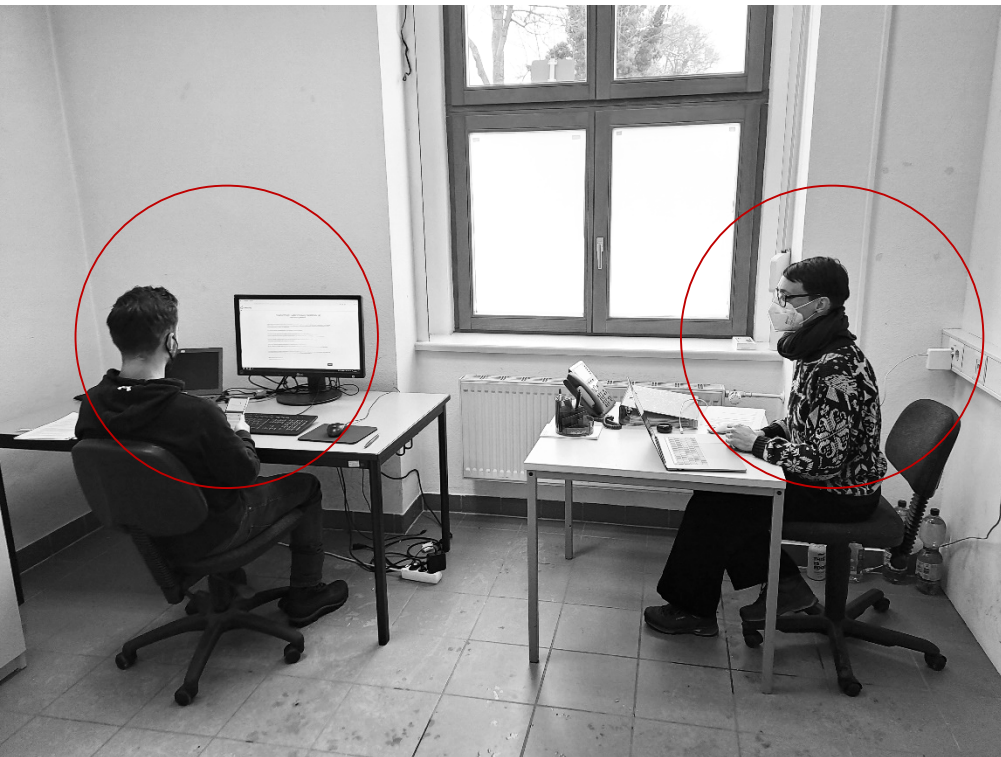
## Recruitment of participants

- Announced goal of the study: app evaluation
- Remuneration: test subject hours or raffle for recruitment questionnaire, cash or test subject hours for lab test
- Channels: off- and online (mailing lists, professorship website, chat-groups, posters, call in lectures)
- Via online questionnaire (13min) including demographics, smartphone usage and behavioral stage



## Procedure

Conducted face-to-face in our lab at the end of 2022,  
under pandemic-related restrictions





## Procedure

Welcome (consent, demographics, experimenter consultation possible, no uninstallations, prototype not fully developed yet)

T1 (H2)

Self-efficacy

10min

Free exploration of the prototype

Task 1 (5min)

Inform yourself about the app *FitnessPro* with the help of the prototype.

Task 2 (5min)

Take action using the prototype to minimize the risk of the app *FitnessPro*.

H1/RQ3

Evaluation of usability and user experience

T2 (H2)

Self-efficacy

...

# Results

RQ1: How usable and transparent is it?

H1: The prototype is evaluated as above-average usable and transparent.

**Usability evaluation proptotype:**  
SUS-Score ( $N = 38$ )

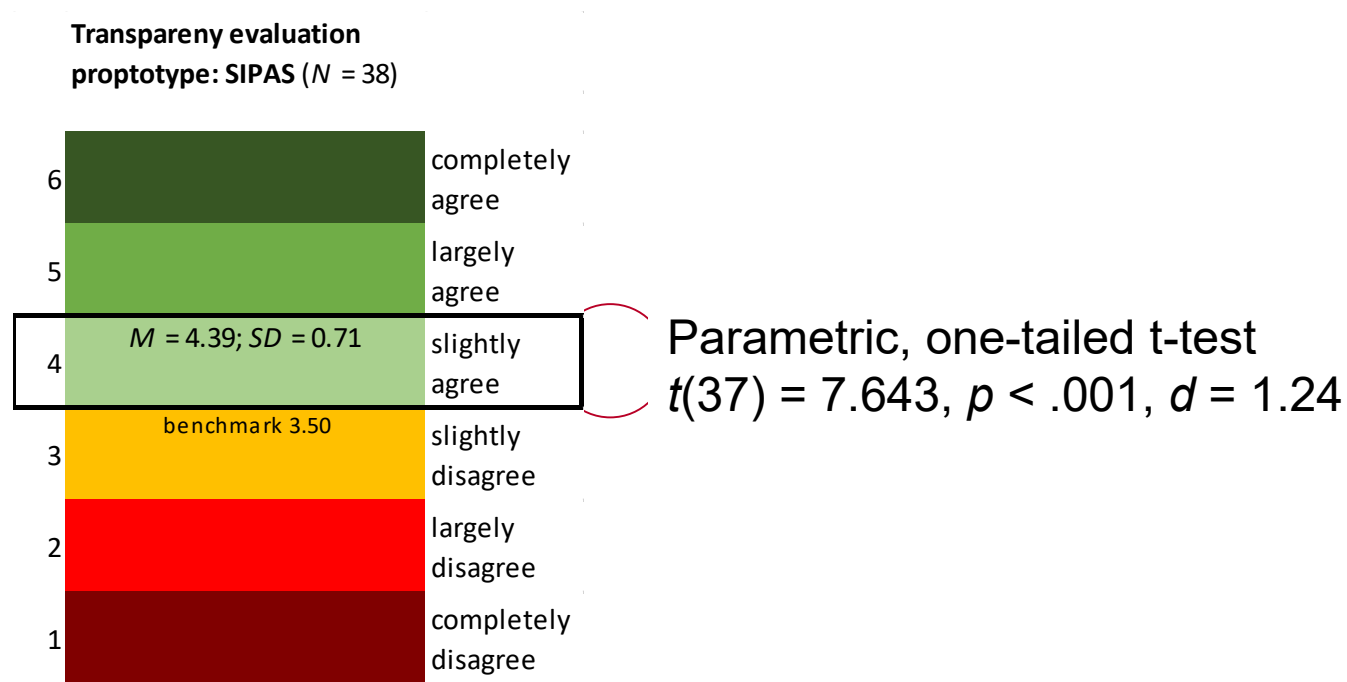
A+	100 - 84		best
A	84-81		excellent
A-	81-79	$M = 80.00; SD = 13.9$	
B+	79-77		
B+	77-74		
B-	74-73		
C+	73-71		good
C	71-65	benchmark 68.00	
C-	65-63		
D	63-52		ok
F	52-25		poor
F-	25-0		worst

Nonparametric, one-tailed Wilcoxon-test  
 $Ws = 660.00, z = 4.02, p < .001, d = 1.86.$

# Results

RQ1: How usable and transparent is it?

H1: The prototype is evaluated as above-average usable and transparent.



## Results

very good

quite transparent

RQ1: **How usable and transparent is it?**

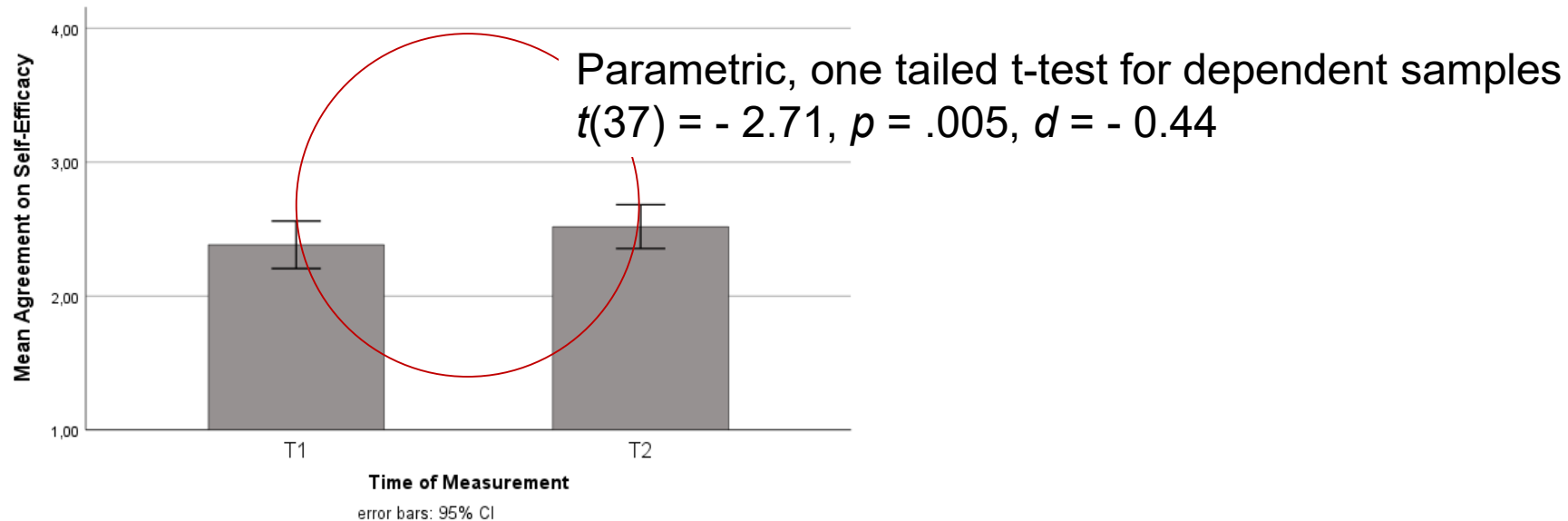
H1: The prototype is evaluated as above-average usable and transparent.



# Results

RQ2: Can it increase self-efficacy regarding data protection and privacy preservation of smartphone app users?

H2: Self-efficacy regarding data protection and privacy preservation is higher after interaction with the prototype than before.



## Results

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quite transparent

RQ1: How usable and transparent is it?

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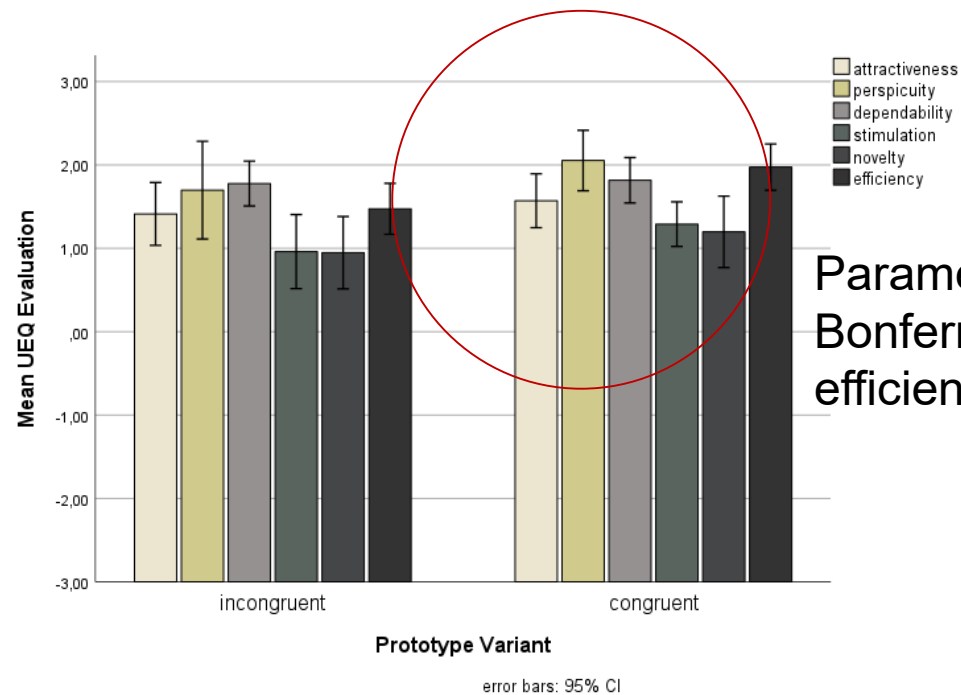
RQ2: Can it increase self-efficacy regarding data protection and privacy preservation of smartphone app users?

H2: Self-efficacy regarding data protection and privacy preservation is higher after interaction with the prototype than before.

Yes, it can!

# Results

exploratory RQ3: On which aspects of UX does the congruent tailoring to the behavioral stage have a positive impact?



Parametric, one tailed t-test for independent samples, Bonferroni corrected  
efficiency:  $t(36) = 2.543, p = .008, d = 0.83$

## Summary

very good

quite transparent

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H2: Self-efficacy regarding data protection and privacy preservation is higher after interaction with the prototype than before.

Yes, it can!

exploratory RQ3: On which aspects of UX does the congruent tailoring to the behavioral stage have a positive impact?

Not that many, but efficiency.

## Summary and discussion

**User centered design pays off.**

Positive biasing possible: prototype status, test situation, predetermined tasks

**We can empower users and increase their digital sovereignty.**

Positive biasing possible: aim of the prototype became apparent during the test

**Tailoring of tools can create additional effects.**

However, more creative ideas are needed here!

## References

- Brooke, J.: SUS: A “Quick and Dirty” Usability Scale. Usability Evaluation. In Industry, 189(194), pp. 4-7. 1996.
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- Schwarzer, R.; Jerusalem, M.: SWE. Skala zur Allgemeinen Selbstwirksamkeitserwartung. In (Leibniz-Institut für Psychologie, ed.): Open Test Archive. Trier: ZPID. 2003.

# Thank you!

Further information:

<https://www.tu-chemnitz.de/hsw/psychologie/professuren/allpsy1/forschungsthemen/AbgeschlosseneProjekte/panderam/index.html.en>

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