

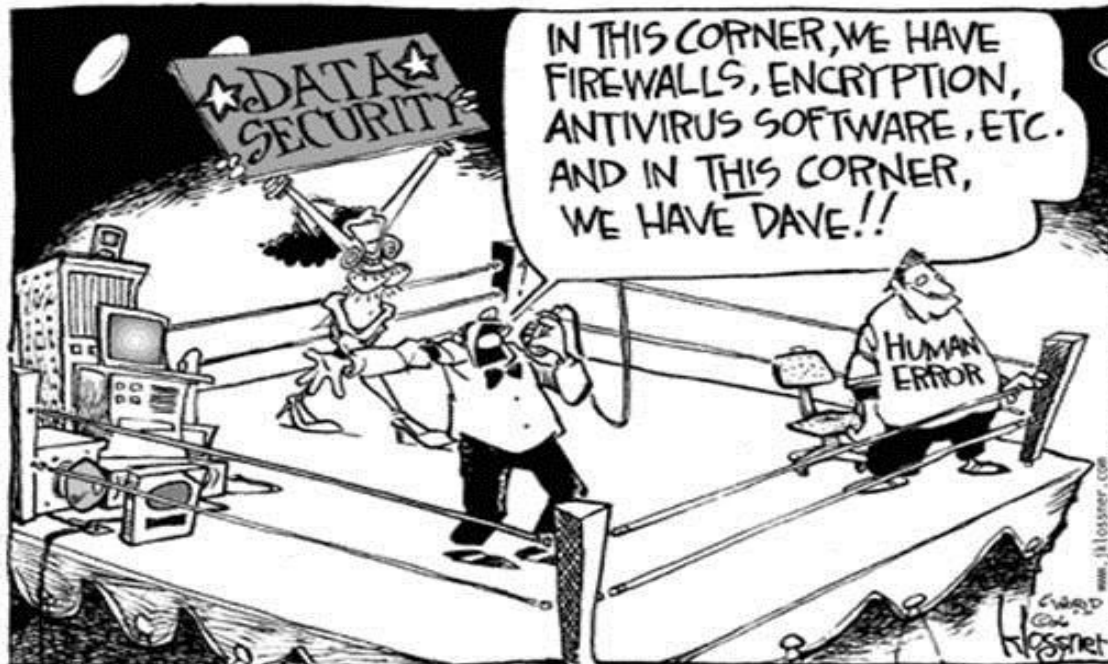


**MASARYK  
UNIVERSITY**  
Czech Republic

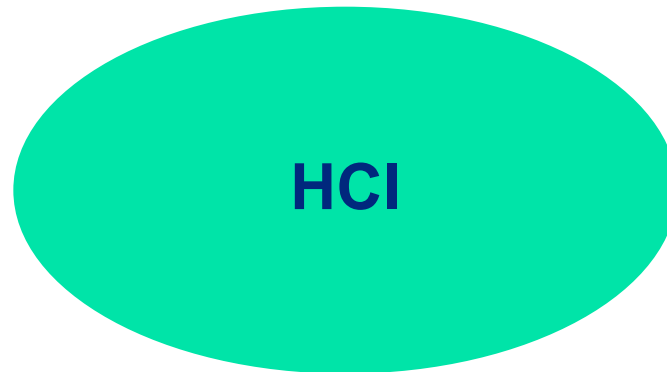
# Human Computer Interaction (HCI)

*prof. David Smahel, Ph.D.*

“Humans are the weakest link in cyber security.”



Uživatel (znalosti, osobní charakteristiky...)



Počítač - interface (informatika)



**Jaké různé obory vstupují do HCI a jakým způsobem?**

# Sociální a humanitní vědy

**Psychologie**

**X**

**Sociologie**

**X**

**Mediální studia**

**X**

**Pedagogika**

**X**

**Sociální práce**

**X**

**Právo**

**X**

**Lingvistika**

**X**

**.....**

# Co je HCI



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Carroll, J. M. (2009). Human computer interaction (HCI). *Interaction Design Encyclopedia*. Retrieved on June, 6, 2010.

- Experti HCI studují, jak lidé komunikují s počítači, a poté vyvíjejí nové technologie, které lidem pomohou používat počítače efektivněji. Cílem HCI je minimalizovat náklady na interakci a učinit interakce „lidštějšími“.
- Oblast HCI si klade za cíl zlepšit interakci člověka a počítače prostřednictvím zlepšení funkčnosti, použitelnosti, spolehlivosti a pohodlí počítačových rozhraní.

- User experience (+ metody výzkumu pro UE)
- Interaction design
- Usable security
- Gaming
- Augmented reality & Virtual reality
- Human AI Interactions (Explainable AI, User-friendly AI)
- Interaction with robots
- Health HCI
- Assistive technology
- Speech recognition technology (Alexa ...)
- Eye tracking



## Použitelnost (usability)

- Použitelnost jako „kvalita interakce ve smyslu parametrů, jako je čas potřebný k provedení úkolů, počet chyb a čas potřebný k tomu, abychom se stali kompetentním uživatelem“ (Benyon et al. 2005, s. 52).
- atribut kvality, který posuzuje, jak snadno se uživatelská rozhraní používají

Fig. 2.5



Usability—prepared by Tomayess Issa

## Kritéria použitelnosti

- Learnability: pomocí které mohou noví uživatelé zahájit efektivní interakci a dosáhnout maximálního výkonu.
- Flexibilita: množství způsobů, jak si uživatel a systém vyměňují informace.
- Robustnost: úroveň podpory poskytované uživateli při určování úspěšného dosažení a hodnocení cílů.
- Efektivita: jakmile se uživatel „naučí systém“, je to rychlost, s jakou může provádět úkoly.
- Zapamatovatelnost: jak snadno si uživatel zapamatuje funkce systému po určité době, kdy jej nepoužívá.
- Chyby: Kolik chyb uživatelé dělají, jak závažné jsou
- Spokojenost: jak příjemná a příjemná je práce se systémem

# Usable security: Experimental research of ICT user behavior in the domain of security

- David Smahel
- Vaclav Matyas
- Vlasta Stavova
- Lenka Dedkova
- Hana Machackova
- Kamil Malinka
- Radim Polcak

**IRTIS** | Interdisciplinary  
Research Team  
on Internet and Society

**CRCS**  
Centre for Research on  
Cryptography and Security

 **ÚVT**



MASARYKOVA UNIVERZITA  
PRÁVNICKÁ FAKULTA



## ESET: Potentially unwanted applications

- How to encourage users to enable PUA (potentially unwanted application) detection?
- Increase user's security by increasing number of users who enable detecting PUA (spyware, adware, etc.) during antivirus installation process
- Legal issues – user's own decision, no recommendation
- PC platform

# ESET SMART SECURITY



**There is power in numbers. Get the maximum level of protection.**

ESET Live Grid gives you the maximum level of protection and provides faster scanning using the latest intelligence collected from millions of ESET customers from all over the world.

Yes, I want to participate (recommended)

## Detection of Potentially Unwanted Applications

Potentially unwanted applications are programs that usually require the user's consent before installation (may include some adware, utilities and rootkits among others). Although they may not pose direct security risk, they can affect your computer's performance and speed, and in some cases, change in behavior.

**Pick an option before you continue:**

- Enable detection of potentially unwanted applications
- Disable detection of potentially unwanted applications

Back

Install

Staňte se UX designery!

## ESET: Potentially unwanted applications

- **Experiment 1:**
  - designed 15 versions (incl. original one)
  - tested on beta users, N = 87 028
- **Experiment 2:**
  - repeated on standard users
  - 2.1 N = 499 142
  - 2.2 N = 600 000+ (still collecting; prior to data cleaning)
  - difference in behavior of beta x standard users

# Proposed variants

## Detection of Potentially Unwanted Applications

ESET can detect potentially unwanted applications and ask for confirmation before they install. Potentially unwanted applications might not pose security risk but they **can affect your computer's**:

- performance,
- speed,
- reliability,
- behavior.

They usually require user's consent before installation.

### Pick an option before you continue:

- Disable detection of potentially unwanted applications.
- Enable detection of potentially unwanted applications.

# Proposed variants

## Detection of Potentially Unwanted Applications

ESET can detect potentially unwanted applications and ask for confirmation before they install. Potentially unwanted applications might not pose security risk but they **can affect your computer's**

## Detection of Potentially Unwanted Applications

**Notice:** ESET can detect potentially unwanted applications and ask for confirmation before they install. Potentially unwanted applications might not pose security risk but they can affect computer's performance, speed and reliability, or cause changes in behavior. They usually require user's consent before installation.

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# Proposed variants

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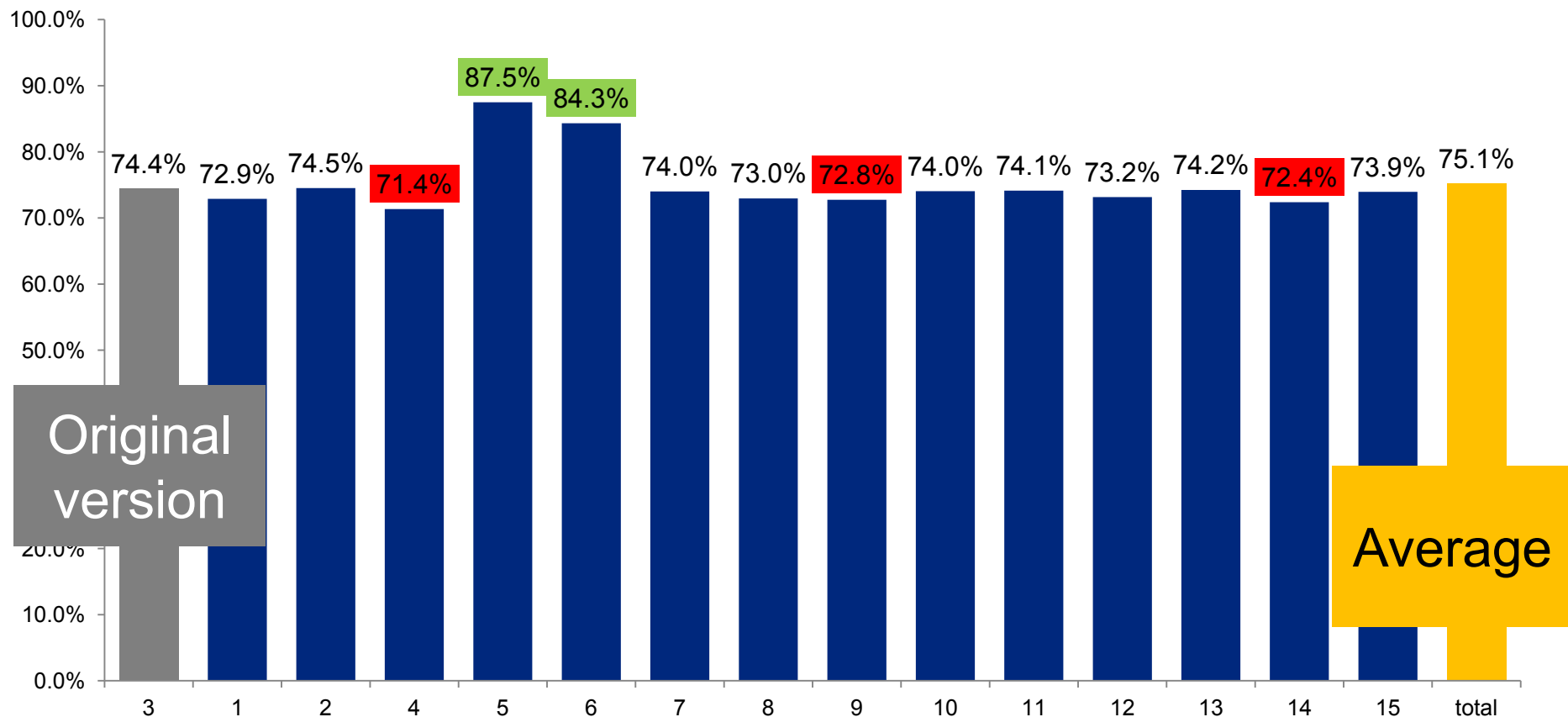
- Disable detection of potentially unwanted applications.
- Enable detection of potentially unwanted applications.

## Detection of Potentially Unwanted Applications [What is a potentially unwanted application?](#)

Pick an option before you continue:

- Disable detection of potentially unwanted applications.
- Enable detection of potentially unwanted applications.

## Beta testers: Detecting PUA across screens



# PUA detection: The good choice

Original screen

The order of options

New screen

Pick an option before you continue:

- Disable detection of potentially unwanted applications.
- Enable detection of potentially unwanted applications.

Pick an option before you continue:

- Detect potentially unwanted applications.
- Don't detect potentially unwanted applications.

83.9%

Pick an option before you continue:

- Enable detection of potentially unwanted applications.
- Disable detection of potentially unwanted applications.

89.8%



→ positive first  
→ „enable“ better than „detect“

## Warnings

### Detection of Potentially Unwanted Applications

**Notice:** ESET can detect potentially unwanted applications and ask for confirmation before they install. Potentially unwanted applications might not pose security risk but they can affect computer's performance, speed and reliability, or cause changes in behavior. They usually require user's consent before installation.

### Detection of Potentially Unwanted Applications

### Detection of Potentially Unwanted Applications

## Links

### Detection of Potentially Unwanted Applications [What is a potentially unwanted application?](#)

Pick an option before you continue:

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### Detection of Potentially Unwanted Applications [What is a potentially unwanted application?](#)

ESET can detect potentially unwanted applications and ask for confirmation before they install. Potentially unwanted applications might not pose security risk but they can affect computer's performance, speed and reliability, or cause changes in behavior. They usually require user's consent before installation.

### Detection of Potentially Unwanted Applications [Why do we ask?](#)

ESET can detect potentially unwanted applications and ask for confirmation before they install. Potentially unwanted applications might not pose security risk but they can affect computer's performance, speed and reliability, or cause changes in behavior. They usually require user's consent before installation.

Text structure

## Detection of Potentially Unwanted Applications

ESET can detect potentially unwanted applications and ask for confirmation before they install. Potentially unwanted applications might not pose security risk but they **can affect your computer's**:

- performance,
- speed,
- reliability,
- behavior.

They usually require user's consent before installation.

Presence of „live grid“

## There is power in numbers. Get the maximum level of protection.

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Yes, I want to participate (recommended)

## Detection of Potentially Unwanted Applications

# PUA detection: The bad choice (but...)

Original screen

## Detection of Potentially Unwanted Applications

ESET can detect potentially unwanted applications and ask for confirmation before they install. Potentially unwanted applications might not pose security risk but they can affect computer's performance, speed and reliability, or cause changes in behavior. They usually require user's consent before installation.

74.5%

Pick an option before you continue:

- Disable detection of potentially unwanted applications.
- Enable detection of potentially unwanted applications.

New screens

Pick an option before you continue:

- Don't detect potentially unwanted applications.
- Detect potentially unwanted applications.

71.4%

## Detection of Potentially Unwanted Applications

ESET can detect potentially unwanted applications and ask for confirmation before they install. Potentially unwanted applications might not pose security risk but they can affect computer's performance, speed and reliability, or cause changes in behavior. They usually require user's consent before installation.

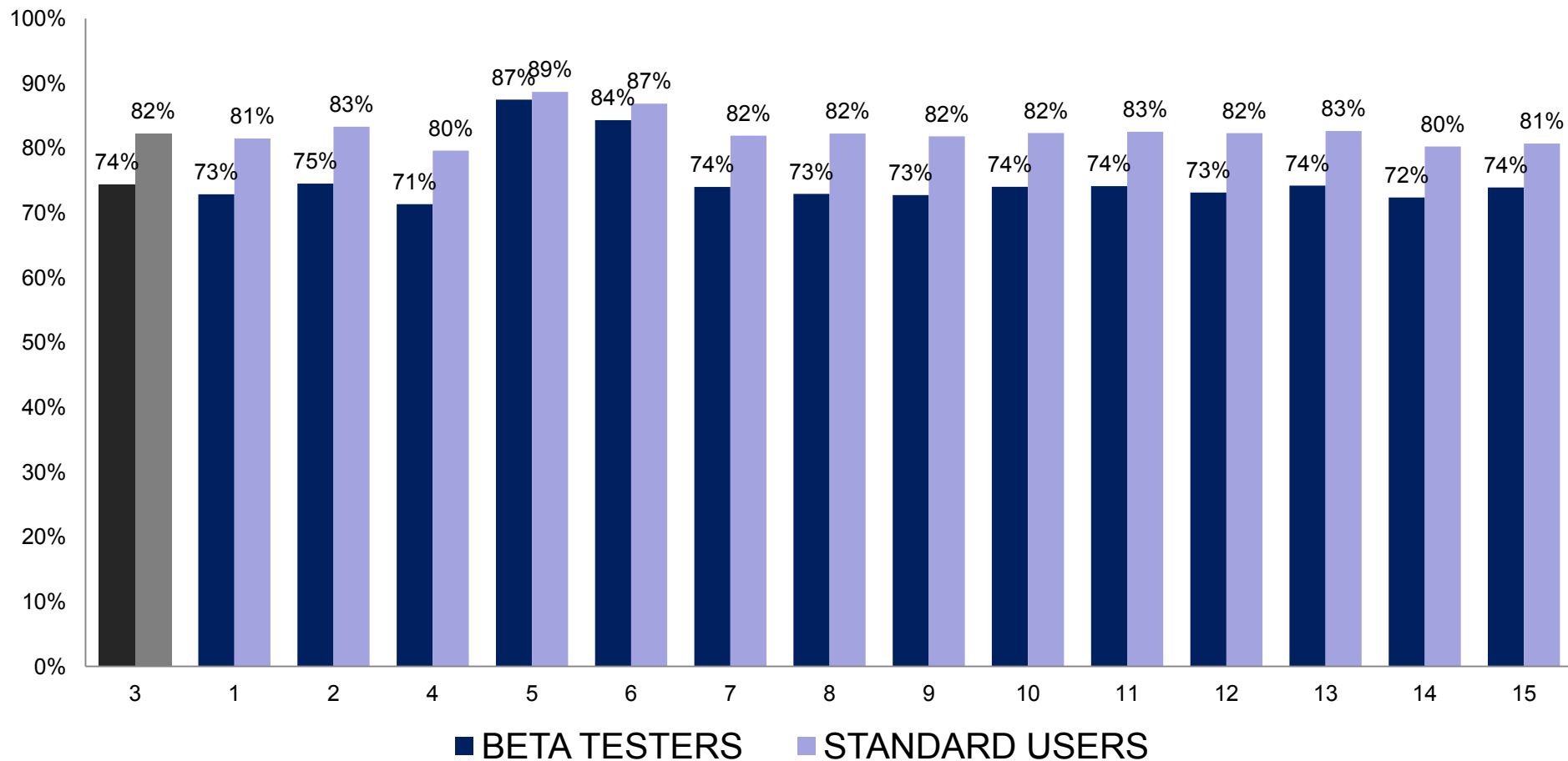
**For example**, they may change your web browser's webpage and search settings.

72.8%

„full“ screen

72.4%

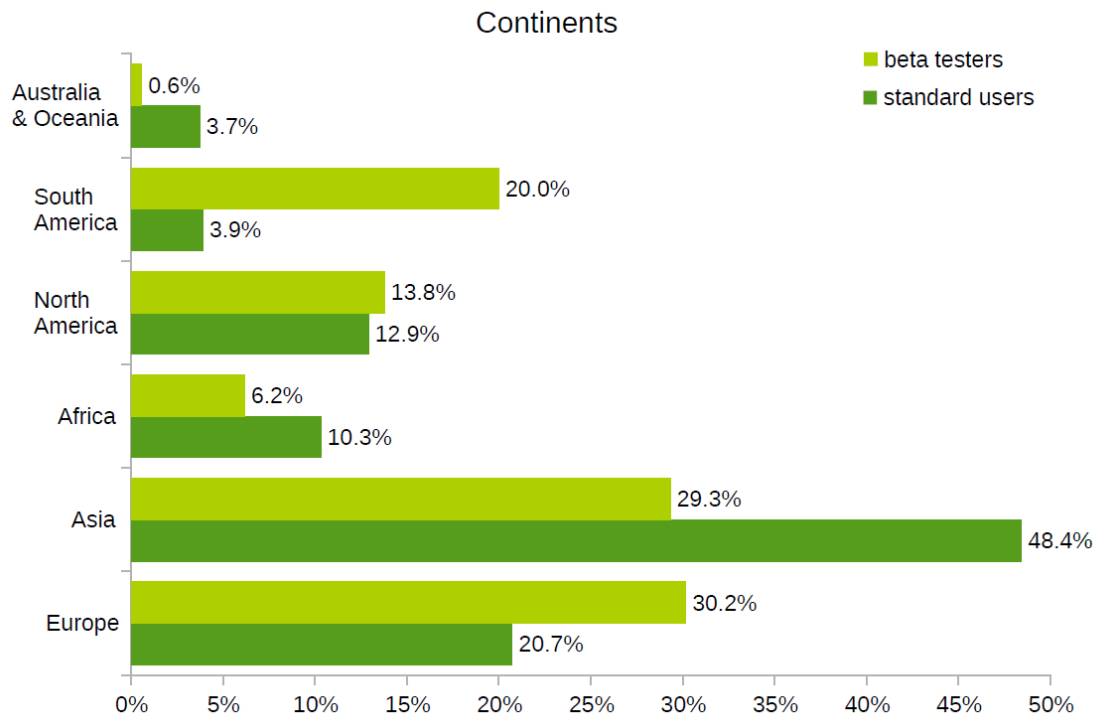
## Beta testers vs. standard users



# Beta testers vs. standard users

Studie: <https://www.youtube.com/watch?v=H7ik9SeAexQ>

- Negligible differences in terms of HW and SW (platform (32/64-bit), CPU model, RAM size, OS version)
- Differences in location





## Beta testers vs. standard users

- Small differences in gender and age
- Beta testers slightly more skilled
- But overall, both sub-samples are quite similar (in ESET's case)

A large-scale comparative study of beta testers and standard users: Case study of a software security system

(Stavova, V., Dedkova, L., Ukrop, M., & Matyas, V.)

published in *Communications of the ACM*



# Metody používané v HCI

# Metody: online nebo offline

- Kvalitativní (rozhovory, fokusní skupiny ..)
- Uživatelské testování
- Kvantitativní (online surveys)
- Experimentální metody (exp. design)
- Obsahové analýzy
- Pozorování
- Diáře
- Ekologické momentální hodnocení (EMA)
- Technické metody
- Smíšené metody

# Populace: kdo jsou naši uživatelé?

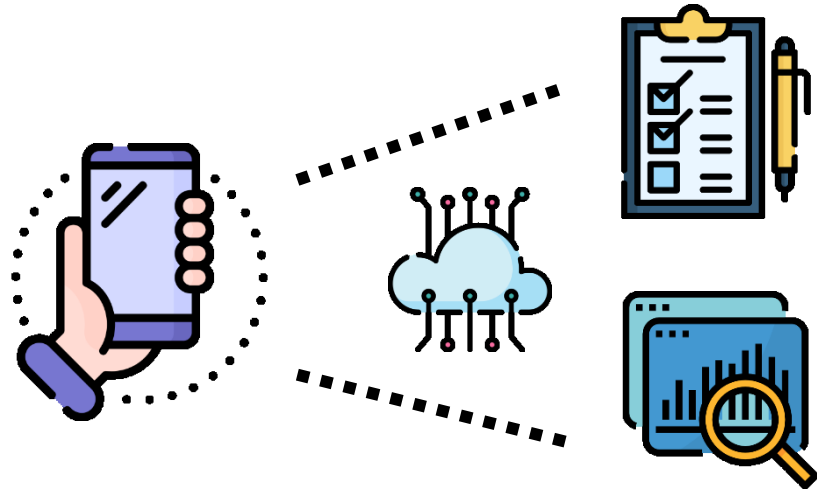
- Kdo jsou naši uživatelé a proč chtějí SW používat?
- Jak se k nim pro výzkum dostat?
- Můžeme je zkoumat online?
- Pro jaké typy výzkumů je vhodné online prostředí?

# Ecological momentary assessment (EMA): example of research

Michaela Lebedikova, Martina Smahelova, David Smahel, Steriani Elavsky, Martin Tancos, Michal Tkaczyk, Jana Blahosova, Jaromir Plhak, Ondrej Sotolar, Michal Schejbal

Interdisciplinary Research Team on Internet and Society  
Masaryk University, Brno, Czech Republic

## Background



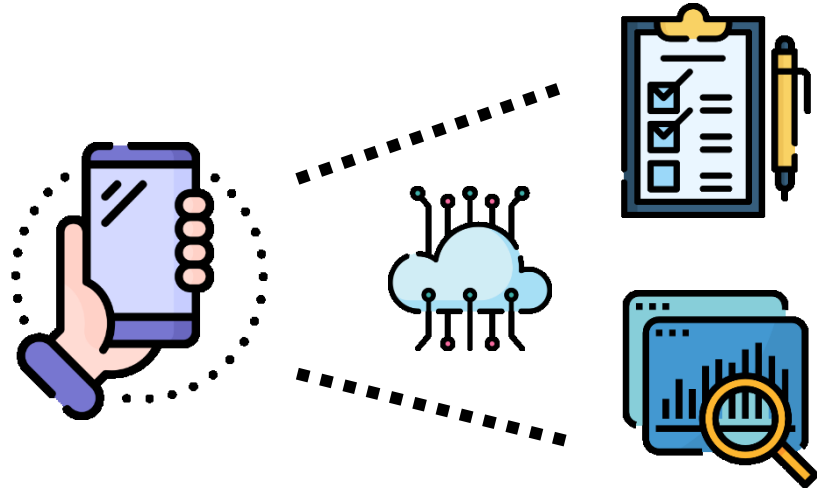
## Adolescents and Smartphones

- More screen time, internet usage, variability in apps, individualized use (Bedrosova et al., 2018)
- Possible diverse impact

## Current Research

- Self-report > not objective data! (Barbovschi, Green & Vandoninck, 2013)
- Call for new methods (Holloway et al., 2013)
- Ecological Momentary Assessment
  - Ecological validity, shortened recall bias
  - Temporal relationships
  - Different sources of variability
  - BUT: researcher-provided phones (i. e. Jensen et al. 2019)

## Background



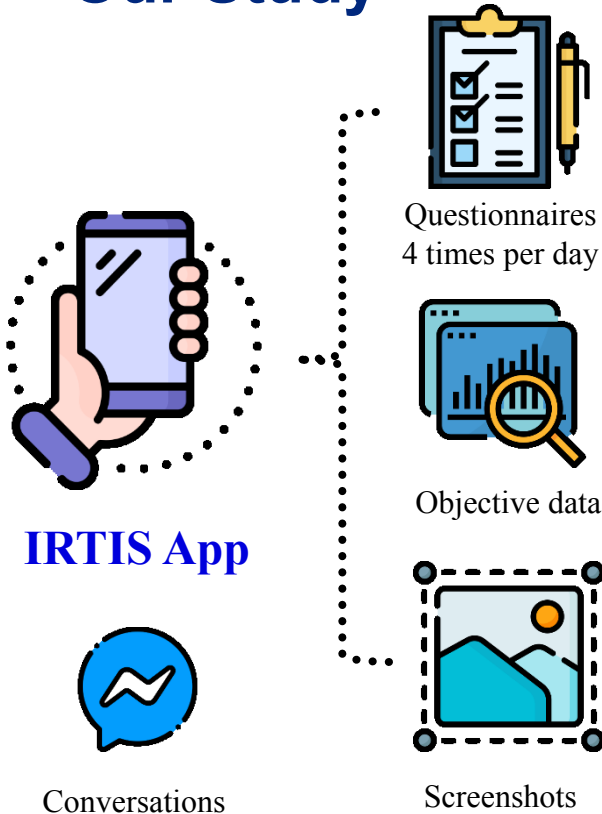
## Project

- Modelling the FUTURE:  
Understanding the Impact of  
Technology on Adolescent's  
Well-Being
- How to best capture adolescents'  
technology usage?
  - Example: social media use

## Solution

- Combine:
  - Intensive sampling (EMA)
  - **Objective smartphone data collection**
  - **Participant's device!**
- Measurement-burst design (Sliwinski 2008)

## Our Study



### Smartphone App

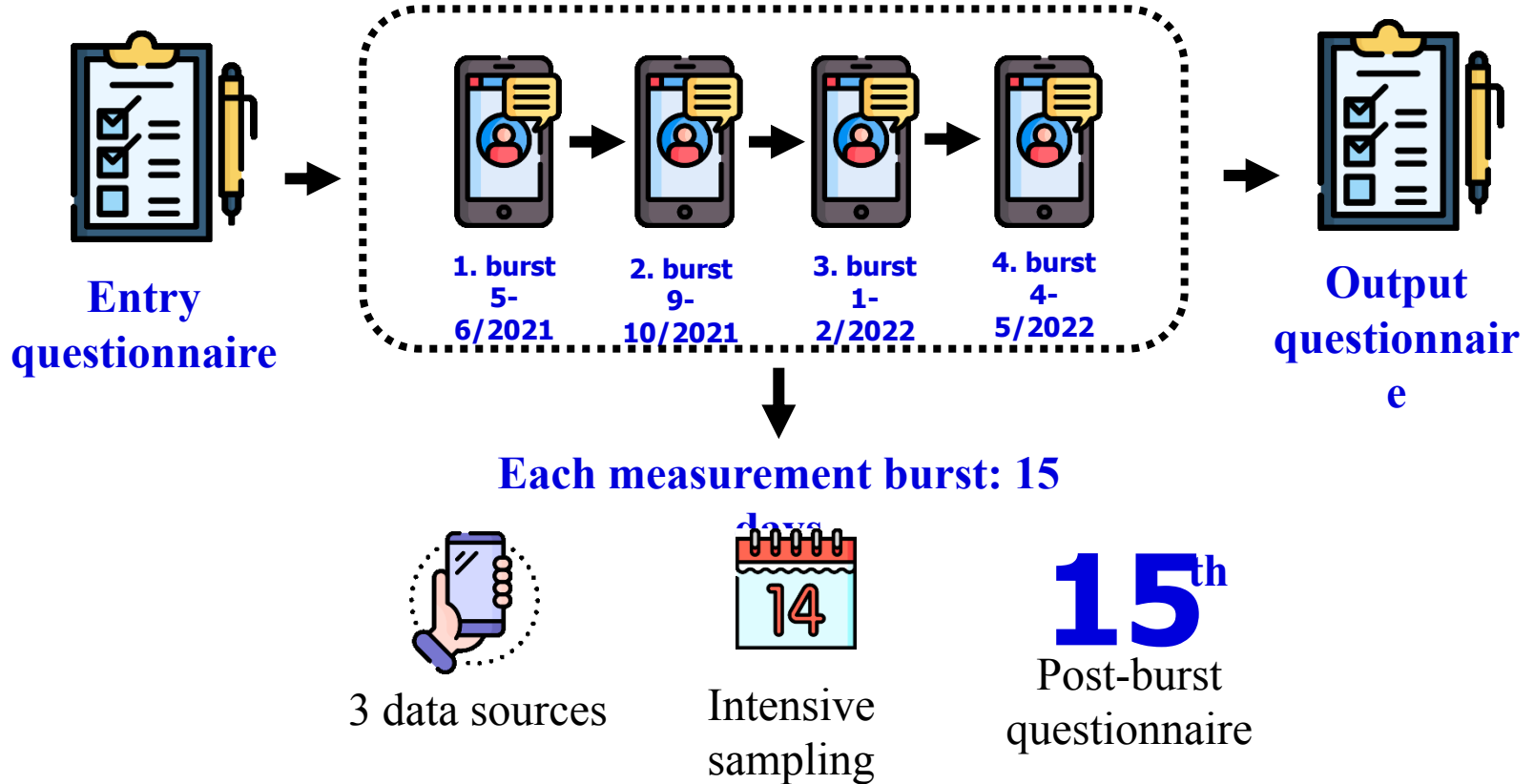
- 3 data sources
- Installed in participant's device via Google Play
- Available on Android v5 Lollipop +

### Ethical Standards

- Approval of all relevant ethical bodies & project lawyer
- Standard data protection practices
- Machine-learning-based anonymization software of screenshots and all third-party data (Sotolář, Plhák, Šmahel 2021)



## Research Design



# Illustrative Example

With this type of research design we could, for example, ask ...

- What is the impact of social media use on momentary affect?**
  - Is the impact of social media on affect different for girls and boys?**  
(between-person hypothesis)
  - Is the impact of social media on affect different on days when the use is higher than average?** (within-person hypothesis)

# Illustrative example: Analytical advantages



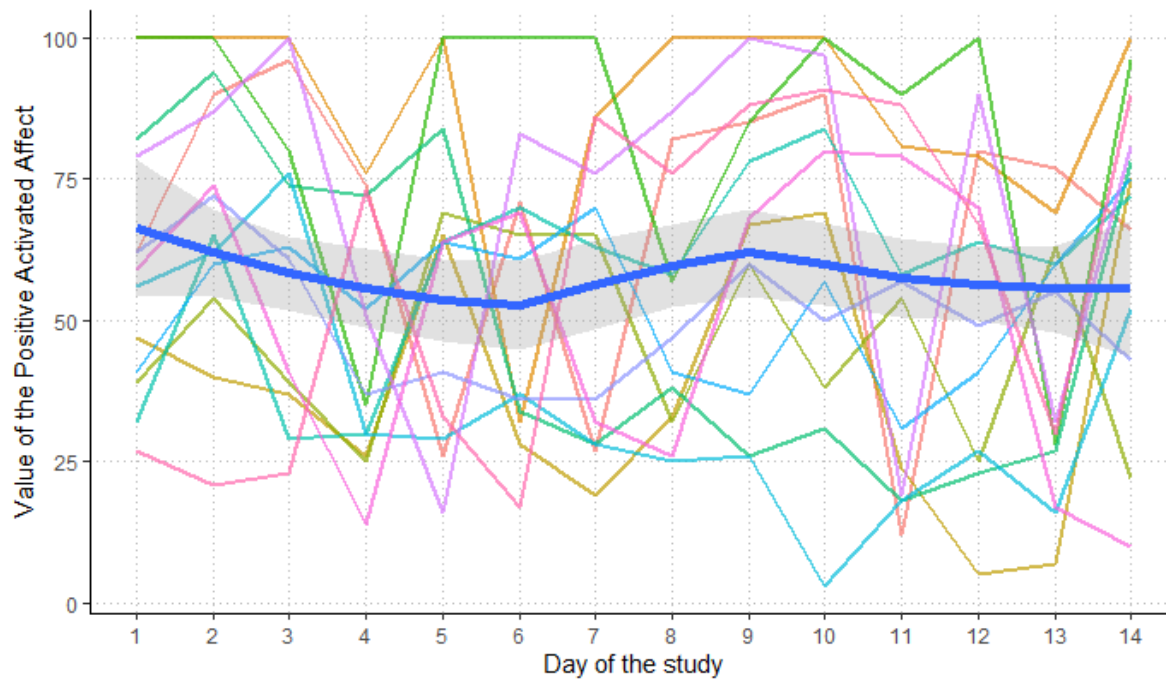
June



N = 201

**73%**

Compliance  
rate



## Example: Between-Person Variability in Positive Activated Affect

subset of 13 people with data from evening EMA questionnaire 35

# Illustrative example: Analytical advantages



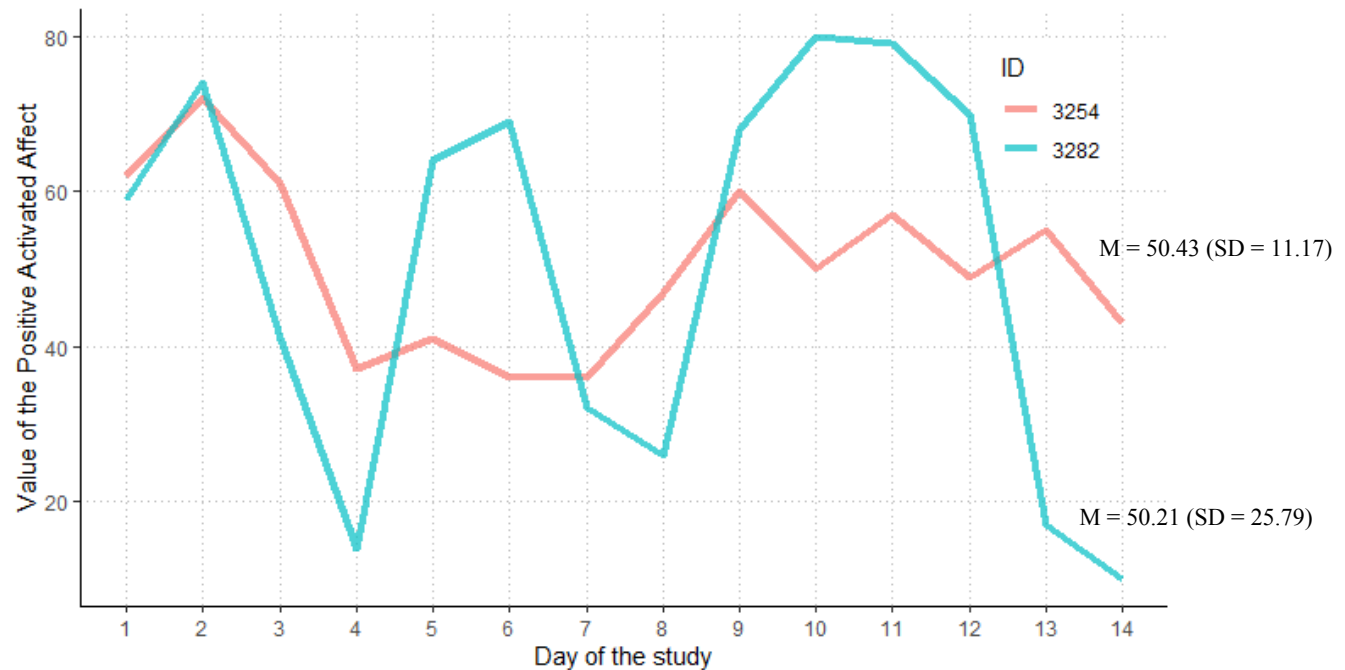
June



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**73%**

Compliance  
rate



## Example: Within-Person Variability in Positive Activated Affect

subset of 13 people with data from evening EMA questionnaire

# Illustrative example: Analytical advantages



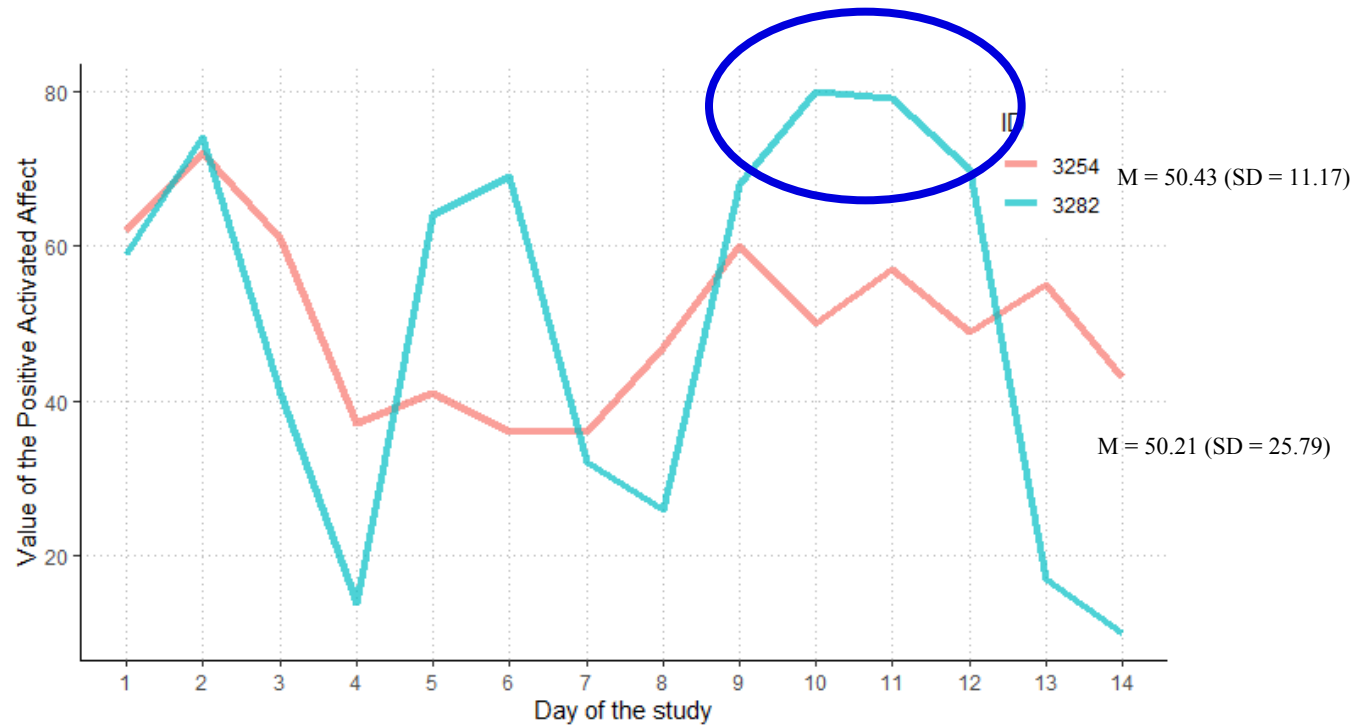
June



N = 201

**73%**

Compliance rate



## Example: Within-Person Variability in Positive Activated Affect

subset of 13 people with data from evening EMA questionnaire

# Feasible? Yes!

However...



## Technical issues

- Different devices, Google Play policy, questionnaire notifications



## Intensive testing required

- 5 pilot studies (N=85), numerous in-house pilot tests



## Recruitment difficulties

- Combination of recruitment agency and social media (low willingness to participate)



## Privacy concerns

- Parents, participants, schools (research advertisement problem)



## Study protocol adjustments

- Fitting questionnaire window to adjust participants' school attendance and hobbies