



Annual Privacy Forum 2015

"bringing research and policy together" 7-8 October, Luxembourg

Privacy-ABCs as a Case for Studying the Adoption of PETs by Users and Service Providers

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Motivation

- PETs are not widely adopted in practice
- Technical features are there, but socioeconomical aspects not fully addressed
- Economic costs and benefits of PETs
 - Technology specific
 - Application specific
- We focus on one PET and one application scenario
 - Privacy-ABCs
 - Anonymous Surveys
- We explore factors affecting adoption of Privacy-ABCs
 - from the user's side
 - from the service provider's side

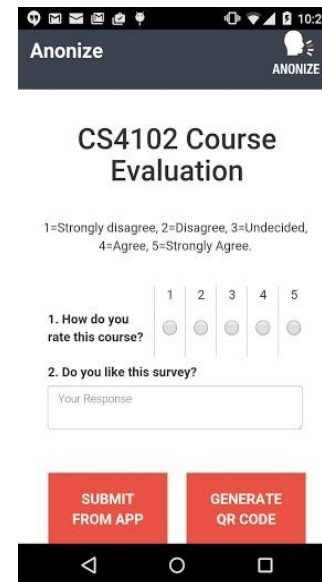
Use Case: Anonymous Surveys

Survey responders can speak their minds with the assurance that it's mathematically impossible for anyone to identify them.

Case 1: EU-Project ABC4Trust



Case 2: Anonize Project (Cornell Tech)

A screenshot of the Anonize mobile application interface. At the top, the status bar shows the time as 10:25. The app header is dark grey with the word 'Anonize' and a profile icon. The main title is 'CS4102 Course Evaluation'. Below it, a legend states: '1=Strongly disagree, 2=Disagree, 3=Undecided, 4=Agree, 5=Strongly Agree.' The first question is '1. How do you rate this course?' with a rating scale from 1 to 5. The second question is '2. Do you like this survey?' with a text input field labeled 'Your Response'. At the bottom, there are two red buttons: 'SUBMIT FROM APP' and 'GENERATE QR CODE'.

Advantages of Privacy-ABCs

- Privacy-ABCs are by default untraceable

IdSPs are not able to track and trace at which sites the user is presenting the information

- Privacy-ABCs can be obtained in advance and stored

No real-time burden of the IdSP – better scalability

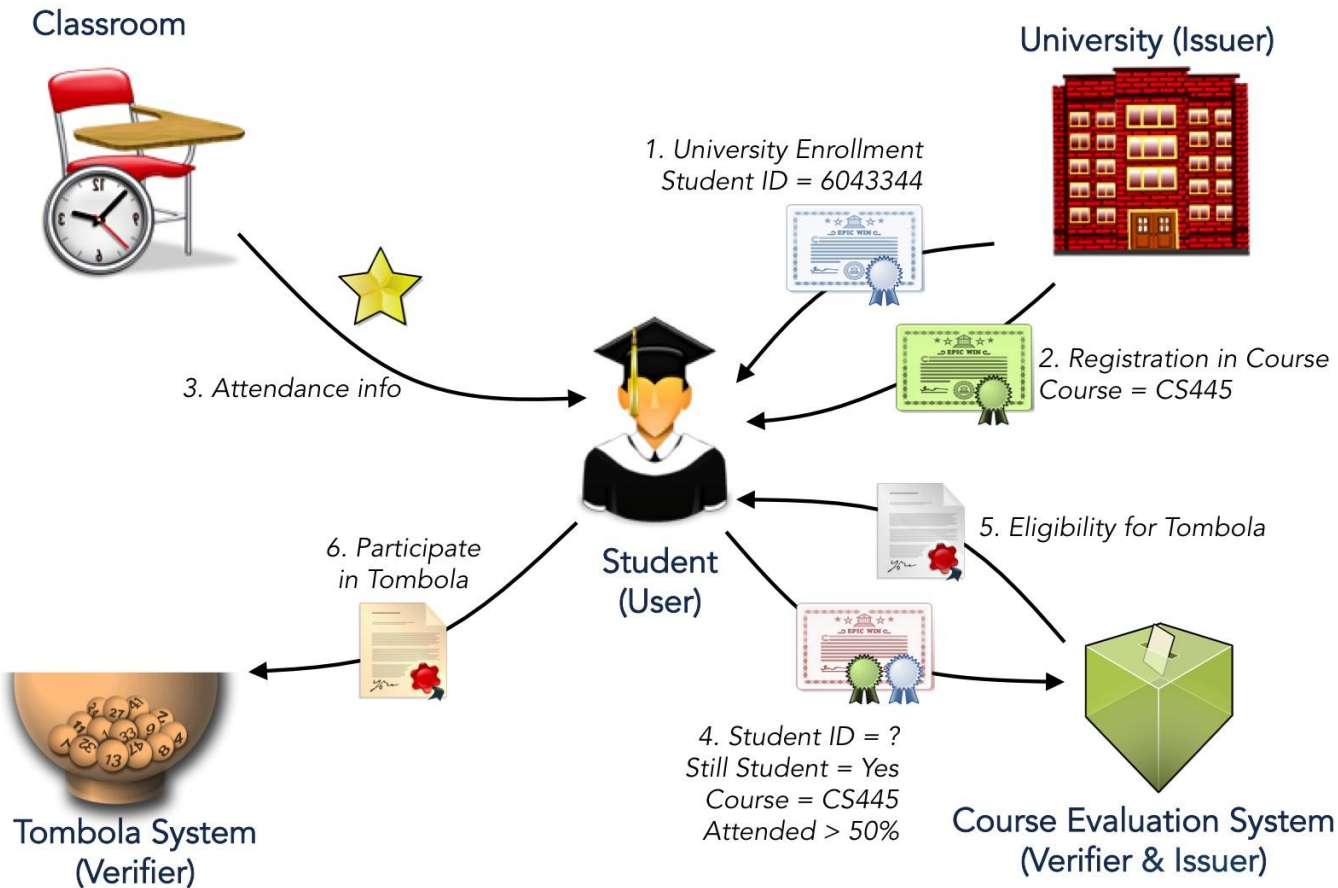
- User-binding

No credential pooling possible – Presentation requires proof of knowledge of a secret key (stored on a secure device like SC)

- Unlimited number of pseudonyms supported

In addition to which, scope-exclusive pseudonyms can be imposed – user can only register one pseudonym per scope (URL).

Patras Pilot of ABC4Trust



Course Evaluation

chrome://samples - English Presentation Credential Selection - Mozilla Firefox

English Presentation Credential Selection

Eng : Instruction : First, Please select policy. Second, select credentials from 'Credential Options'. Third, select Pseudonyms and Inspector. Presentation token information will be updated dynamically.

English : Presentation Policy
Policy: Authorized Students only

Selection

Credential Options

no credential
No Credential : Select Pseudonym :
No detection : 13

Pseudonym Options

No Description Pseudonymed pseudonym
Scope : um-patras-registration

Inspector Options

Inspector Choice List does not exist

Presentation Token

there is no credentials in token

Pseudonym Information

No Description Pseudonymed pseudonym Scope
: um-patras-registration

Inspector Information

Submit Cancel



ABC⁴TRUST Course Evaluation System

Log out
Hello Kisa-pseudonym2

Home Course Questionnaires Contact

Home

Questionnaire for Course1

Submitted by professor2 on Mon, 02/20/2012 - 13:07

Classroom

Was any of the provided reading material (files, script, slides e.t.c) non comprehensive? *

☐ Yes
☐ No

Select a number from 1 to 10 for each question. *

	1	2	3	5	6	7	8	9	10
Were the course topics presented in a clear and understandable manner?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Was the pace of the presentation appropriate?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How good was the connection to other courses?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Did the presented lectures cover all important areas of the course subject?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have the course objectives as laid out in the curriculum been covered?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do lectures prepare well a student for using the acquired knowledge in practice?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Professor

In which level are you satisfied from each of the subjects below? *

	A lot	Enough	Not at all
Did the instructor encourage student participation?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Was the instructor well-prepared?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Did the instructor know the material?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Did the instructor encourage students to formulate questions and to develop their own discretion?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Did the instructor succeed in stimulating interest in the subject of course?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Facility

Select one of the options below. *

	Bad	Average	Good	Excellent
Was the facility comfortable?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Was the facility clear of distractions?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Were you able to hear the instructor?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overall impression?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Save Draft Submit



Patras Pilot User Trial

- Course “Distributed Systems I” (80 students)
- 42 students participated in the pilot with a SC
- From 23. November 2012 – 11. February 2013
- Printed questionnaires distributed to 54 students

Questionnaire:

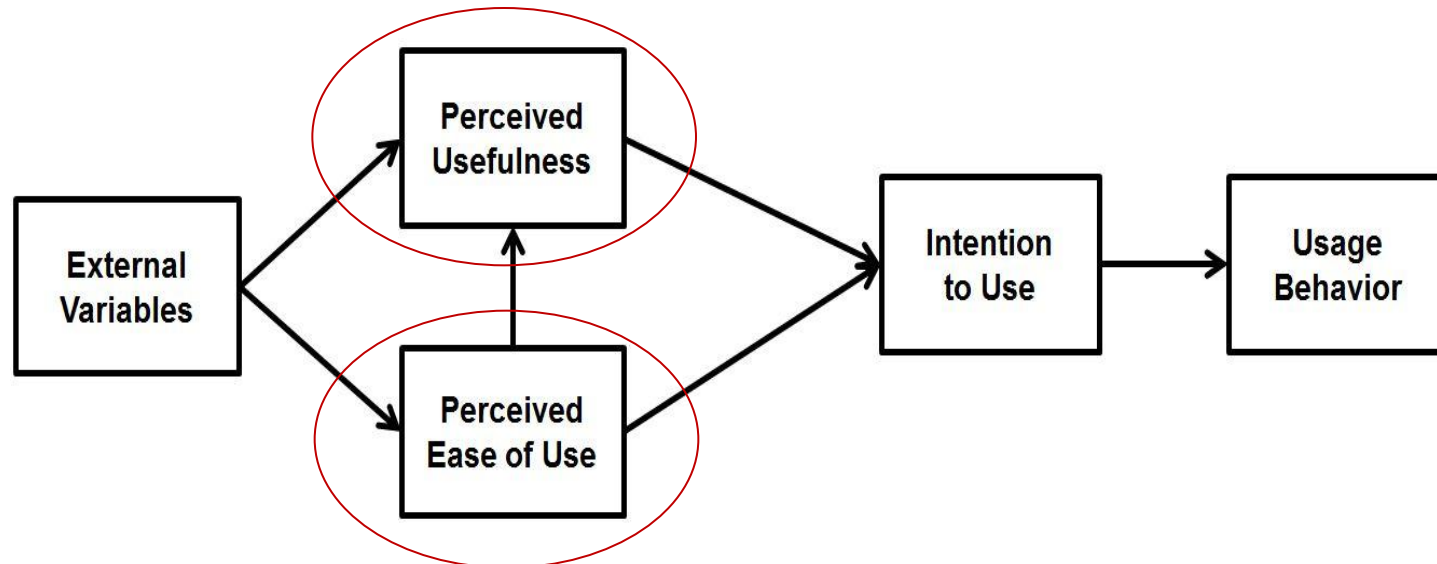
- 54 students: 23 years old on average (36 male, 18 female)
- 41 respondents used the system,
- 13 did not used the system

Goal of the questionnaire:

- What factors influence user acceptance of Privacy-ABCs?

Technology Acceptance Model (Davis 89)

Classic TAM considers **Perceived Usefulness** and **Perceived Ease of Use** as main factors in user acceptance

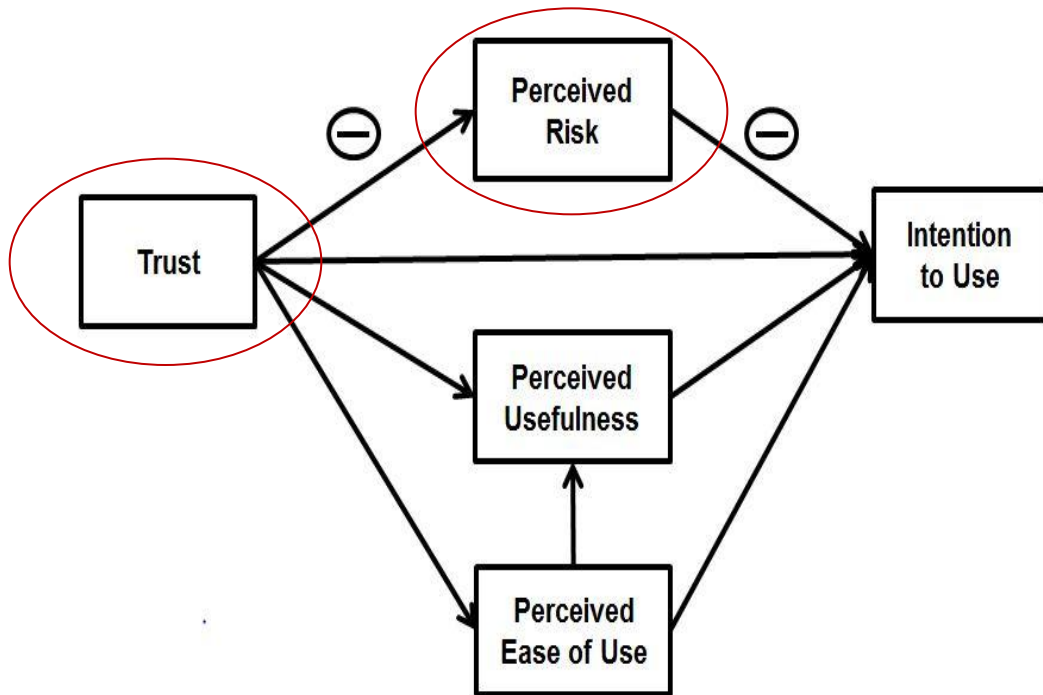


Adaptation of Perceived Usefulness

- PU for the **Primary Task** (PU1)
 - Degree to which a person believes the system to be useful for the **primary task** (= course evaluation)
- PU for the **Secondary Task** (PU2)
 - Degree to which a person believes the system to be useful for the **secondary task** (= privacy protection)
- Novel extension to the TAM
 - Specific to security- and privacy-enhancing technologies

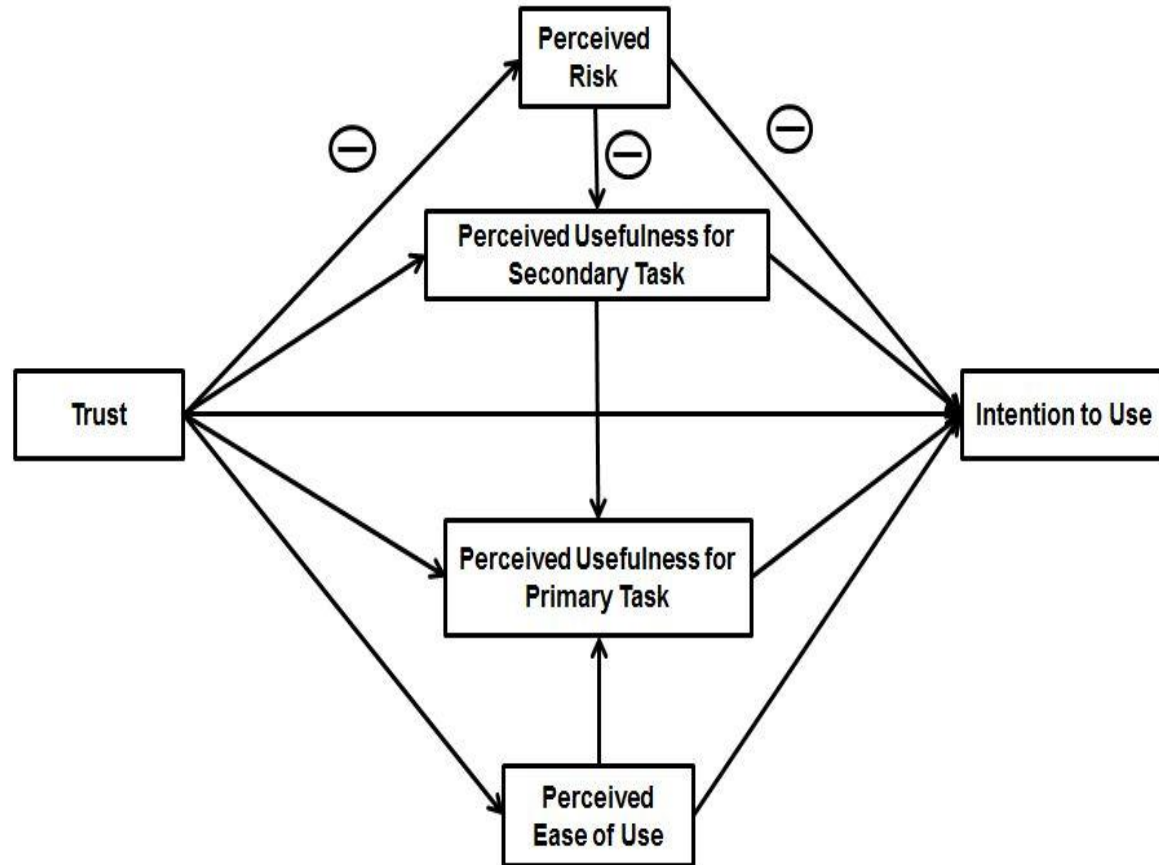
TAM + Trust + Risk (Pavlou 03)

Pavlou integrated **Trust** and **Perceived Risk** into the TAM, which we also considered in our model.

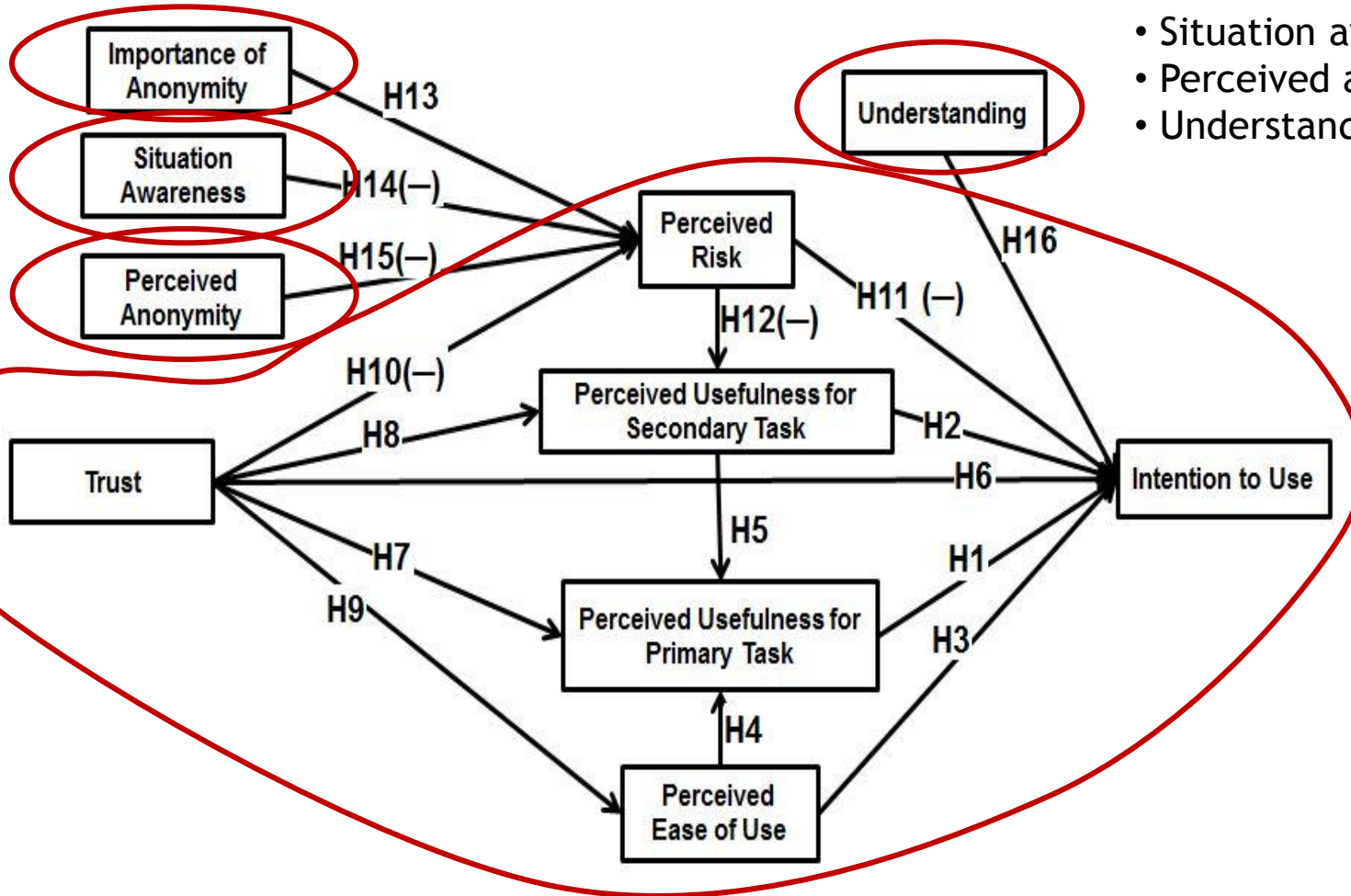


- Trust into the Privacy-ABC technology
- Perceived Risk of usage of Privacy-ABCs

The model so far...



The model so far...



Additional factors:

- Situation awareness
- Perceived anonymity
- Understanding of technology

Conclusions for users' side

- Ease of Use, both kinds of Perceived Usefulness, Trust and Situation Awareness are significantly positively correlated to the intention to use Privacy-ABCs
- Perceived Risk is significantly negatively correlated
- Perceived Usefulness for Primary Task is the most important one for user acceptance
- no correlation between the Understanding of Privacy-ABCs and the intention to use them
- Analytical details are presented in the following paper:
Z. Benenson, A. Girard, I. Krontiris, "User acceptance factors for anonymous credentials: An empirical investigation", In Workshop on the Economics of Information Security (WEIS), 22-23 June 2015.

Cost-Benefit Trade-Offs

Usability issues

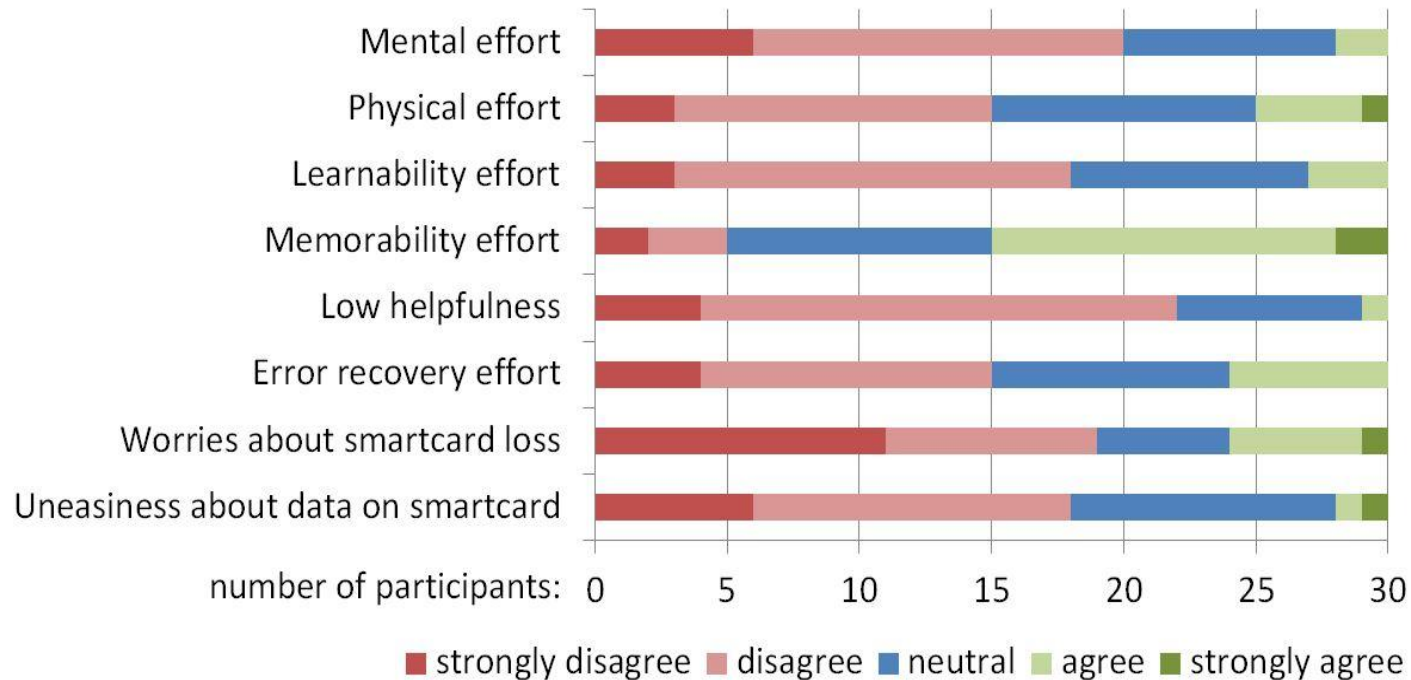
- Mental effort
 - Interaction with the system
- Physical effort
 - E.g. handling smartcard, etc.
- Learnability effort
- Memorability effort
 - Remembering how to interact with it
- Low helpfulness
 - Help information provided
- Error recovery effort
- Worries about smartcard loss
- Uneasiness about data on smartcard



Perceived usefulness

- For primary task
- For secondary task

Usability Costs of Privacy-ABCs



Adoption of PETs by Service Providers

- Technology
 - Compatibility with existing protocols and standards
 - Complexity to understand and use
 - Trialability and Observability
- Organization
 - Top management support
 - Business model dependency on user data collection
- External Pressure
 - Regulatory pressure
 - Social pressure
 - Extend of adoption among competitors
 - Standardization
- Environment
 - Established infrastructure readiness

Cost-Benefit Trade-Offs

- Data usability loss
 - Business models currently based on personal data
- Social loss
 - Uncertainty created to users
- Integration and deployment costs
 - Lack of engineering practices for PETs
 - Different standards and regulations
- Educational costs
 - Educate the users how to use it



- Reduced risk of data breaches and misuse
 - Efficient protection of personal data
- Reduced reputation loss
 - Regulation mandates disclose of privacy failures
- Better protection of trade secrets
 - Unlinkability property

Recommendations

Users

- still missing more and broader field trials to explore the socioeconomic factors of privacy technologies.
- we should investigate not only adopters, but also non-adopters of PETs in order to better understand the acceptance factors.

Service provider

reliable data to inform the analysis:

- there is a need of reliable estimates of the potential loss from a privacy incident.
- data on the reputation impact of privacy breach notifications or on the revenue loss of firms due to privacy concerns.