GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

PANDERAM

User study “Smartphone and App usage behavior“

Results questionnaire AP 6.1

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Chemnitz, February 2021

secuvera
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INSTITUT FÜR TECHNIK UND JOURNALISMUS

Overview

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Objective(s) of the survey

- **Overview of app and smartphone usage behavior** to derive personas
- Practicable **methodology for behavioral stage identification**
- Identify different **behavior levels** regarding privacy-protective behavior in smartphone app use
- Research question: What **norms and values** are associated with different characteristics of (data privacy) **behavioral stages**? How do individuals with no problem awareness and those with distinct privacy-protecting behaviors differ (extreme group comparison)?

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Organisation

Time schedule

- Conception (10/2020)
- Implementation and testing (11/2020)
- Start: 10.12.2020
- Completion: 07.02.2021

Recruitment

- Sending out via e-mail distribution list of the Institute for Human and Social Sciences of the Chemnitz University of Technology (remuneration: one test person hour for students)
- Sending to project partners with request for forwarding
- News Homepage Professorship General Psychology and Human Factors
- Newsletter Digital Autonomy HUB

https://iconmonstr.com/calendar-4-svg/; https://iconmonstr.com/marketing-27-svg/

Procedure of the survey

- Welcome, objective and process of the survey, consent to voluntary participation, privacy statement.
- Hardware and software definition (number of smartphones, operating system, model, competence)
- App usage behavior (number of installed apps, frequently used apps, frequency and reasons for (de)installations, competence, smartphone "dependency“)
- Behavioral stages (Predecision, Preaction, Action, Postaction)
- Privacy concerns (Internet & mobile)
- Norms and values (self-improvement & -transcendence; short scale to 10 values)
- Demographics (age, gender, educational attainment, employment status, affinity for technology)
- Willingness to participate in follow-up examination (query requirements), dismissal
    - In case of willingness: separate link with contact options

Data preparation and analysis

- N = 102 questionnaires completed in full (and 36 incomplete) by the end of the survey
- Three sets of answers had to be deleted due to nonsensical information (jumble of letters in the free entries, indication of constant values in standardized scales, very short response time to questionnaires)
- Evaluated data set ***N* = 99 participants**
- Quantitative data analysis:
  - Import of the data into SPSS
  - Testing the reliability of individual questionnaire scales
  - Calculation and compilation of descriptive statistics depending on data level (arithmetic mean = *MW*, standard deviation = *SD*, Minimum = Min, Maximum = Max, Median = *Mdn*, absolute frequencies = (X))
  - Testing for normal distribution-> selection of parametric or nonparametric procedures
    - differences in behavioral levels tested unilaterally, because of directional hypotheses
- Qualitative data analysis: citation and, if necessary, indication of the absolute frequencies of the answers

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Preliminary remark

The following results are **not** presented along the survey flow.

Not all questions were **mandatory.** Therefore, the subsamples (n) for some questions may vary. If fewer than 99 participants provided information, this will be explicitly stated.

The survey was conducted during the 2nd Corona Lockdown in Germany. **Time-related influences** (e.g. on the specification of standards and values) can therefore not be excluded.

Results: demographics 1/2

Age: *MW* = 22,77 (*SD* = 5,79; Min = 18,00; Max = 52,00)

Gender: 88 female, 10 male, 1 divers

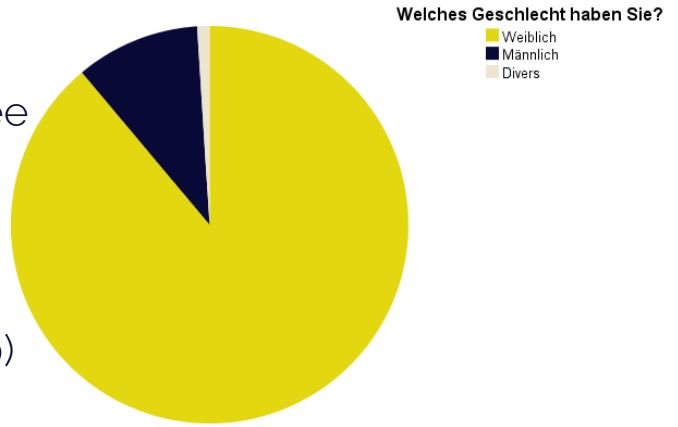
Highest educational qualification: 1. Gymnasium/Abitur (72), 2. University degree (15), 3. completed vocational training(6)

Courses of Study (*n* = 84): 1. Psychology (61), 2. Sensory & Cognitive Psychology (11), 3. Media Communication (6)

Semester (*n* = 85): Bachelor (80); Semester (*n* = 54): *Mdn* = 3,00 (Min = 1,00; Max = 9,00) Master (5); Semester (*n* = 4): *Mdn* = 2,50 (Min = 1,00; Max = 4,00)

Current employment status: 1. Student (87), 2. Employee (10), 3. Job Seeking (1)

Job title (*n* = 10): z.B. „research assistant “ (2), „testing expert “ (1), „geriatric nurse“ (1), „IT spezialist“ (1), „part-time cashier“ (1)



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Results: behavioral stages 1/2

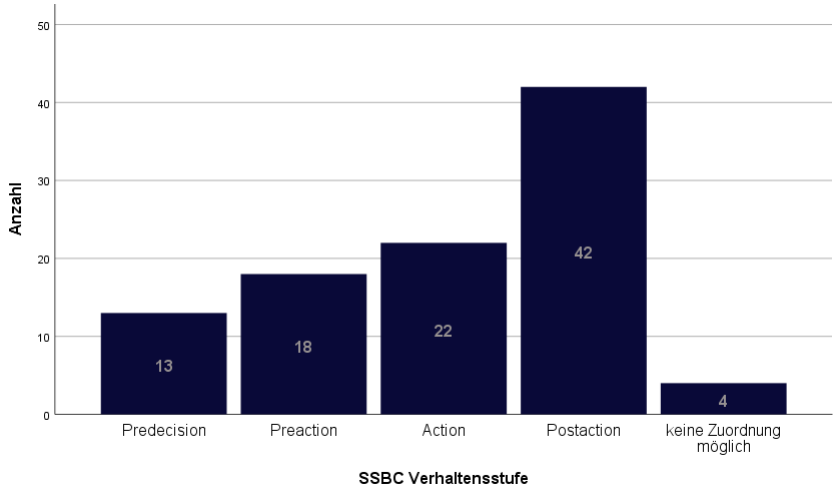
Stage model of self-directed behavior change (SSBC; [1], [2])

„[…] conceptualizing behavioral change as a transition through a time-ordered sequence of four qualitatively different stages: predecisional, preactional, actional, and postactional.” [1]

- 5 adapted statements, two of them form level Predecision, answer format: single choice

Most frequently selected behavior level: Postaction(42)

„ Since I am aware that there are many issues regarding privacy when using mobile apps, I already try to take many actions to protect my data. I will continue to do so or do even more to protect my data in the next months.“



[1] Bamberg, S. (2013a); [2] Bamberg, S. (2013b); https://iconmonstr.com/layer-21-png/

Results: behavioral stages 2/2

Stage model of self-directed behavior change (SSBC; [1], [2])

- Only 4 participants were not able to assign themselves to any behavioral level
- Reasons: "[...] I am rather in between.", "Too little choice [...]" "Because I pay a little attention to data protection, but I don't intend to extend my restrictions in this respect", "The statements are all too extreme“

= Statements too rough for a few participants

[1] Bamberg, S. (2013a); [2] Bamberg, S. (2013b); https://iconmonstr.com/layer-21-png/

Results: demographics 2/2

Affinity for technology interaction (ATI Scale; [3])

*„[…] defined as the tendency to **actively engage in intensive technology interaction**, as a key personal resource for coping with technology.”* [3]

- 9 Statements, 6-point agreement scale (from 1 = "Not at all true" to 6 = "Completely true")

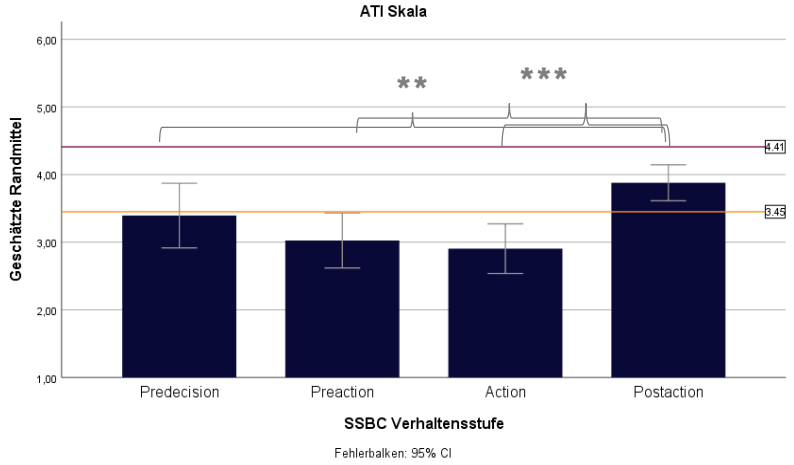
Reliability: α = .913 („*excellent*“)

Normal distribution Total scale: given

Mean agreement: *MW* = 3,45 („*Tends to agree*“; *SD* = 0,97; Min = 1,56; Max = 5,89)

Comparison with norm sample (*N* = 300; *MW* = 4,14): significant (*t*(98) = -7,06; *p* = .000; *r* = 0,58) **less tech-savvy**

Behavioral stage differences: yes,(*F*(3, 91) = 7,57; *p* = .000; *r* = 0,51); Post-hoc (one-sided): Postaction from all others



Summary

Our typical participant…

…is aware that there are many problems regarding data protection when using apps and is taking actions on data protection, intends to continue to do so, or to do more about it.

… cautiously assesses himself/herself as "rather tech-savvy.

… is female, 23 years old and studies.

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Results: hardware and software 1/2

Number of used Smartphones: *Mdn* = 1,00 (Min = 1,00 (93); Max = 2,00 (7))

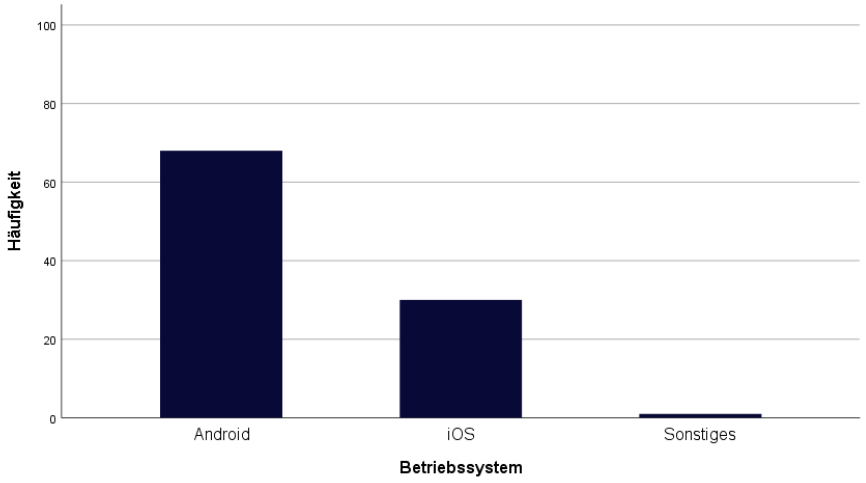
Operating system (main) smartphone : 1.) **Android** (68), 2.) iOS (30), 3.) Sonstiges (1; „EMUI + Android“)

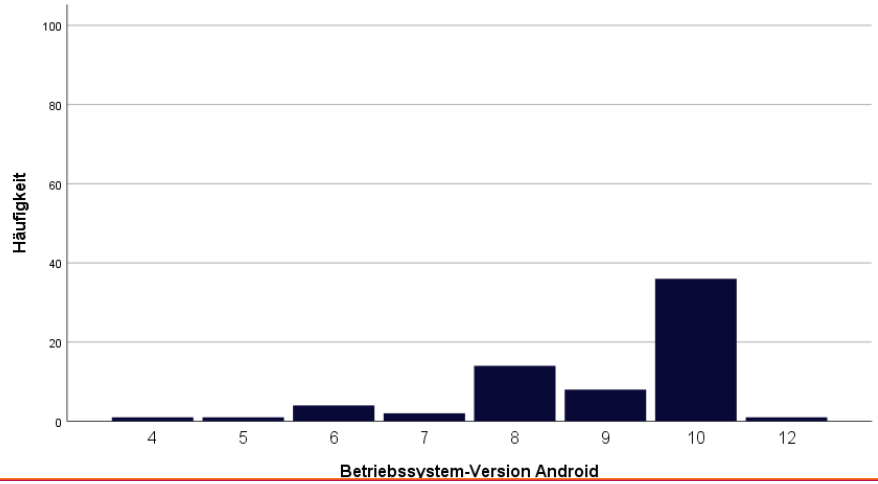
Operating system version Android (*n* = 67): 1.) **10** (36), 2.) 8 (14), 3.) 9 (8)

Operating system version iOS (*n* = 30): 1.) **14** (25), 2.) 13 (3), 3.) 12 (2)

Manufactorer: 1.) Apple (30), 2.) Samsung (28), 3. Huawei (20), 4.) Xiaomi (8)

Experience with smartphones in years (*n* = 94): *MW* = 7,51 (= seit ca. 2012; *SD* = 2,81; Min = 1,00; Max = 15,00)





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Results: hardware and software 2/2

Competence regarding smartphones (TAEG; [4])

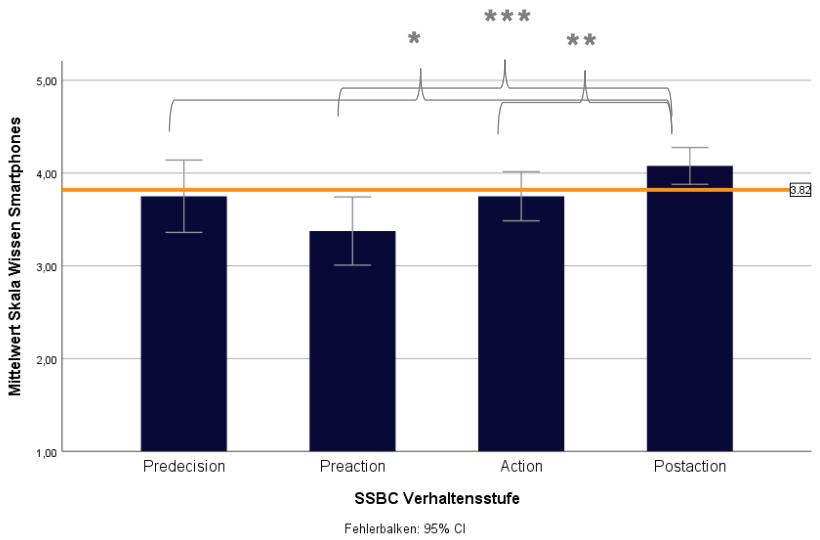
- TAEG [4] questionnaire scale, four adapted statements, 5-point agreement scale (strongly disagree; rather disagree; partly agree; rather agree; strongly agree)

Reliability Skale: α = .752 („*acceptabel*“)

Normal distribution: not given

Descriptive statistics total sample:
MW = 3,82 (= „ ***somewhat agree***“; SD = 0,69; Min = 2,50; Max = 5,00)

Differences between the behavioral levels: **yes**;
(*H*(3) = 12,98, *p* = .005); Post-hoc (one-sided): Postaction vs. All other



[4] Karrer, K., Glaser, C., Clemens, C., & Bruder, C. (2009); https://iconmonstr.com/smartphone-7-png/

Results: app usage 1/4

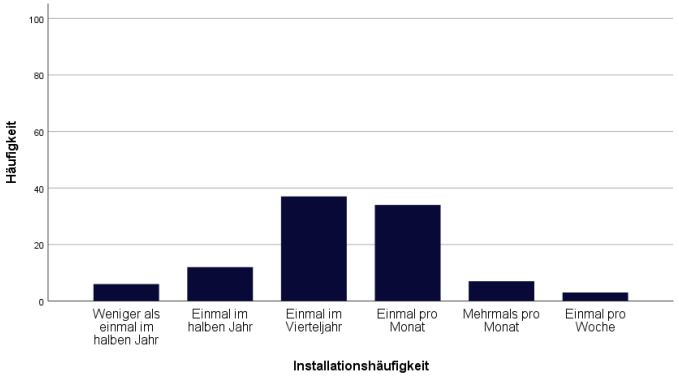
Installed Apps: *MW* = 87,59 (*SD* = 53,26; Min = 20,00; Max = 387,00)

Apps used regularly: *MW* = 16,22 (*SD* = 10,38; Min = 3,00; Max = 58,00)

Percentage of apps used/installed: *MW* = 22,31 (*SD* = 14,66; Min = 2,07; Max = 74,07)

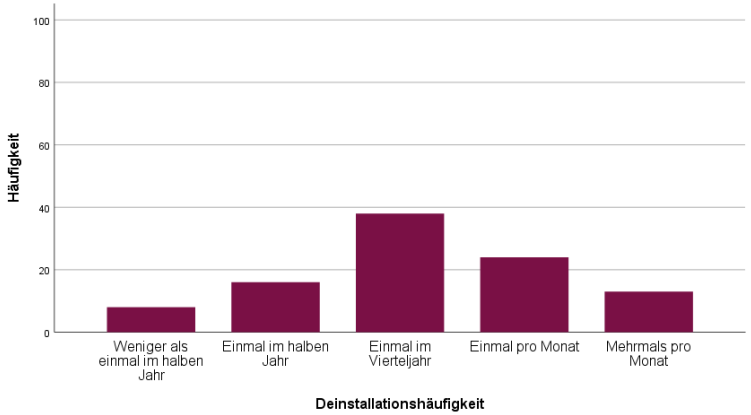
Installation frequency: *Mdn* = 3,00 (= „ *Once a quarter*“; Min = 1,00; Max = 6,00)

Uninstallation frequency: *Mdn* = 3,00 (= „ *Once a quarter*“; Min = 1,00; Max = 5,00)



Normal distribution: not given

- **no statistically significant differences between de- and installation frequency**
- **No differences between the behavioral levels** in terms of disassembly and installation frequency



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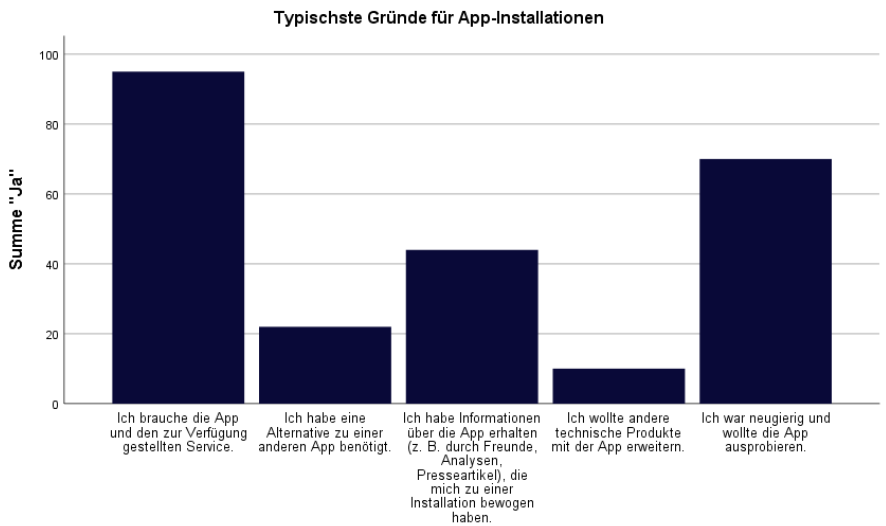
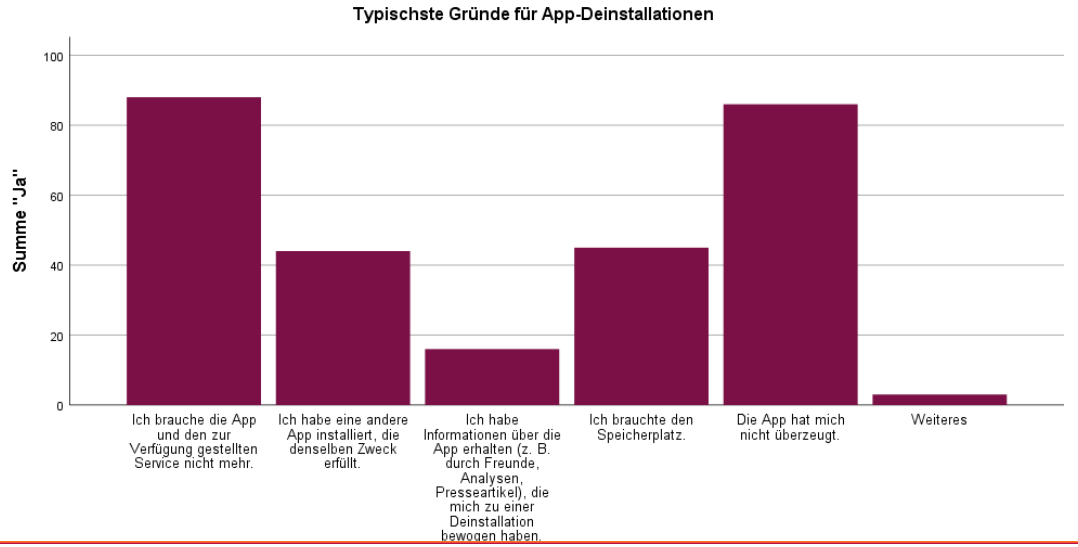
Results: app usage 2/4

Typical reasons for installations (multiple choice): 1.) „***I need the app and the provided services***.“ (95), 2. „ ***I was curious and wanted to try the app***.“ (70), 3.) „ *I received information about the app (e.g., through friends, analysis, press articles) that led me to install it..“* (44)

Typical reasons for uninstall (multiple choice): 1.) „ ***I no longer need the app and the service provided.***“ (88), 2.) „ ***The app did not convince me***.“ (86), 3.) "I need the storage space." (45), 4.) „ *I have installed another app that serves the same purpose.*“ (44)





https://iconmonstr.com/smartphone-7-png/

Results: app usage 3/4

Current frequently used apps (multiple choice possible, *n* = 280): 1. **WhatsApp** (77), 2.) **Instagram** (54), 3.) **Spotify** (25) 4. Youtube (15), 5. Safari (7), 6.) Snapchat (6), 7. Google (6), 7. Telegram (4), 8. Pinterest (3), 9. Der Spiegel (3), 10. Google Chrome (3)

Daily views of these apps (*n* = 97): *MW* = 16,96 (*SD* = 17,66; Min = 1,20; Max = 113,33)

Estimated time of use in minutes/day of these apps (*n* = 97): *MW* = 64,86 (*SD* = 49,66; Min = 9,33; Max = 300,00)

Self-assessed competence:

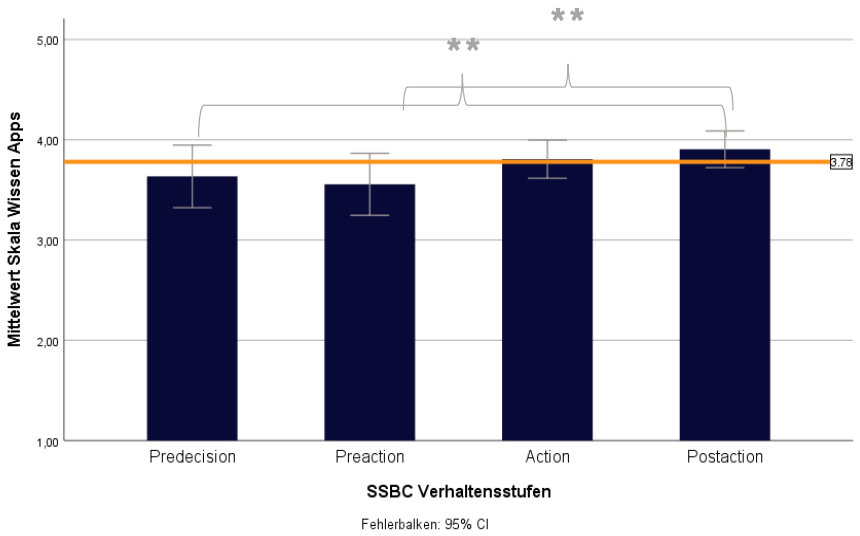
Reliability scale: α = .628 („*questionable", no decisive increase possible by omitting an item*)

Normal distribution: not given

Descriptive statistics total sample:
MW = 3,78 (= „ ***rather true***“; *SD* = 0,56; Min = 2,00; Max = 5,00)

Differences between behavioral levels: **marginal**;
(*H*(3) = 6,27, *p* = .099, *r* = 0.64); Post-hoc (one-sided): Postaction vs. Preaction, Predecision

Difference to competence smartphones: no



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Results: app usage 4/4

Mobile Phone "Addiction“ (MPIQ Scale; [5])

„[…] conceptualised as people's cognitive and behavioural interaction with their mobile phone.” [5]

- 8 Statements, 7-point agreement scale (from 1 = "Not at all true" to 6 = "Completely true")

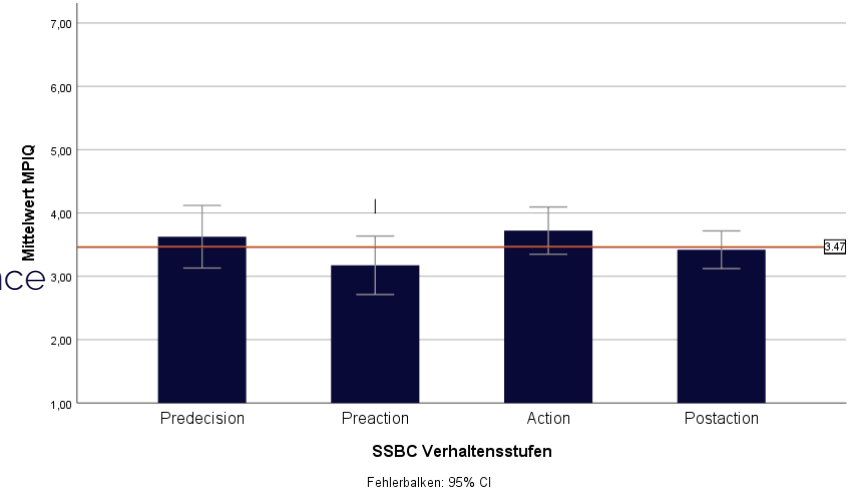
Reliability Skale: α = .743 („*acceptabel*“)

Normal distribution: not given

Descriptive statistics total sample:
MW = 3,47 (= rather not true; *SD* = 0,91; Min = 1,25; Max = 5,63)

Comparison with norm sample (*N* = 946, *MW* = 3.46): no difference = **value respondent corresponds to norm**

Differences between behavioral levels: no



[5] Walsh, S. P., White, K. M., & Young, R. M. (2010); https://iconmonstr.com/smartphone-7-png/

Summary

Our typical participant…

… uses 16 apps regularly, especially WhatsApp and Instagram.

…de- and installs an app once a quarter, predominantly for service-oriented reasons.

…does not consider herself/himself to be particularly smartphone "addicted".

…is aware that there are many problems regarding data protection when using apps and is taking actions on data protection, intends to continue to do so, or to do more about it.

…has been using a smartphone for 7 years and currently has one from Samsung with Android 10.

…cautiously assesses himself/herself as "rather tech-savvy.

…is female, 23 years old and studies.

https://iconmonstr.com/generation-10-svg/

Results: concerns 1/4

Internet privacy (IUIPC; [6])

*„[…] analyzing online consumers' **reactions to various privacy threats** on the Internet"* [6]

- 6 scales, three to six statements each, 7-point agreement scale (from 1= "Not at all true" to 7 = "Completely true")

Reliability scales: Unauthorized Secondary Use scale was excluded due to poor reliability (α = .547)

α = .610 („*questionable*"; *Awareness*) to .873 („*good*"; Collection); no significant improvement of the "questionable" scales possible by excluding single items

Normal distribution: not given, except for Control

Descriptive statistics total sample:

MW $_{Gobal\ Privacy\ Concerns}$ = 4,39 (*SD* = 1,03; Min = 1,87; Max = 7,00)
MW $_{\textbf{Improper Access}}$ **= 6,22** (*SD* = 0,77; Min = 4,00; Max = 7,00)
MW $_{Collection}$ = 5,42 (*SD* = 1,16; Min = 2,00; Max = 7,00)
MW $_{Awareness}$ = 5,98 (*SD* = 0,83; Min = 4,00; Max = 7,00)
MW $_{Control}$ = 5,73 (*SD* = 0,89; Min = 3,00; Max = 7,00)

[6] Malhotra, N. K., Kim, S. S., & Agarwal, J. (2004); https://iconmonstr.com/weather-33-png/

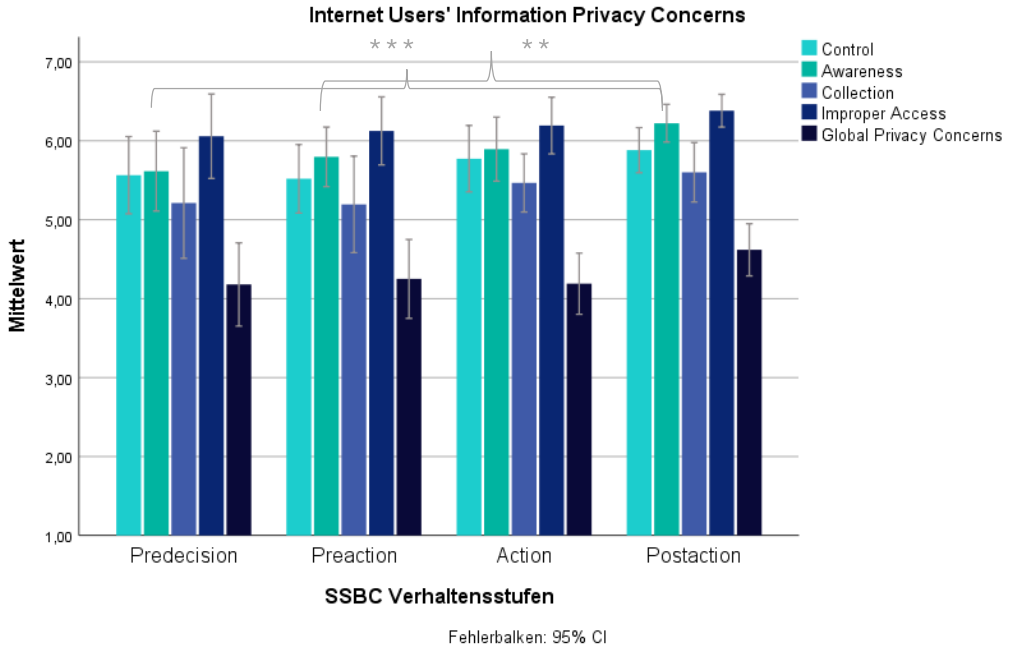
Results: concerns 2/4

Internet privacy (IUIPC; [6])

Difference between scales: **yes**; (χ^2 (4) = 188,98, p = .000);
Post-hoc: all scales differ except Awareness and Collection

Differences between behavioral levels: **weakly significant** at scale **Awareness** (H(3) = 8,09; p = .044; r = .83);
Post-hoc (one-sided): Postaction vs. Predecision, Preaction

Awareness: „[…] *passive dimension of information privacy, and it refers to the degree to which a consumer is concerned about his/her awareness of organizational information privacy practices.*” [6]



[6] Malhotra, N. K., Kim, S. S., & Agarwal, J. (2004); https://iconmonstr.com/weather-33-png/

Results: concerns 3/4

Mobile privacy concerns (MUIPC; [7])

„[…] explore the ***interplay between mobiles users and service providers where privacy is concerned****.”* [7]

- Three scales, three statements each, 7-point agreement scale (from 1= "Not at all true" to 7 = "Completely true")

Reliability Scales: α = .781 („*acceptabel*“; *Perceived Surveillance*) to .892 („*good*“; Secondary Use)

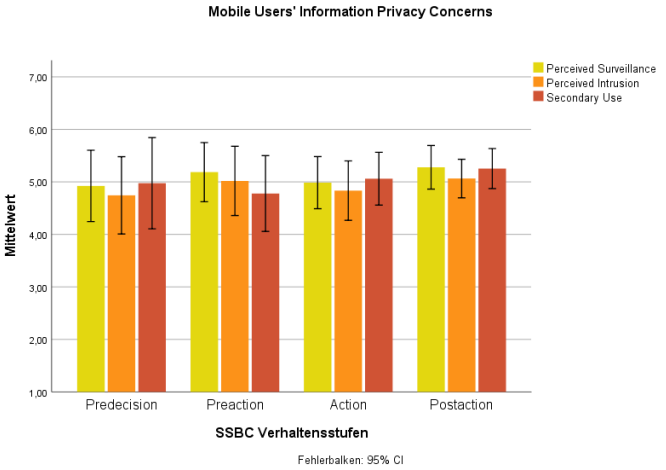
Normal distribution: not given, except for Perceived Intrusion

Descriptive statistics total sample:

$MW_{\text{Perceived Surveillance}}$ = 5,14 (*SD* = 1,21; Min = 2,00; Max = 7,00)
$MW_{\text{Perceived Intrusion}}$ = 4,91 (*SD* = 1,30; Min = 1,00; Max = 7,00)
$MW_{\text{Secondary Use}}$ = 5,08 (*SD* = 1,27; Min = 2,00; Max = 7,00)

Differences between scales: no

Differences between behavioral levels: no



[7] Xu, H., Gupta, S., Rosson, M. B., & Carroll, J. M. (2012); https://iconmonstr.com/weather-33-png/

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…does not consider herself/himself to be particularly smartphone "addicted".

…is aware that there are many problems regarding data protection when using apps and is taking actions on data protection, intends to continue to do so, or to do more about it.

…has been using a smartphone for 7 years and currently has one from Samsung with Android 10..

… cautiously assesses himself/herself as "rather tech-savvy.

…has particularly concerns about unauthorized data access when using the Internet.

… is female, 23 years old and studies.

https://iconmonstr.com/generation-10-svg/

Results: norms and values 1/5

Schwartz Values Questionnaire (SVI; [8], [9])

„[…] The scale measures 10 distinct value types representing underlying motivational structures. The value types can be described in two dimensions: openness to change versus conservation and self-transcendence versus self-enhancement. […] people who give priority to collective, or self-transcendent, values are more willing to engage in different forms of altruistic, cooperative, or proenvironmental behavior than people who give priority to individual or self-enhancement values” [9]

- Selection of two scales (self-transcendence and self-enhancement), 15 and 9 statements each; 9-point agreement scale (from -1= "Against my values," 0 = "Not important," 3 = "Important," 6 = "Very important," to 7 = "Of highest importance").

Reliability Scales: α = .830 („*good*“; *self-transcendence*) and α = .848 („*good*“; self-enhancement)

Normal distribution: not given for self-enhancement, given for self-transcendence

Descriptive statistics total sample:

MW $_{\text{self-transcendence}}$ = 5,22 (*SD* = 0,81; Min = 2,80; Max = 6,93)
MW $_{\text{self-enhancement}}$ = 3,03 (*SD* = 1,16; Min = 1,00; Max = 6,11)

[8] Schwartz, 1992 angelehnt an [9] Nordlund, A. M., & Garvill, J. (2002); https://iconmonstr.com/trophy-13-png/

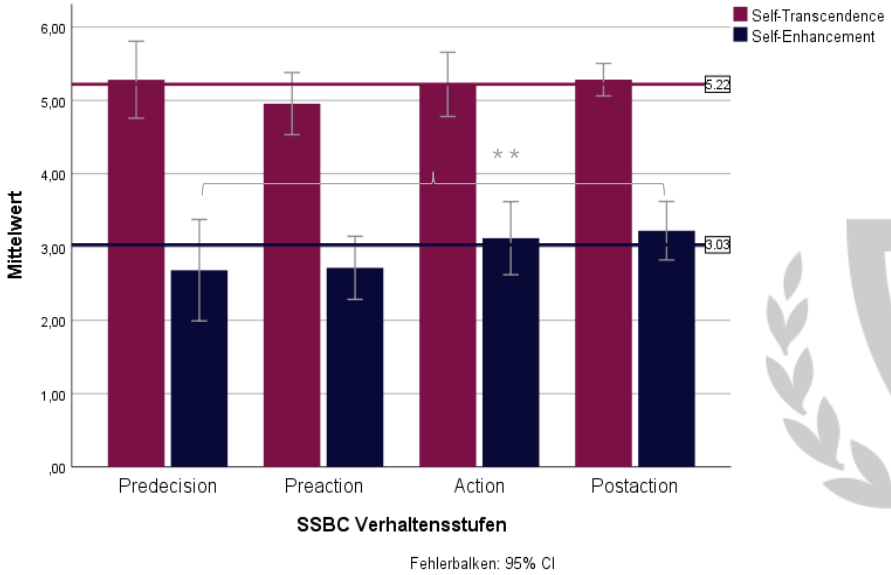
Results: norms and values 2/5

Schwartz Values Questionnaire (SVI; [8], [9])

Differences between Scales: **yes**;
Scores of **self-transcendence** (*Mdn* = 5,33) **significantly higher than self-enhancement** (*Mdn* = 2,89, *z* = 8,31, *p* = .000, *r* = .83)

Differences between behavioral levels: no

Extreme group comparison **Predecision vs. Postaction**:
self-enhancement (one-sided): **marginally significant**;
(*U* = 197,50, *z* = -1,50, *p* = .067, *r* = -0,21)
for self-transcendence (one-sided): no



[8] Schwartz, 1992 angelehnt an [9] Nordlund, A. M., & Garvill, J. (2002); https://iconmonstr.com/trophy-13-png/

Results: norms and values 3/5

German abridged version Schwartz Values Questionnaire (SSVS-G; [10])

- 10 statements about values, 6-point agreement scale (from "Not at all important" to "Very important").
- Theoretically, four scales can be formed from the items

Reliability Scales: do not meet the requirements to a large extent ($\alpha > .600$), therefore no scales were formed in the following, but evaluations were only carried out at item level.

Normal distribution: not given

[10] Boer, D. (2013); https://iconmonstr.com/trophy-13-png/

Results: norms and values 4/5

German abridged version Schwartz Values Questionnaire (SSVS-G; [10])

- Descriptive statistics total sample:

  MW_{Macht} = 2,56 (*SD* = 1,05; Min = 1,00; Max = 6,00)
  $MW_{Leistung}$ = 2,97 (*SD* = 1,36; Min = 1,00; Max = 6,00)
  $MW_{Hedonismus}$ = 2,93 (*SD* = 1,29; Min = 1,00; Max = 6,00)
  $MW_{Anregung}$ = 4,28 (*SD* = 1,10; Min = 1,00; Max = 6,00)
  $MW_{Selbstbestimmung}$ = 4,61 (*SD* = 1,07; Min = 1,00; Max = 6,00)
  $MW_{Universalismus}$ = 4,62 (*SD* = 1,09; Min = 1,00; Max = 6,00)
  $\mathbf{MW_{Sozialität} = 5,48}$ (*SD* = 0,66; Min = 4,00; Max = 6,00)
  $MW_{Tradition}$ = 4,78 (*SD* = 1,34; Min = 2,00; Max = 6,00)
  $MW_{Konformität}$ = 5,00 (*SD* = 1,02; Min = 2,00; Max = 6,00)
  $MW_{Sicherheit}$ = 3,73 (*SD* = 1,47; Min = 1,00; Max = 6,00)

[10] Boer, D. (2013); https://iconmonstr.com/trophy-13-png/

Results: norms and values 5/5

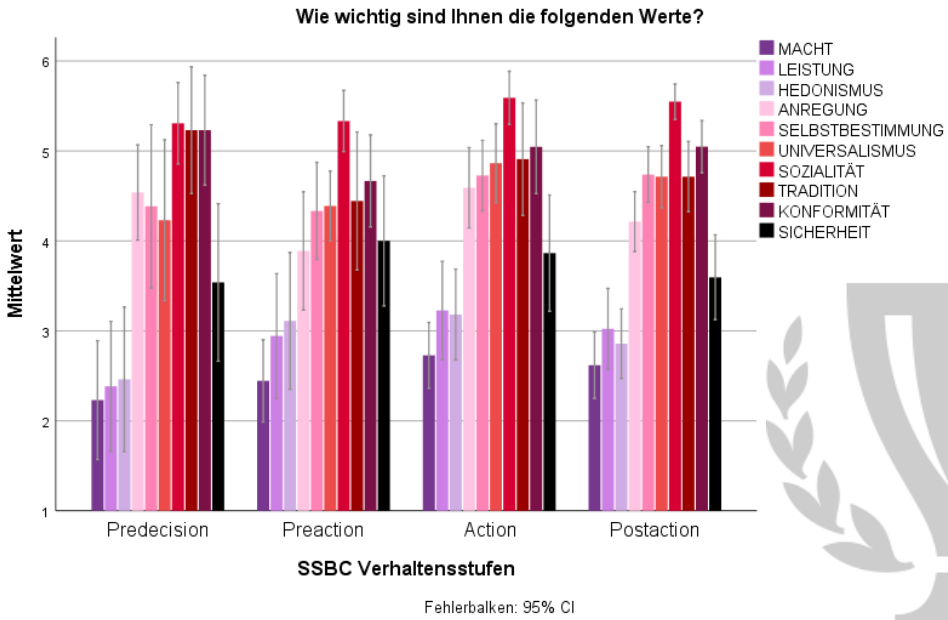
German abridged version Schwartz Values Questionnaire (SSVS-G; [10])

Differences between scales: **yes**; ($\chi^2(9) = 391{,}06$, $p = .000$)

Post-hoc: All except hedonism vs. achievemen, stimulation vs. universalisums and self-determination, universalisums vs. tradition and conformity, self-determination vs. tradition and conformity, tradition vs. conformity.

Differences between behavioral levels: no

Extreme group comparisons (one-sided):
marginal in performance ($U = 204{,}50$, $z = -140$, $p = .081$, $r = -0.19$)
and tradition ($U = 202{,}00$, $z = -1{,}47$, $p = .071$, $r = -0.20$, in reverse!)



[10] Boer, D. (2013); https://iconmonstr.com/trophy-13-png/

Summary

Our typical participant…

…uses 16 apps regularly, especially WhatsApp and Instagram.

…de- and installs an app once a quarter, predominantly for service-oriented reasons.

…does not consider herself/himself to be particularly smartphone "addicted".

…is aware that there are many problems regarding data protection when using apps and is taking actions on data protection, intends to continue to do so, or to do more about it.

… has been using a smartphone for 7 years and currently has one from Samsung with Android 10.

…has particularly concerns about unauthorized data access when using the Internet.

…cautiously assesses himself/herself as "rather tech-savvy.

… is self-transcendent oriented and sociality is important to her/him.

…is female, 23 years old and studies.

https://iconmonstr.com/generation-10-svg/

Results: summary survey objectives

- The respondents most frequently used an Android smartphone with operating system version 10
- Smartphones with iOS operating system were used second most often, here predominantly with version 14
- The number of installed apps varies greatly from individual to individual
- On average, 16 apps are used regularly by the respondents, which corresponds to 22% of the installed apps.
- At the time of the survey, the apps "WhatsApp", "Instagram" and "Spotify" were used most frequently
- Most frequently, respondents reported de-installing or installing apps "*once a quarter*“
- The most common reasons for uninstalling or installing apps are "service-oriented" in nature, i.e., respondents were interested in or disappointed with the service provided by the app

https://iconmonstr.com/christmas-42-png/

Results: summary survey objectives

- The methodology used to determine the behavioral level can be assessed as suitable, because only 4% of respondents were unable to classify themselves.
- The respondents most frequently classified themselves in the Postaction behavioral level, i.e., they have an awareness of the problem of data privacy in the mobile area and have already identified adequate behavioral strategies that they use in everyday life.
- The behavioral stages studied differ in terms of:
  - Affinity for technology
  - Competence in the use of smartphones and apps (marginal)
  - Level of concern regarding awareness of a company's data protection practices
- The behavioral levels studied do not differ regarding:
  - De-installation frequency of apps
  - The level of cognitive and behavioral interaction with their cell phone (smartphone "addiction")
  - Mobile privacy concerns

https://iconmonstr.com/christmas-42-png/

Results: summary survey objectives

- Extreme group comparisons between the Predecision and Postaction behavioral levels showed marginal differences regarding value orientation:
  - Individuals in the Postaction level show higher expressions for individual values (self-enhancement) and performance
  - Individuals in the Predecision level show a higher tradition-oriented value expression.

https://iconmonstr.com/christmas-42-png/

Conclusion

Follow-up study: users' approach to informing and adjusting privacy-relevant app behavior.

- Participant observation due to the Corona pandemic in digital format.
- Investigation of behavioral stage extreme groups
- Intended sample size *N* = 10
  - Start of the survey: 01.02.2021
  - Planned end of the survey: 05.03.2021
- Integration of the results from the questionnaire study and the follow-up study: Differentiate persona creation

Study on characteristics for risk assessment of apps (Master thesis)

https://iconmonstr.com/binoculars-7-png/

Thank you for your attention!

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