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The Effect of Context on Smartphone Usage Sessions

Master's thesis
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Background

- Context information provides a possibility to produce more personalized mobile consumer services
- Analyzing smartphone usage sessions gives an overview of smartphone usage
 - Adding context information gives more depth into the usage analysis
- New handset-based data available
 - Cell id data, WiFi scan data, Bluetooth scan data
 - A possibility to pursue more accurate context detection
 - Better context detection algorithms needed

Research questions

- What are the effects of context on smartphone usage sessions?
 - a) How to use cell id data, WiFi scan data, and Bluetooth scan data to detect mobile user contexts?
 - b) How to extract smartphone usage sessions from smartphone application usage data?
 - c) What are the characteristics of mobile user context?
 - d) What are the characteristics of smartphone usage sessions?
 - e) How does the mobile user context affect the characteristics of smartphone usage sessions?

Structure of the research

Context detection

- Define context
- Extract context information from the data (context detection algorithm)
- Study the context information

Smartphone usage sessions

- Define smartphone usage session
- Extract usage session information from the data
- Study the usage session information



Combining context information and smartphone usage information

- Study the characteristics of usage sessions in different contexts

Defining context

- Merriam Webster Online Dictionary: Context is "the interrelated conditions in which something exists or occurs"
- Dey (2001): "Context is any information that can be used to characterize the situation of an entity"
- In this work the information narrows to time and place information, and information about nearby people
- The entities are the user and the user's smartphone

Contexts used in this work

Place-related contexts:

- Abroad
- Home
- Office
- Other meaningful
- Elsewhere

Other:

- Social context

Defining a smartphone usage session

- Smartphone usage session is an encounter between a user and a smartphone
- The user interacts with smartphone applications
- A usage session consists of one or more application sessions

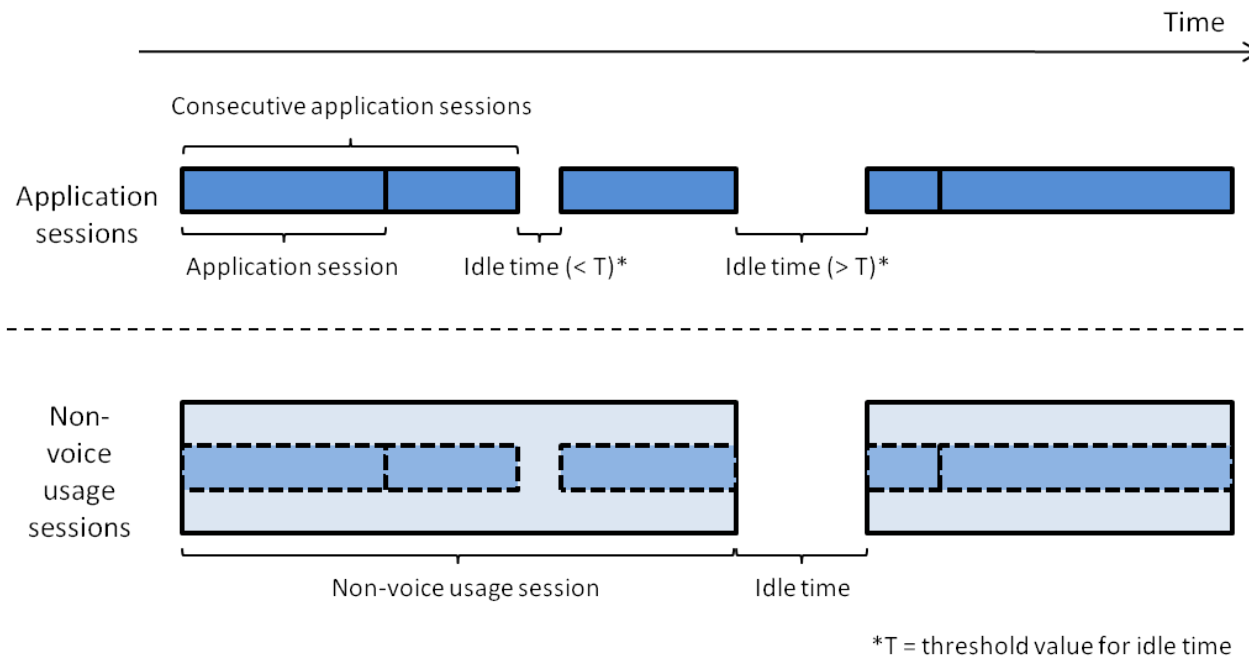
Technical definitions from other studies:

- Falaki et al. (2010); Rahmati & Zhong (2009): A smartphone usage session is under way whenever the smartphone's screen is on
- Oliver (2010): ...whenever the smartphone's LCD backlight is on

Points to consider:

- Should there be an “idle time” allowed between the application sessions?
- A technical definition applicable to our application usage data is needed

Defining smartphone usage session

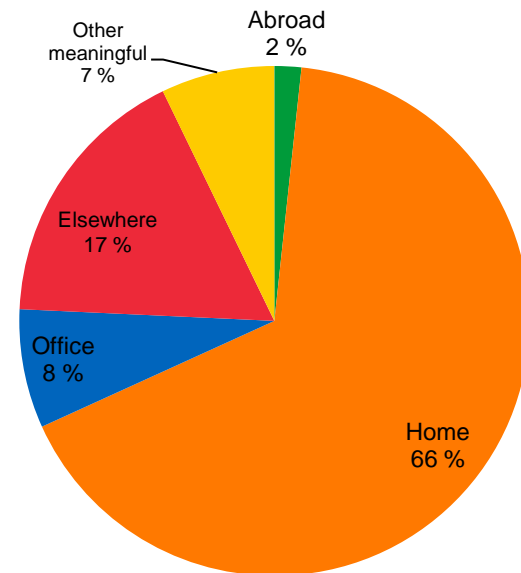


Smartphone usage session is a sequence of smartphone application sessions which have an idle time smaller than T between them.

Context information

- Cell id-based context detection and WiFi scan-based context detection combined
- Aggregated results from 140 users
- Home detected for 139 users
- Office detected for 116 users (but only 54 without WiFi)
- Time share results similar to other studies (Jiménez 2008; Bayir et al. 2010; Eurostat 2004)

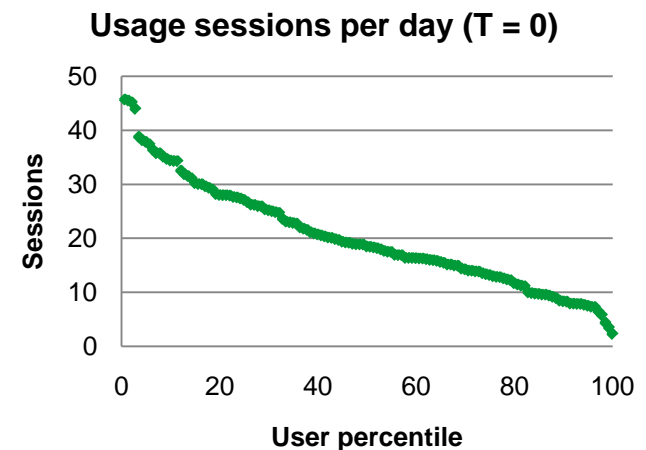
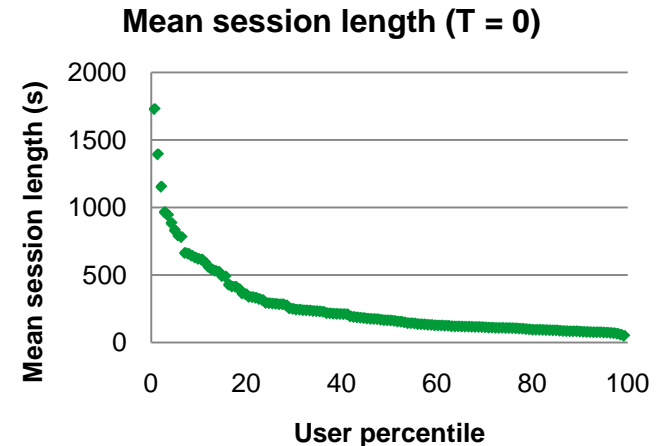
Share of time spent in different contexts



Smartphone usage sessions

- Smartphone usage is very diversified between users
- Majority of the sessions are very short, i.e., the distribution of session lengths has a very long tail

Case	Mean session length	Median session length	Sessions per day	Interaction time per day
T = 0	263 seconds	57 seconds	20	74 minutes
T = 30	429 seconds	101 seconds	13	74 minutes



Smartphone usage sessions

Comparison to similar smartphone usage studies

	Mean session length	Sessions per hour	Interaction time per hour
Oliver (2010)	1 min 8 sec	3,6	4 min 12 sec
Rahmati & Zhong (2009)	6 min	0,42	3 min
Our study (T = 0)	4 min 23 sec	0,83	3 min 2 sec
Our study (T = 30)	7 min 9 sec	0,54	3 min 5 sec
Falaki et al. (2010)	10 sec - 4 min 10 sec	0,42 - 8,3	1 min 15 sec - 20 min 50 sec

Differences in session lengths and sessions per hour are most likely due to differing definitions of a usage session

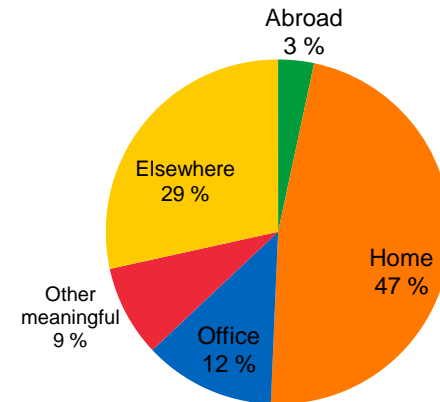
Interaction times are quite similar

In all of the studies the usage is very diversified between users, and most of the sessions are short

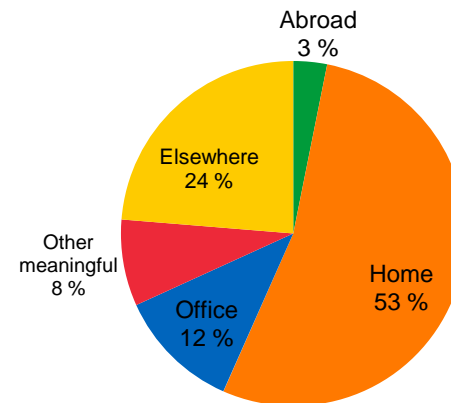
Usage sessions in different contexts

- Home context dominates in the absolute measures of smartphone usage
 - It is, however, notable that the shares are much lower than the share of time spent at Home
- These shares compared to the shares of time spent in different contexts indicate differences in intensity of usage
- The differences in the shares of sessions and the shares of interaction time indicate differences in session lengths

Share of sessions per context (T = 0)



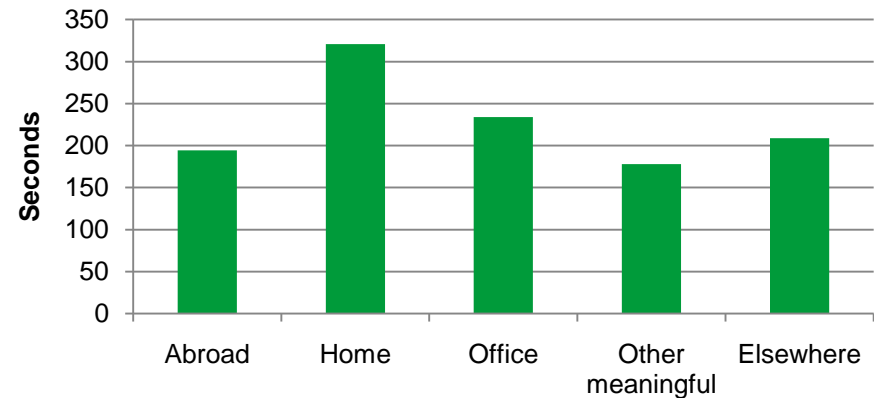
Share of interaction time per context



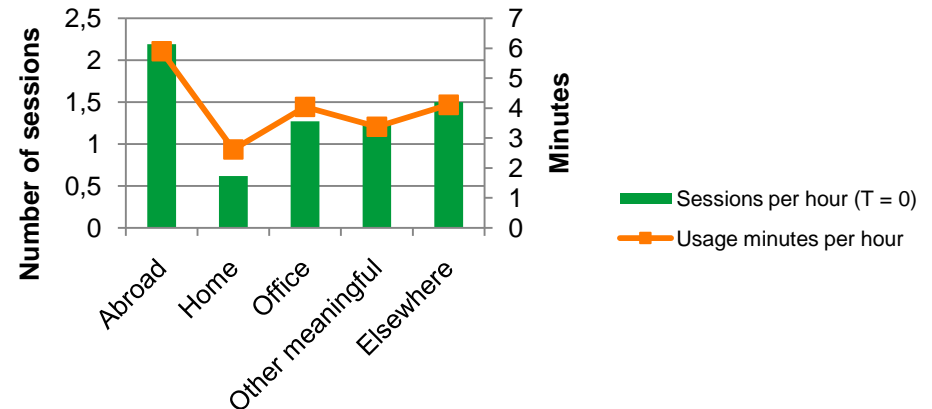
Usage sessions in different contexts

- Home context has the longest sessions, but the lowest intensity of usage
- Other contexts have notably shorter sessions, but higher intensity of usage
- There is a need to be careful when drawing conclusions
 - E.g., the intensity of usage at home is lowered by the night hours
 - Median session lengths are more similar between the contexts

Mean session length per context (T = 0)



Intensity of usage



Conclusions and future research

- Based on this study, context seems to have an effect on smartphone usage sessions
- Next steps
 - Deeper context detection
 - Analyzing the structure (e.g. applications) of the smartphone usage sessions
 - Link the analysis to the theory of value of time

Thank you!

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