TaskyApp: Inferring Task Engagement via Smartphone Sensing

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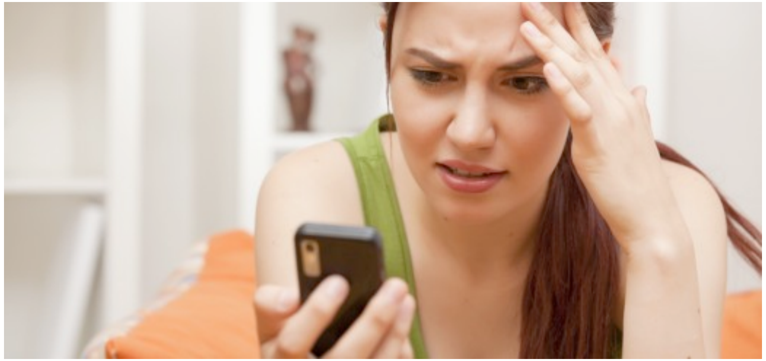
Interruptibility and Task Engagement

Location

Movement

Time of day



Sender

Content

Task engagement

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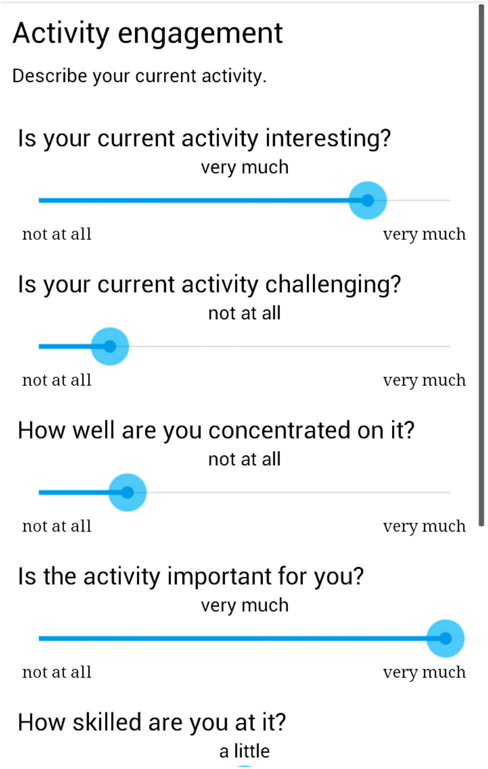
V. Pejovic, A. Mehrotra, and M. Musolesi, *Investigating the Role of Task Engagement in Mobile Interruptibility,* Smarttention'15 Workshop, Copenhagen, Denmark

A. Mehrotra, M. Musolesi, R. Hendley and V. Pejovic, *Designing Content-Driven Intelligent Notification Mechanisms for Mobile Applications,* ACM UbiComp'15, Osaka, Japan.

V. Pejovic and M. Musolesi, *InterruptMe: Designing Intelligent Prompting Mechanisms for Pervasive Applications,* ACM UbiComp'14, Seattle, WA, USA

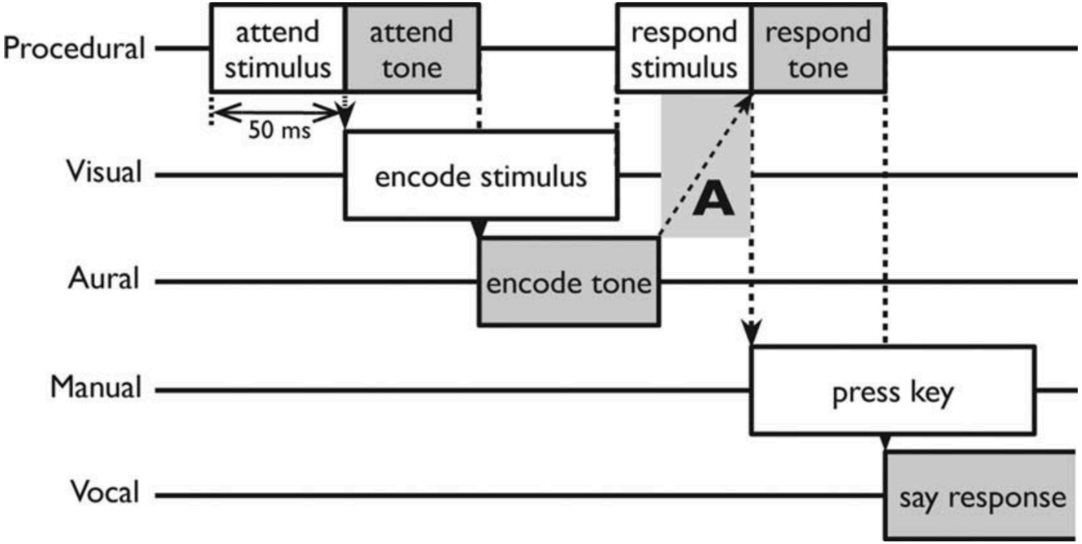
Interruptibility and Task Engagement

- Link between task engagement and opportunity to interrupt (self-reported)
  - More skilled a person is, less she will be irritated by an interruption
  - More challenging a task is to a person, more irritated she will be with an interruption
  - More concentrated a person is on a task, more she will be irritated by an interruption



Theory of Multitasking

- Interference when two or more threads ask for the same resource at a time



Example from [Borst2010]

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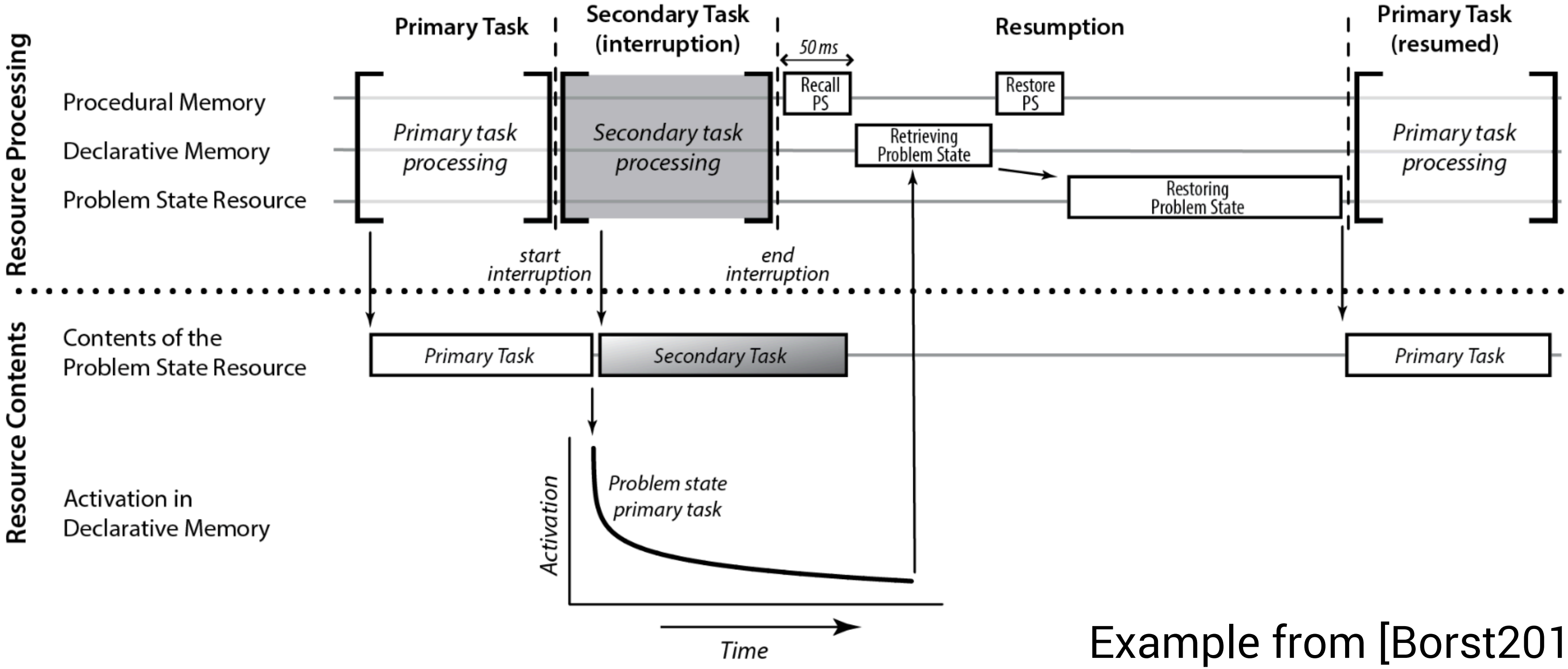
Theory of Multitasking

- Complex tasks require problem state saving/retrieving

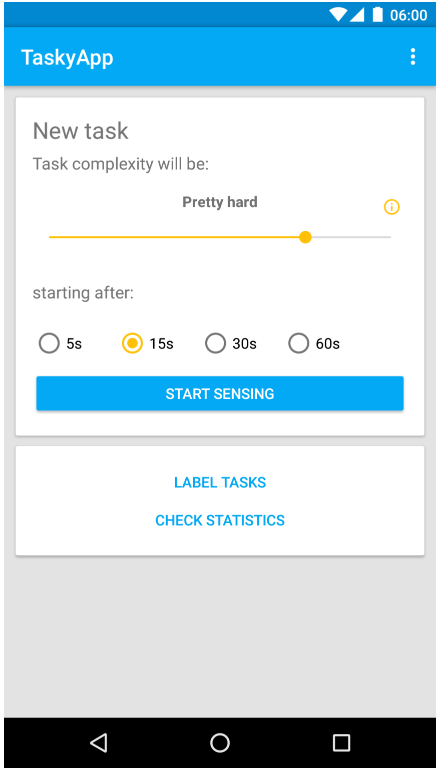


Example from [Borst2015]

Can we automatically infer task engagement?

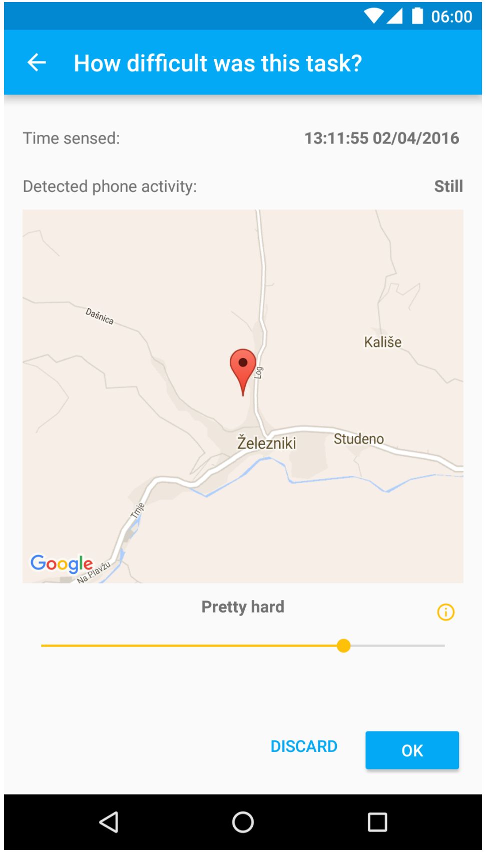
TaskyApp

- Can smartphones sense that their users are busy (in an office setting)?
- TaskyApp data collection app
  - Background sensing of:
    - Device movement (raw and Google Activity Recognition reported), ambient sound, location
    - BT/WiFi sensing
    - Screen status, sound settings
    - Google calendar events
  - Data labelling via experience sampling and retroactive assisted labelling



TaskyApp

- Data collection trial
  - Volunteering (with a chance of winning 50€)
  - Eight office workers for five weeks
    - 232 labelled instances (3035 unlabelled)
    - Most data between 8am and 6pm



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TaskyApp – Data Analysis

- Linear regression fit with task difficulty (1-5 on a Likert scale) as a dependent variable
  - Movement data gives the most informative features
  - The regression explains only a small part of the data

Variable	B(Std. Err.)	t (Sig)
Acc. Y mean	-.038 (.02)	-1.82 (.068)
Acc. Z mean	.026 (.02)	1.43 (.153)
Acc mean intensity	-.711 (.23)	**-3.04 (.003)**
Gyro. MCR	-.003 (.00)	**-4.06 (.000)**
Gyro. variance	.200 (.16)	1.24 (.217)
Hour of day	.067 (.02)	**3.49 (.001)**
Reg.Constant	*8.385 (2.31)*	*3.63 (.000)*

N=232; R^2=0.19, F=8.64 (p=.000)

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TaskyApp – Data Analysis

- Classify a task engagement moment as either easy or difficult depending on the sensed features
  - We experimented with different classifiers but Naïve Bayes seems to work best (probably due to the low amount of data)
    - 62.5% accuracy compared to 52.8% baseline
    - Also, leads to favourable errors – few difficult tasks predicted as easy

easy'	difficult'	
45 (19,4%)	62 (26,7%)	**easy**
25 (10,8%)	100 (43,1%)	**difficult**

Task Engagement Inference

- Even in a restricted office setting smartphone-based task inference is challenging
- Movement features seem to be the most informative
- Next step – wearables
  - Sense heart rate and skin temperature

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Thank you!

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