

A Study on The Value of Location Privacy

Dan Cvrcek[⊗], George Danezis[⊕], Marek Kumpost[⊗],
Vashek Matyas[⊗]

[⊗] Masaryk U. Brno, Czech Rep.

[⊕] K.U. Leuven, Belgium

Starting Points

- Privacy intrusive technologies become more common
 - GSM system used for tracking down particular handsets (more precise than needed for the GSM system itself)
- What is the value of privacy?
 - How much are people willing to pay to protect their privacy (location privacy in this case)
 - What are black market prices and penalties
 - UK: £17.50 for address; up to £500 for criminal records check; £750 for mobile phone account details. (UK IPC, May 2006)
 - UK – penalties for privacy breaches in low £'000 per individual
 - US health data (HIPAA) – civil penalty \$100 per violation
- Design a study about how much people want to get for being tracked 24/7

Grounds of the Experiment

- 2005 Cambridge University Study
 - *How Much is Location Privacy Worth (WEIS 2005)*
 - Same goal: money people ask for being tracked by mobiles
 - Subjects were students in the Computer Lab
 - about 75 students, homogenous population, identifiable
- Monetary compensation but our budget is limited
 - what's your bid to take part
- The cover-story
 - Study about mobility of people to assess appropriateness of the mobile networks' topologies
 - Scanning every 5 minutes, 24x7 for 30 days
 - Academic research, no commercial exploitation of the raw data
 - Position resolution 800m in rural areas / 100-200m in towns

New Study

- Organised within FIDIS project (www.fidis.net)
 - Spring 2006
 - Pseudonymity, with only email address provided
- Five countries involved
 - Belgium, Czech Republic, Germany, Greece, Slovakia
- Information advertised to
 - University students (IT) – all countries
 - University students (regardless on study) – CZ, DE, SK
 - Mobile phone community – CZ, DE

Structure of the Implementation

- First form (webpage)
 - Language
 - Background (computers, law, other)
 - Gender
 - Network operator used (list of local operators)
 - Do you carry your mobile all the time?
 - How often are irregular movements (hourly, daily, weekly, monthly)?
 - Who do you talk to (friends, family, partner, business)?
- Second form
 - Commercial exploitation (decline, same bid, revised bid)
- Third form
 - Commercial use for one year (decline, write the bid)

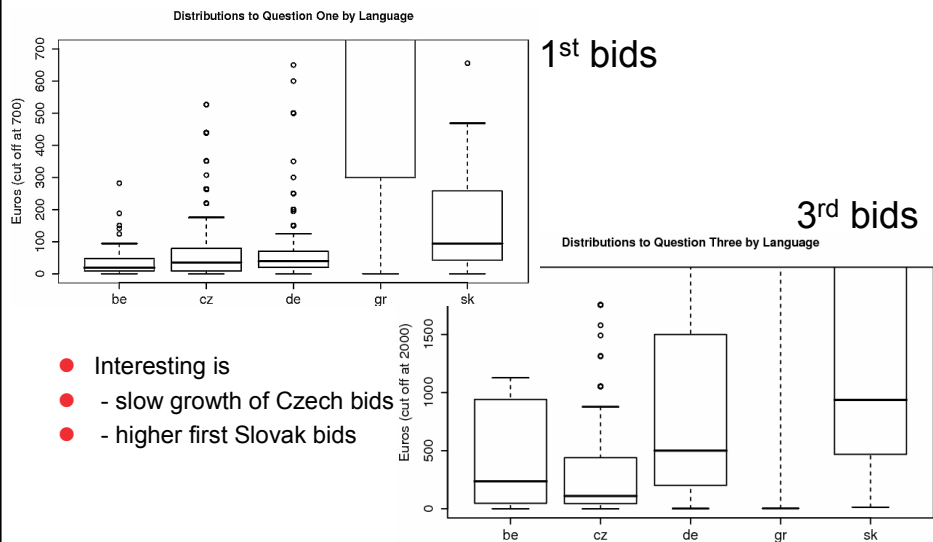
Demographics

- Number of participants per country
 - Belgium 37/3 (# of participants/females)
 - Czech Republic 744/131
 - Germany 251/33
 - Greece 30/6
 - Slovak Republic 152/46
- Students in all countries, mobile phone communities in Czech Republic and Germany
- Size of sample sets
 - Czech Republic, Germany, Slovak Republic – detailed analyses
 - Belgium, Greece – too small, control sets

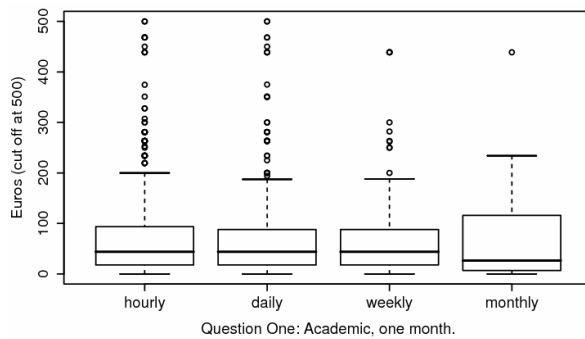
Cautiousness

- Drop-out rates
 - Early drop-outs (239 out of 2582)
 - BE 12 % CZ 6 % DE 12 % GR 25 % SK 12 %
 - Standard drop-outs
 - BE 56 % CZ 44 % DE 48 % GR 68 % SK 58 %
- Not interested
 - Greeks stand out, unfortunately the sample set too small
 - There is a remarkable number of really high bids
 - creating “linearity” from “not interested” to average bid

Differences among Countries

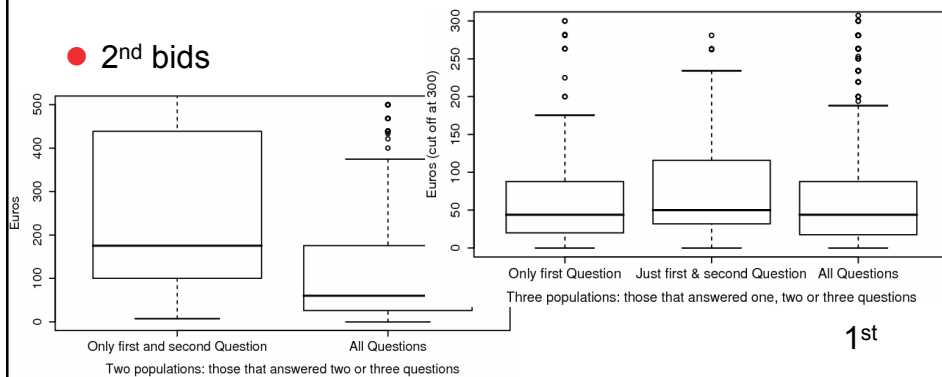


Mobility



- Sizes of sample sets: daily 520, hourly 485, weekly 195, monthly 15
- Expectation was that there is correlation between values and irregular movements

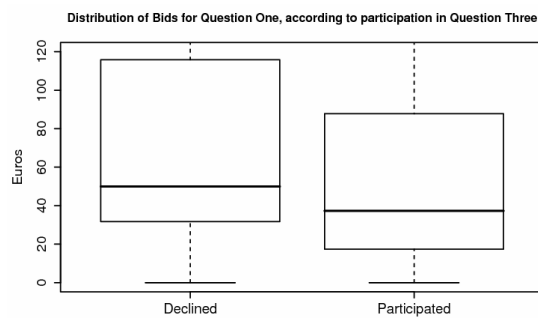
Impact of scenarios



- Curiosity vs privacy cautiousness
 - Left – low bids: curiosity and falling off in the second round
 - Middle – higher bids, increased in the second round
 - Right – low first bid increased in each consecutive round

Impact of Scenarios II

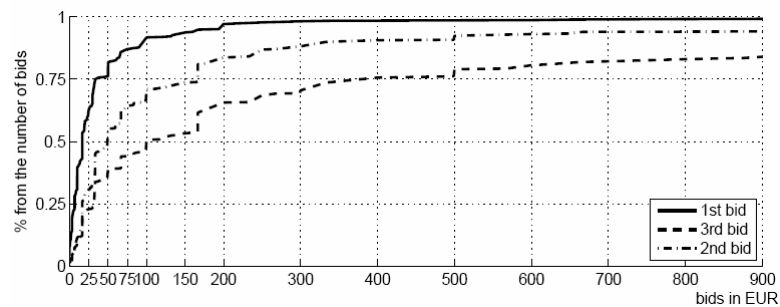
- Medians of the first bids according to answers in the second round (decline, same, revise) are all the same – 47 EUR
- Bids according to answers in the third round (declined, participated)



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Overall distribution of bids



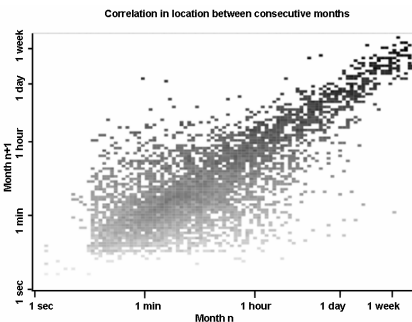
- Second bids (2.5x first bids)
- Third bids (2x second bids)

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Non-linearity in time

- 12-fold increase in the experiment length
 - 2x increase of the bids
- Hypothesis
 - Data after the 1st month are of less value
 - Little information in consecutive data
- Correlation between consecutive months (MIT Reality Mining project)



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Why Participating in The Study

- Questioned after the experiment
 - 300 responses (25 % of the participants)
- Why did you take part in the experiment
 - Money (38 %), results (32 %), fun (30 %)
- Correlated bid values (medians)
 - 1st auction: 12, 8, 9 (roughly)
 - 2nd auction: 9, 5, 6 (roughly)
 - No substantial difference between bids

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Conclusions

- 10 % of participants bidding < €1
 - Curiosity and enthusiasm for cover story
- Greek sensitivity to privacy breaches
 - Eavesdropping scandal a couple of months before
- Non-linearity in regard of the study length
- No correlation between bids and movements
- Insignificant difference between sexes
 - the 2nd and 3rd bids 1.4 : 1 (F : M)
- Medians of Cambridge study correspond to our results (€43 to £28)

Your turn ...