

Happier and Healthier.. with Smartphone Data

@neal_lathia
Cambridge Science Festival





Long-term Conditions (LTCs) are defined on the Department of Health website as:

“those conditions that cannot, at present, be cured, but can be controlled by medication and other therapies. The life of a person with a LTC is forever altered – there is no return to ‘normal’.”

15 million people in the UK live with a long-term health condition.

That is approximately 1 in 4 of us, or about 2 times the population of London.

Patients with long-term health conditions account for 7 out of every 10 pounds spent by the National Health Service.



*Handbook of
Research Methods
for Studying
Daily Life*

edited by
Matthias R. Mehl
Tamlin S. Conner

DIARY METHODS: Capturing Life as it is Lived

Niall Bolger, Angelina Davis, and Eshkol Rafaeli

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Key Words experience sampling method, longitudinal designs, electronic data collection, self-report measures, multilevel models

■ Abstract In diary studies, people provide frequent reports on the events and experiences of their daily lives. These reports capture the particulars of experience in a way that is not possible using traditional designs. We review the types of research questions that diary methods are best equipped to answer, the main designs that can be used, current technology for obtaining diary reports, and appropriate data analysis strategies. Major recent developments include the use of electronic forms of data collection and multilevel models in data analysis. We identify several areas of research opportunities: 1. in technology, combining electronic diary reports with collateral measures such as ambulatory heart rate; 2. in measurement, switching from measures based on between-person differences to those based on within-person changes; and 3. in research questions using diaries to (a) explain why people differ in variability rather



“by 2025, when most of today’s *psychology* undergraduates will be in their mid-30s, more than 5 billion people on our planet will be using ultra-broadband, sensor-rich smartphones far beyond the abilities of today’s iPhones, Androids, and Blackberries.”



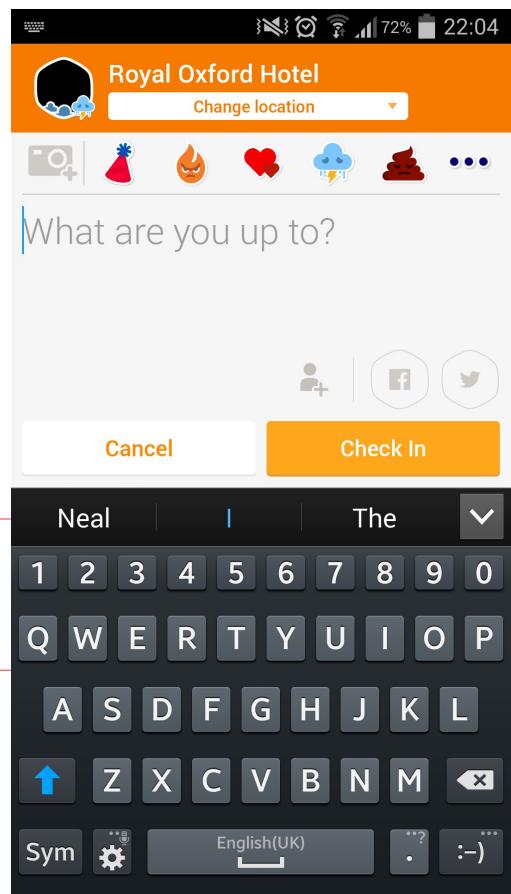


Neal Lathia
@neal_lathia
Senior Research Associate @Cambridge_Uni,
working on @EmotionSense
City of London · cl.cam.ac.uk/~nkl25/
632 FOLLOWING 1,395 FOLLOWERS

Tweets Photos Favourites

Parra @denisparra 54m
Our #sigir2015 Workshop proposal on
Social Personalization & Search
accepted, w/@peterpaws @ctrattner
@abellogin & @lbalby, updates soon !
4 2

What's happening?  



Royal Oxford Hotel
Change location

What are you up to?

Cancel Check In

Neal | The 

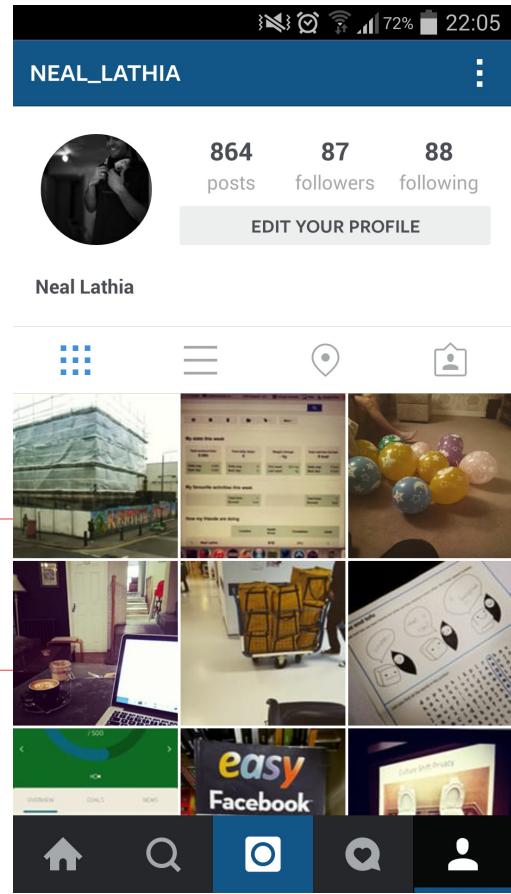
1 2 3 4 5 6 7 8 9 0

Q W E R T Y U I O P

A S D F G H J K L

Z X C V B N M 

Sym  English(UK)  . :-)



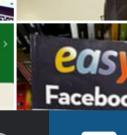
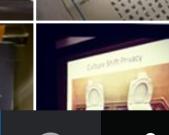
NEAL_LATHIA

864 posts 87 followers 88 following

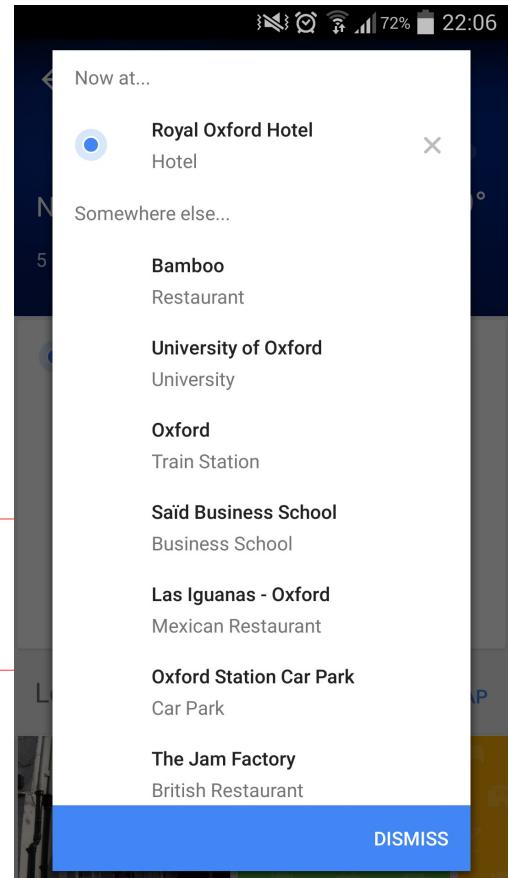
EDIT YOUR PROFILE

Neal Lathia



Now at... 

Royal Oxford Hotel
Hotel

Somewhere else...

Bamboo
Restaurant

University of Oxford
University

Oxford
Train Station

Saïd Business School
Business School

Las Iguanas - Oxford
Mexican Restaurant

Oxford Station Car Park
Car Park

The Jam Factory
British Restaurant

DISMISS

Accelerometer
GPS / Wi-Fi
Gyroscope
Bluetooth
Microphone
Humidity
Temperature
Phone / Text Logs
Device Logs
Social Media APIs
App Usage

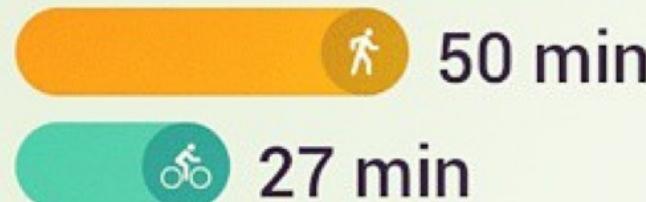


Accelerometer | Physical Activity
GPS / Wi-Fi | Mobility
Gyroscope | Orientation
Bluetooth | Co-Location
Microphone | Ambient Audio
Humidity | Environment
Temperature | Environment
Phone / Text Logs | Socialising
Device Logs | Network
Social Media APIs | Socialising
App Usage | Information Needs



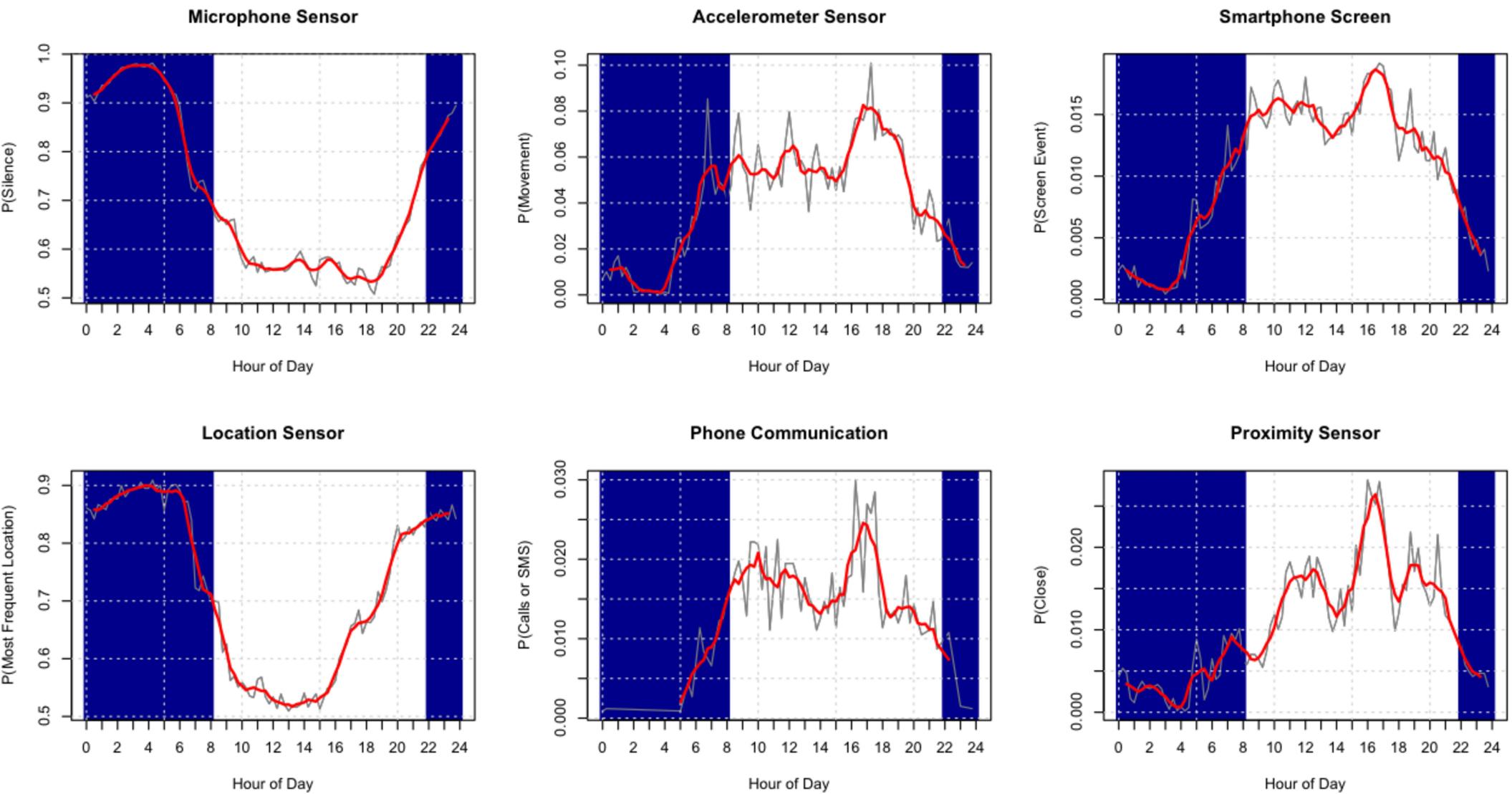
Yesterday

1 hr 18 min



● 29 min walking
Wembley • 19:39

● 15 min cycling
11 min walking
Cambridge • 18:06



Case 1: Subjective Wellbeing & Behaviour

N. Lathia, G. Sandstrom, P. Rentfrow, C. Mascolo (in prep). *Happy People Live Active Lives*. 2015.

What is Emotion Sense?

Emotion Sense is a collection of Android libraries to quickly build applications that collect sensor, mobile phone usage, and survey response data from participants of human interaction or social psychology experiments.

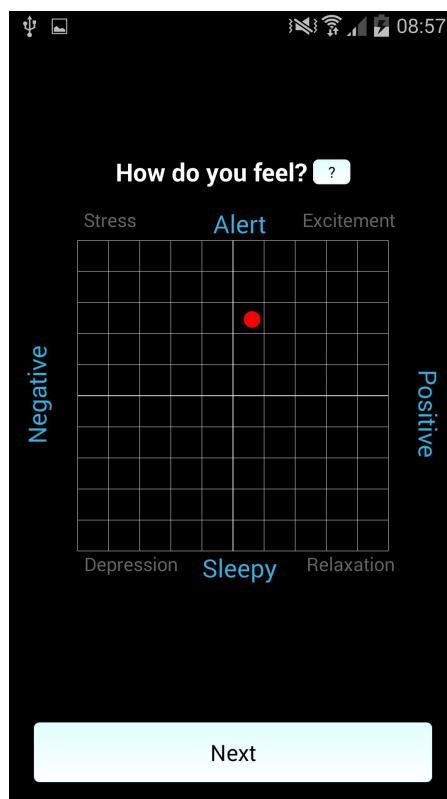
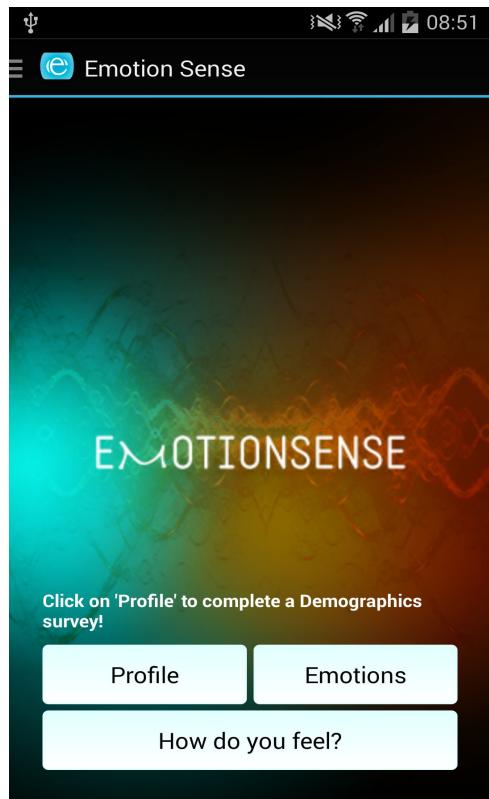
The tools are fully configurable: social scientists can define what sensor data they would like to collect, a range of surveys with questions they would like to ask, and the conditions that should trigger each survey. Similarly, participants can set the application to meet their own personal preferences, by setting when they are available to answer surveys. The application is fully automated, and its configuration can be remotely updated, in order to adapt experiments as they are ongoing.

Recent Publications

[pdf] **SociableSense: Exploring the Trade-offs of Adaptive Sampling and Computation Offloading for Social Sensing.** In Proceedings of the 17th Annual International Conference on Mobile Computing and Networking (MobiCom 2011). Las Vegas, USA, September 2011.
K. Rachuri, C. Mascolo, M. Musolesi, P. J. Rentfrow.

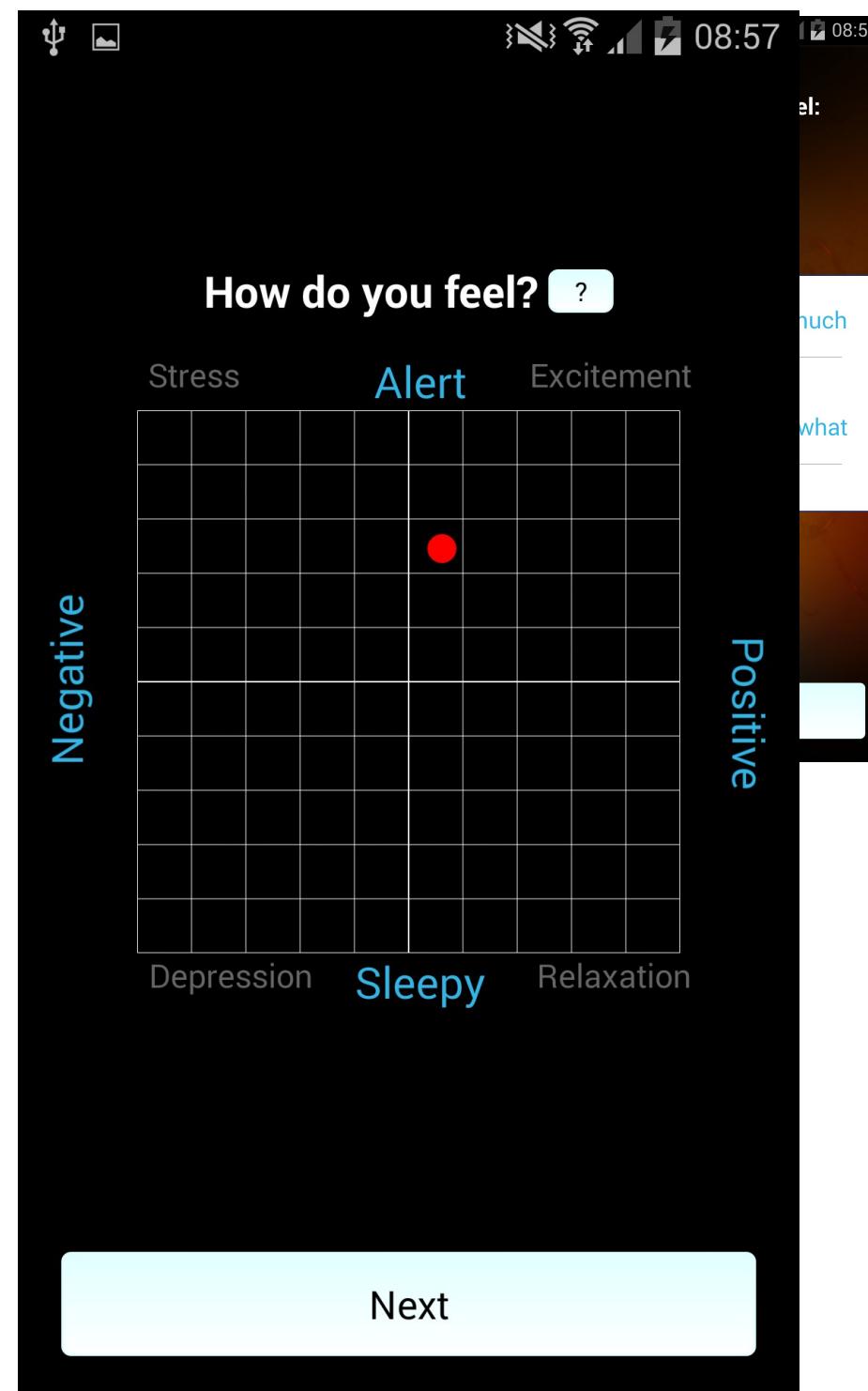
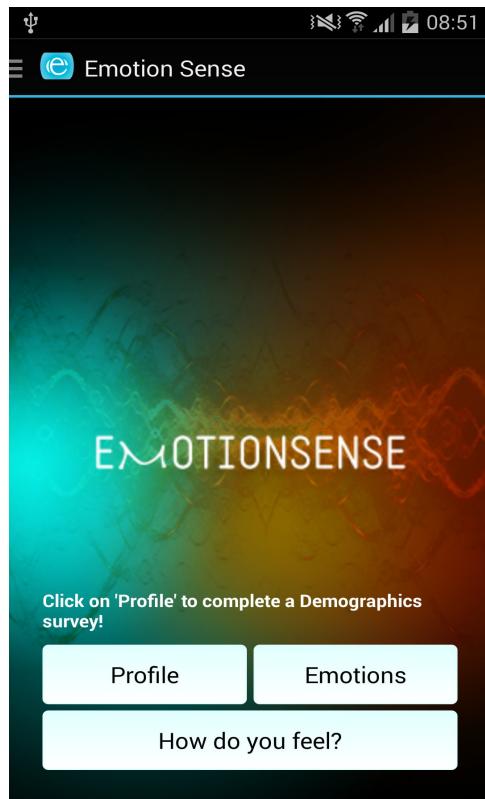
[pdf] **EmotionSense: A Mobile Phones Based Adaptive Platform for Experimental Social Psychology Research.** In Proceedings of the 12th ACM International Conference on Ubiquitous Computing. Copenhagen, Denmark. September 2010.
K. Rachuri, M. Musolesi, C. Mascolo, P. J. Rentfrow, C. Longworth, A. Aucinas.





The title "Page 1/10" and subtitle "To what extent do you feel:" are at the top. Two horizontal sliders are shown: one for "1. Calm?" with endpoints "Very much" and "Somewhat", and another for "2. Anxious?" with endpoints "Somewhat" and "Very much". Both sliders have blue circular markers near the "Very much" end. Below them is a "Submit" button.

-
- The title "Page 7/10" and subtitle "In the last 15 minutes, have you been...?" are at the top. A list of activities with checkboxes follows: "Sitting" (unchecked), "Standing" (unchecked), "Walking" (checked), "Running" (unchecked), "Lying Down" (unchecked), "Cycling" (unchecked), and "Other" (unchecked). A "Submit" button is at the bottom.



This screen shows a survey page titled "Page 7/10". The question "In the last 15 minutes, have you been...?" is displayed above a list of activities. The list is identical to the one shown in the previous screen. Below the list is a large, light-blue rectangular button with the word "Submit" in the center. The background of this screen is a dark teal color.

The image displays four screenshots of the Emotion Sense mobile application, showing various features and user data.

Screenshot 1: My Profile

This screen shows the user's profile information:

- Account: neal.lathia
- Join Date: 6 Apr 2014
- Notifications: 488
- Responses: 252
- Demographics: (not visible)
- Personality: [View](#)
- Gratitude: [View](#)

Screenshot 2: My Profile - Personality

This screen lists personality traits with "View" buttons:

- Personality: [View](#)
- Gratitude: [View](#)
- Health: [View](#)
- Sociability: [View](#)
- Job Satisfaction: [View](#)
- Life Aspirations: [View](#)
- Connectedness: [View](#)

Screenshot 3: Mood Tracking

This screen shows mood levels across three dimensions:

- How do you feel? (Alert is highlighted)
- Stress
- Excitement

Screenshot 4: Personality Report

This screen displays personality reports with "READ" buttons:

- Conscientiousness**: You scored on the lower end of the average range for conscientiousness (lower than 50% of all people). Conscientious people tend to be efficient, organized and thorough, and tend not to be careless, lazy or impulsive.
- Emotional Stability**: You scored quite high on emotional stability (higher than 75% of all people). Emotionally stable people tend to be contented and self-confident, and tend not to be tense, irritable, shy or moody.
- Extraversion**: You scored on the upper end of the average range for extraversion (higher than 50% of all people).

Emotion Sense

How do you feel? ?

Stress Alert Excitement

10:24

My Profile

Account

Join Date

Notifications

Responses

Demographic

View Persona

View Gratitudo

Time Of Day

Alert

Stress Excitement

Negative Positive

Sleepy

Depression Relaxation

Data: Last 30 days.

Colours

Page 1/10 To what extent do you feel:

Page 7/10 In the last 15 minutes, have you been...?

Sitting

Conscientiousness READ

My Emotions ?

Time Of Day

Location

SMS Patterns

Accelerometer

Phone Screen

Microphone

Call Patterns

Personality

Sociability

Conscientiousness READ

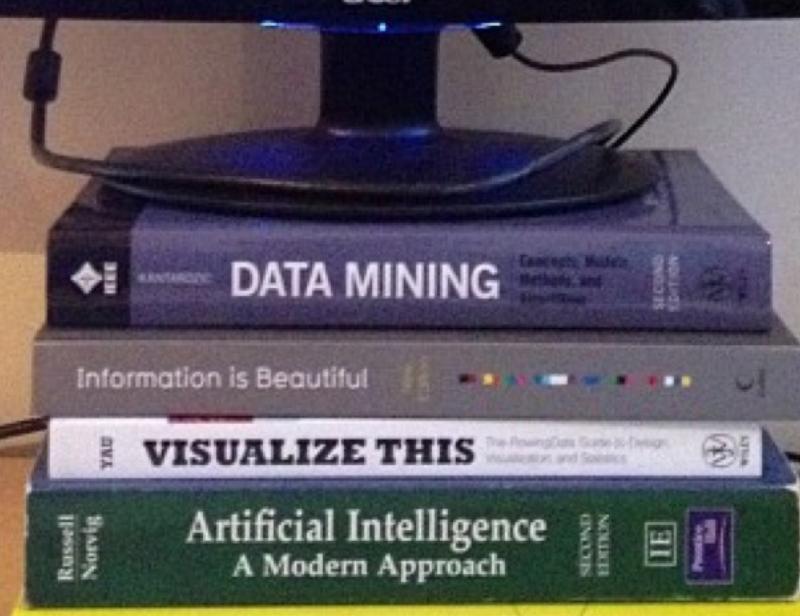
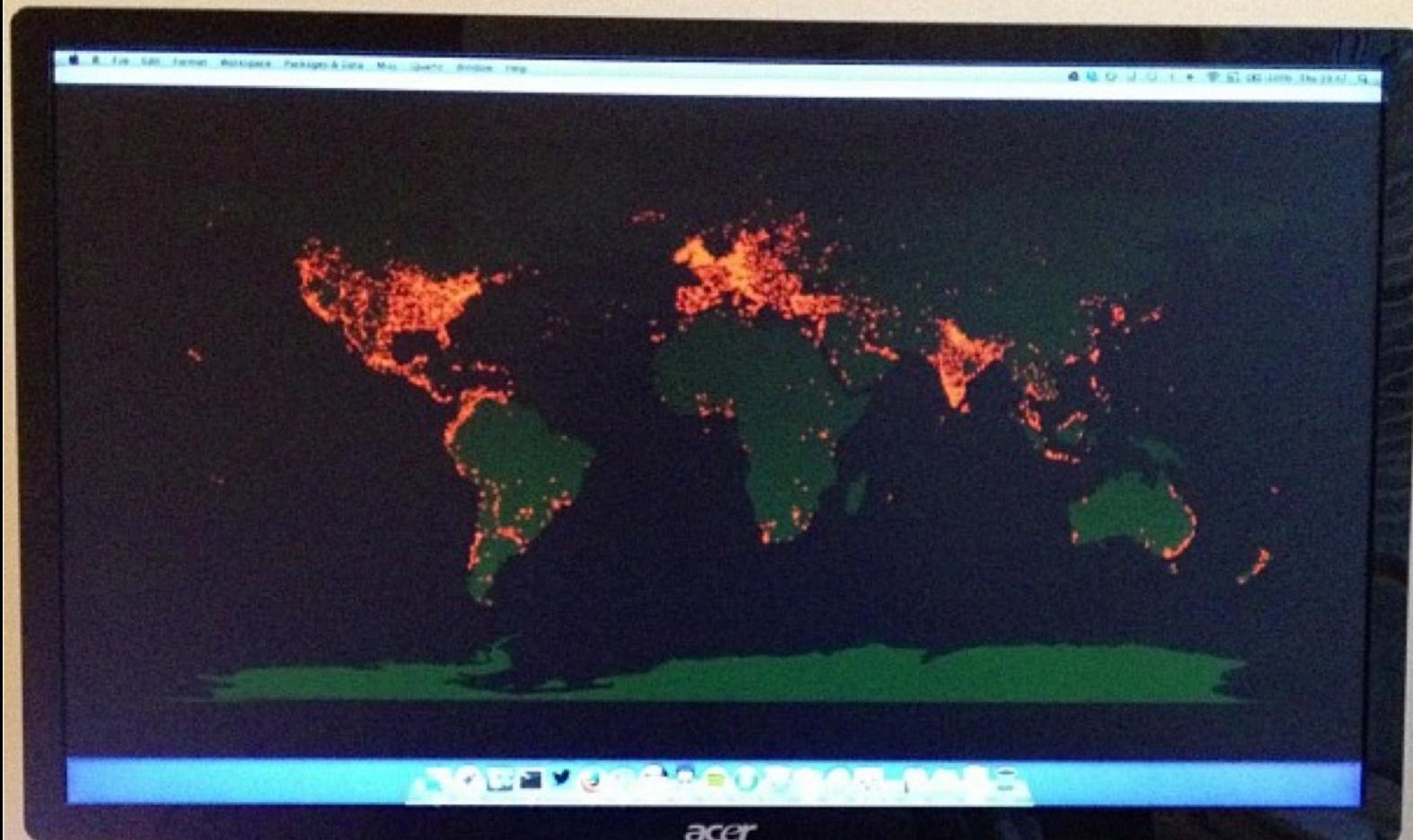
Stability READ

the lower end of the scale for conscientiousness (lower than most people). People tend to be organized and thorough, but also be careless, lazy.

quite high on stability (higher than most people). Stable people tend to be calm and self-confident, but also be tense, irritable.

in the upper end of the range for extraversion (higher than 90% of all people).

Survey Stats





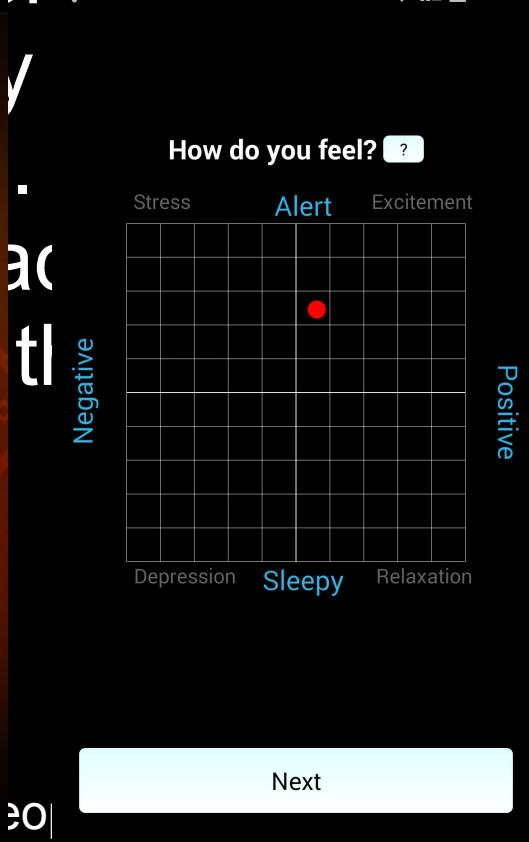
“A sample of 222 undergraduates was screened for high happiness using multiple confirming assessment filters. We compared the upper 10% of consistently very happy people with average and very unhappy people. The very happy people were highly social, and had stronger romantic and other social relationships than less happy groups...”

“A sample of 222 undergraduates was screened for high happiness using multiple confirming assessment filters. We compared the upper 10% of consistently happy individuals to the lower 10% of consistently unhappy individuals. The two groups were highly similar in terms of their social support from other social groups...”

Page 1/5
To what extent do you agree:

In most ways my life is close to my ideal.
Slightly agree

Submit

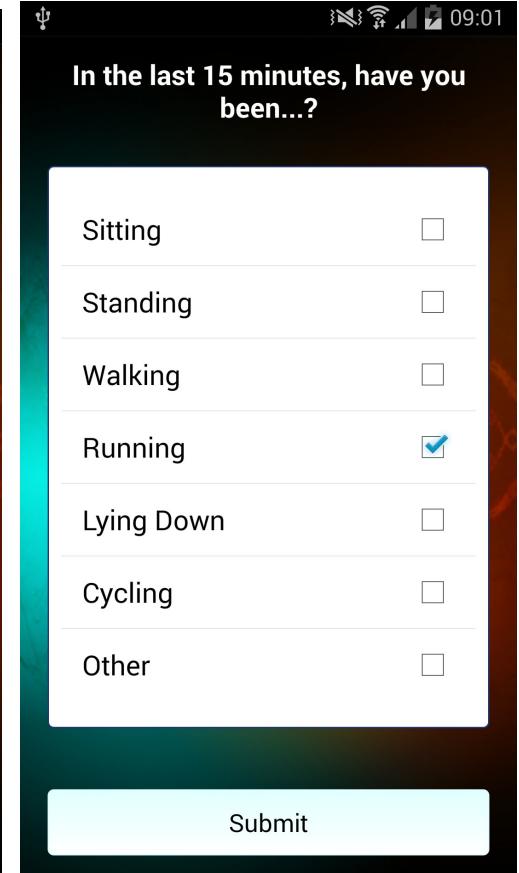
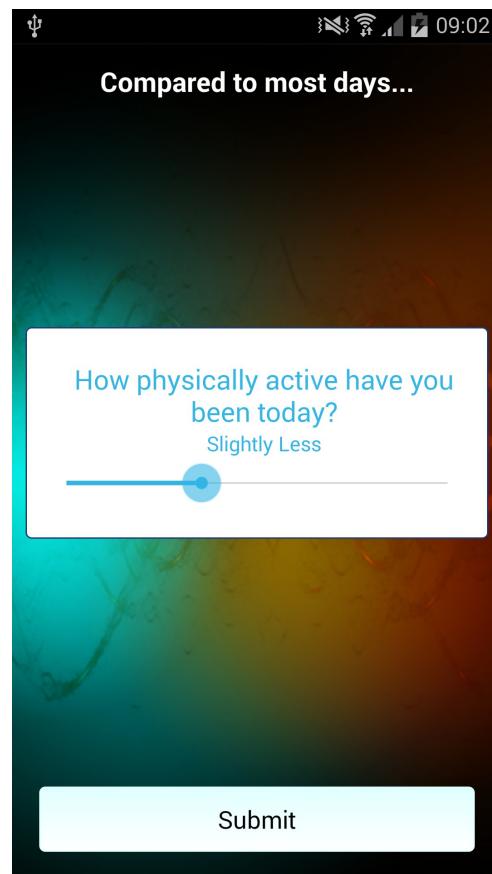
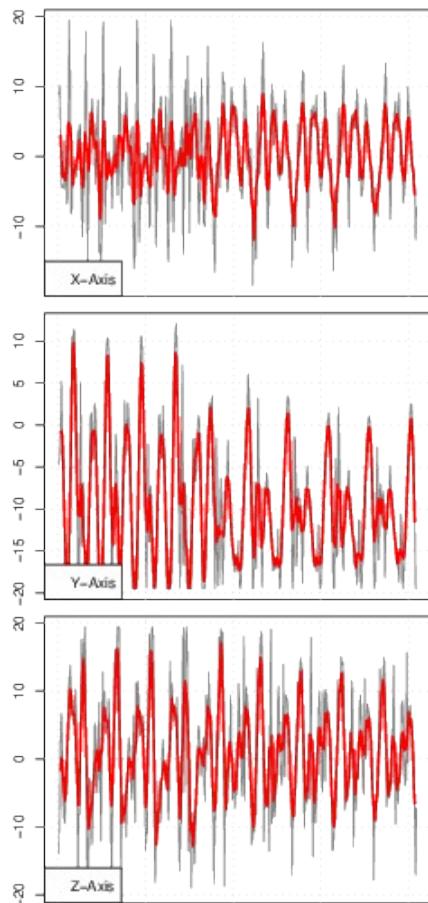
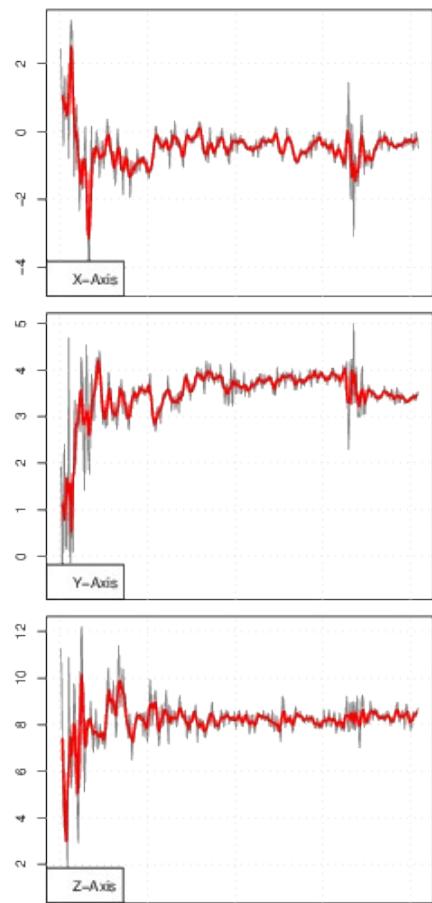


Page 1/10
To what extent do you feel:

1. Calm?
Very much

2. Anxious?
Somewhat

Submit



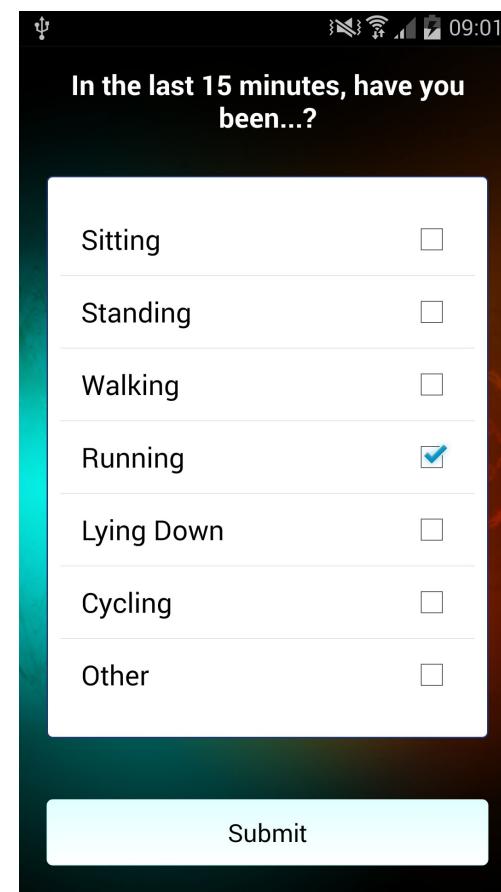
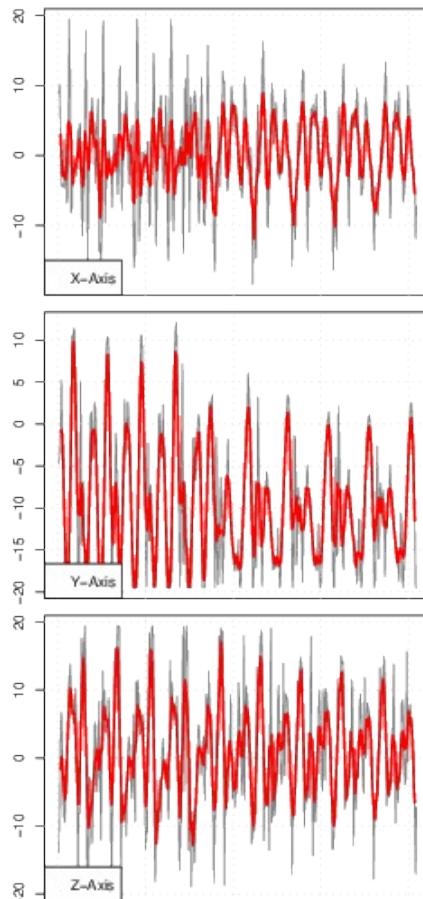
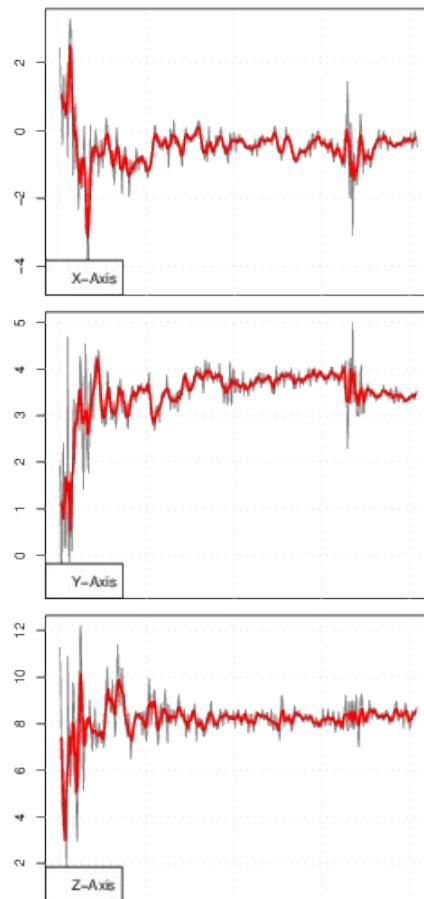
Statistical: mean, standard deviation, median, etc.

Time: auto-correlation, mean-crossing rate, etc.

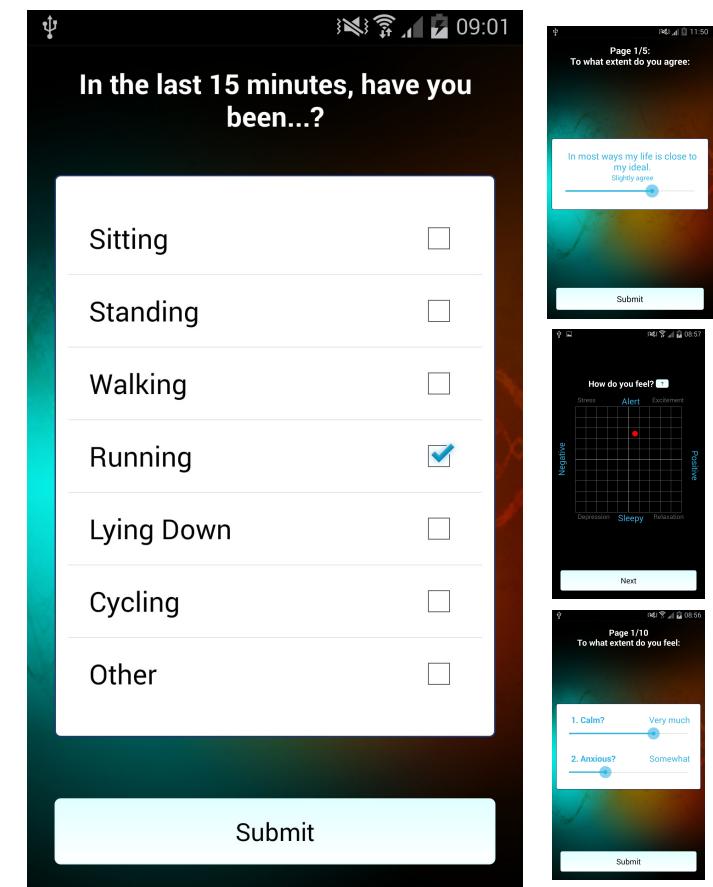
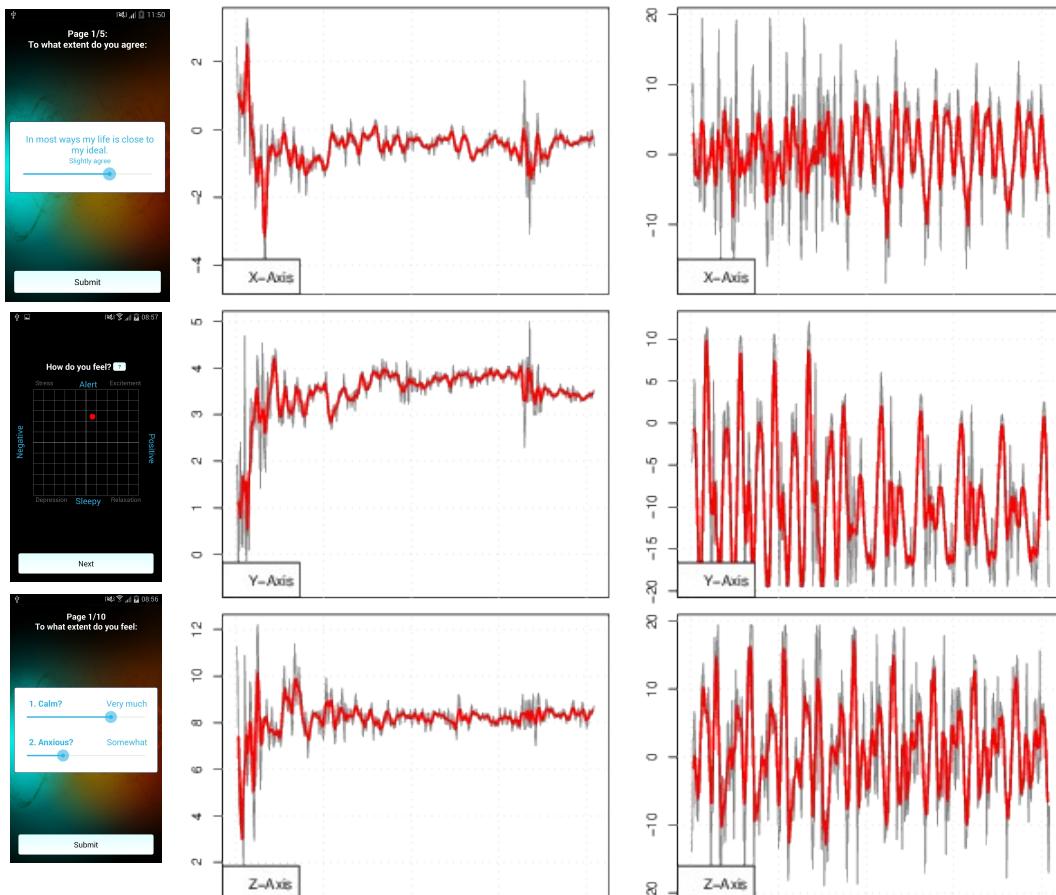
Frequency: FFT, spectral energy, etc.

Peak: volume, intensity, skewness, etc.

Segment: e.g., velocity change rate



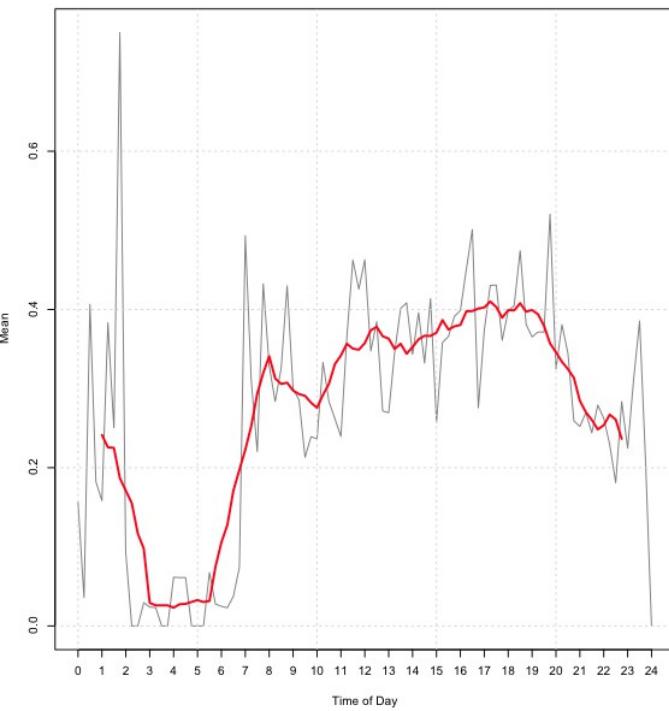
$$r(24,201) = .37, p < .001 \quad d = .80$$



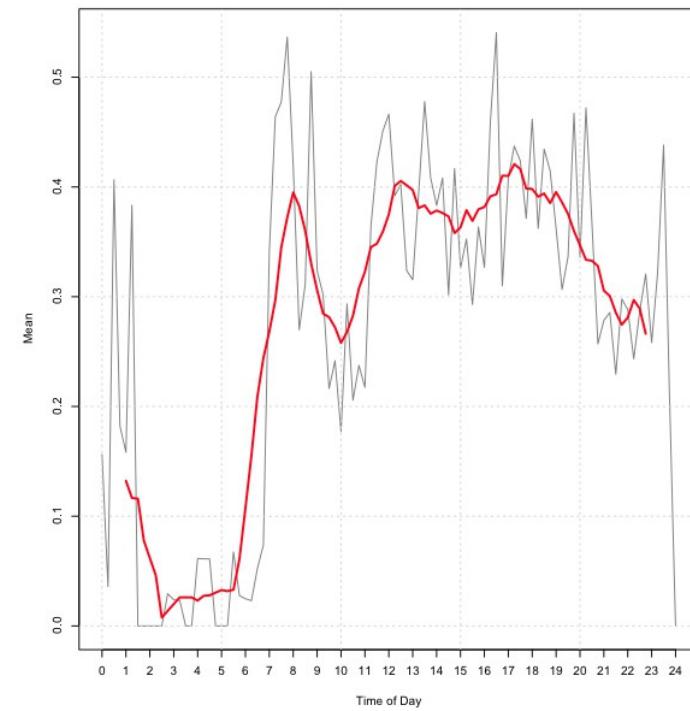
$$r(10,376) = .03, p < .001 \quad d = .07$$

$$r(2,969) = .10, p < .001 \quad d = .19$$

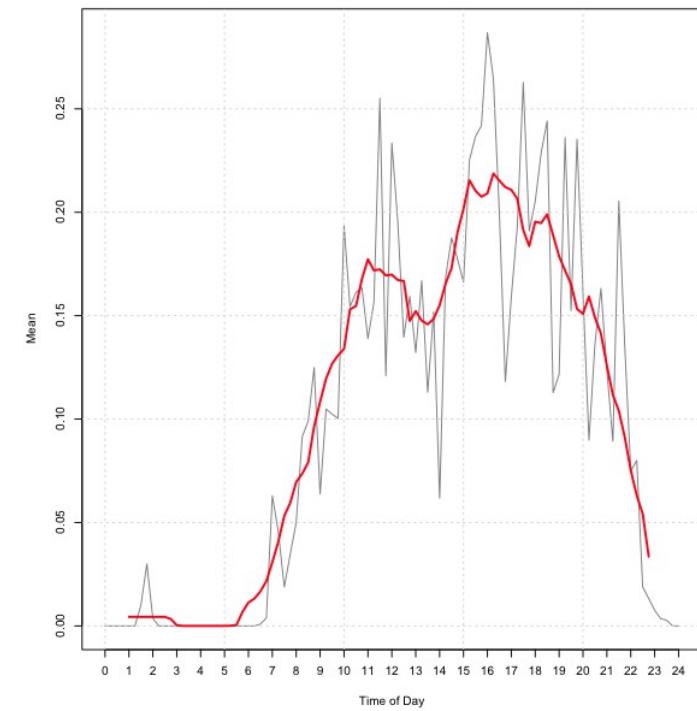
summary_all_axes_sd.csv



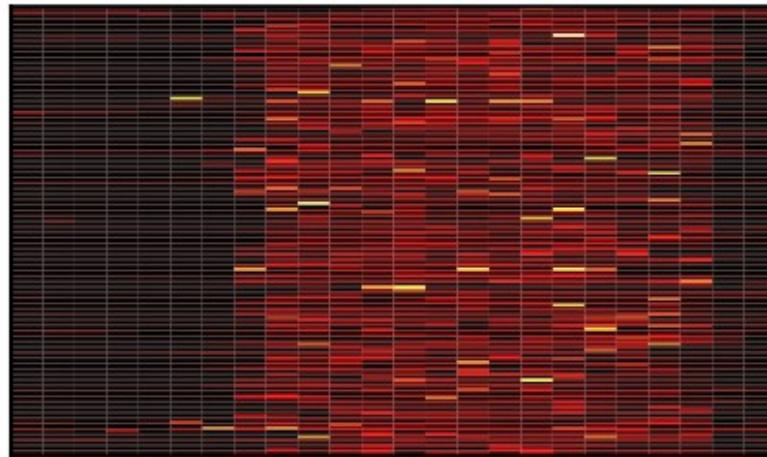
summary_week_day_axes_sd.csv



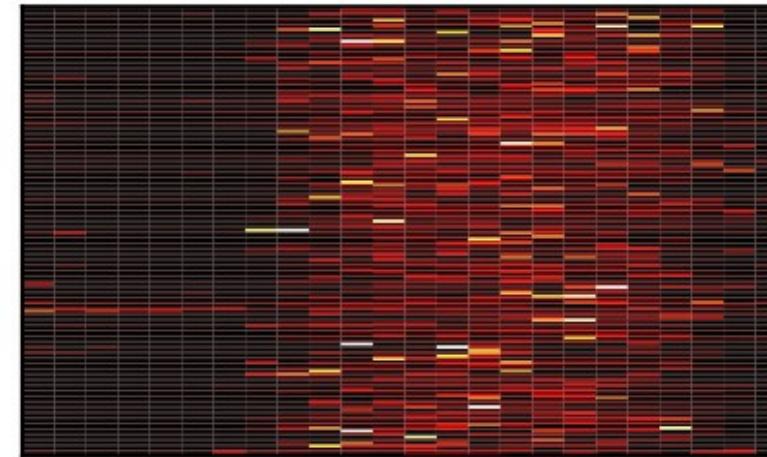
summary_week_end_axes_sd.csv



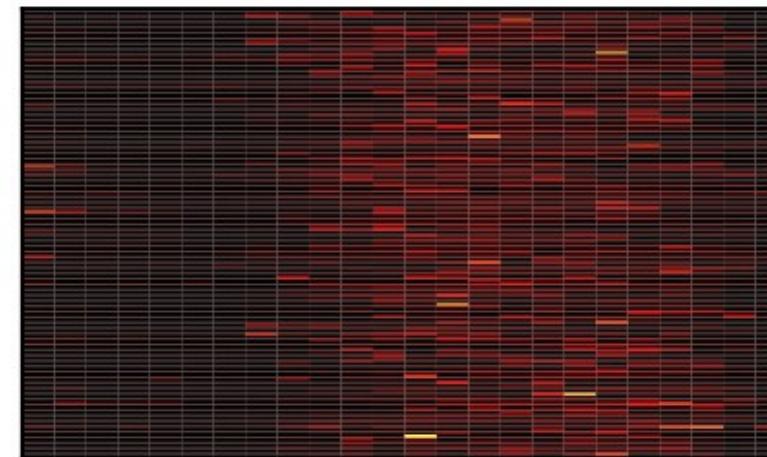
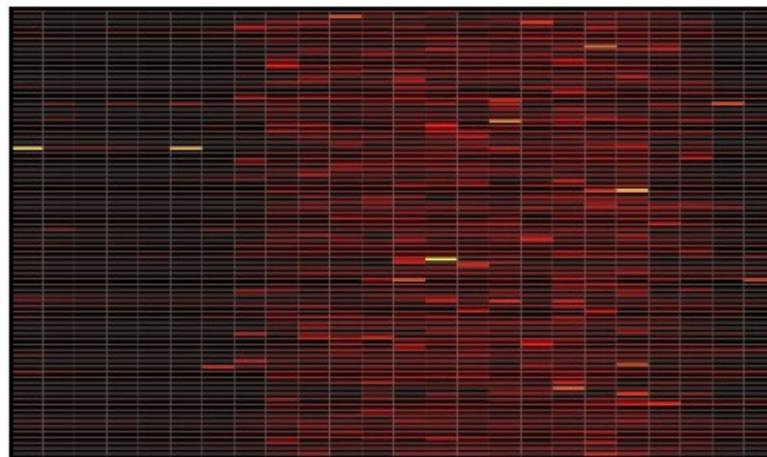
Weekday Sample



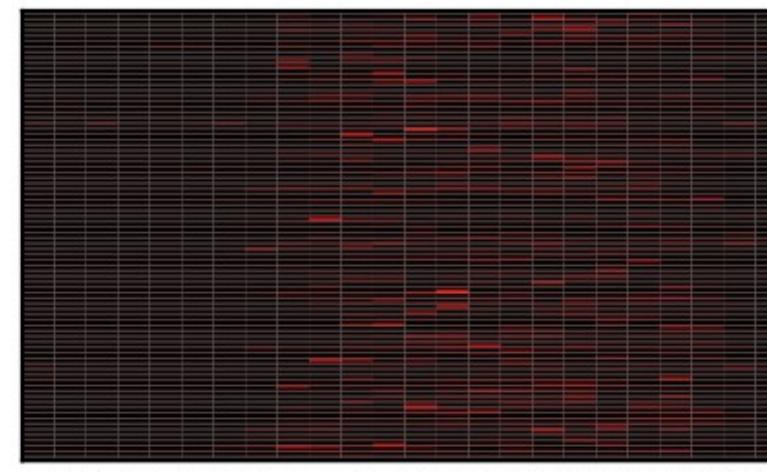
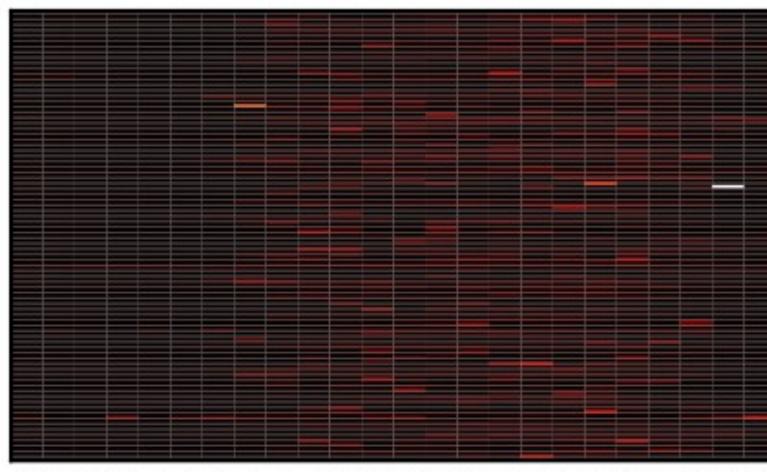
Weekend Sample



High Activity



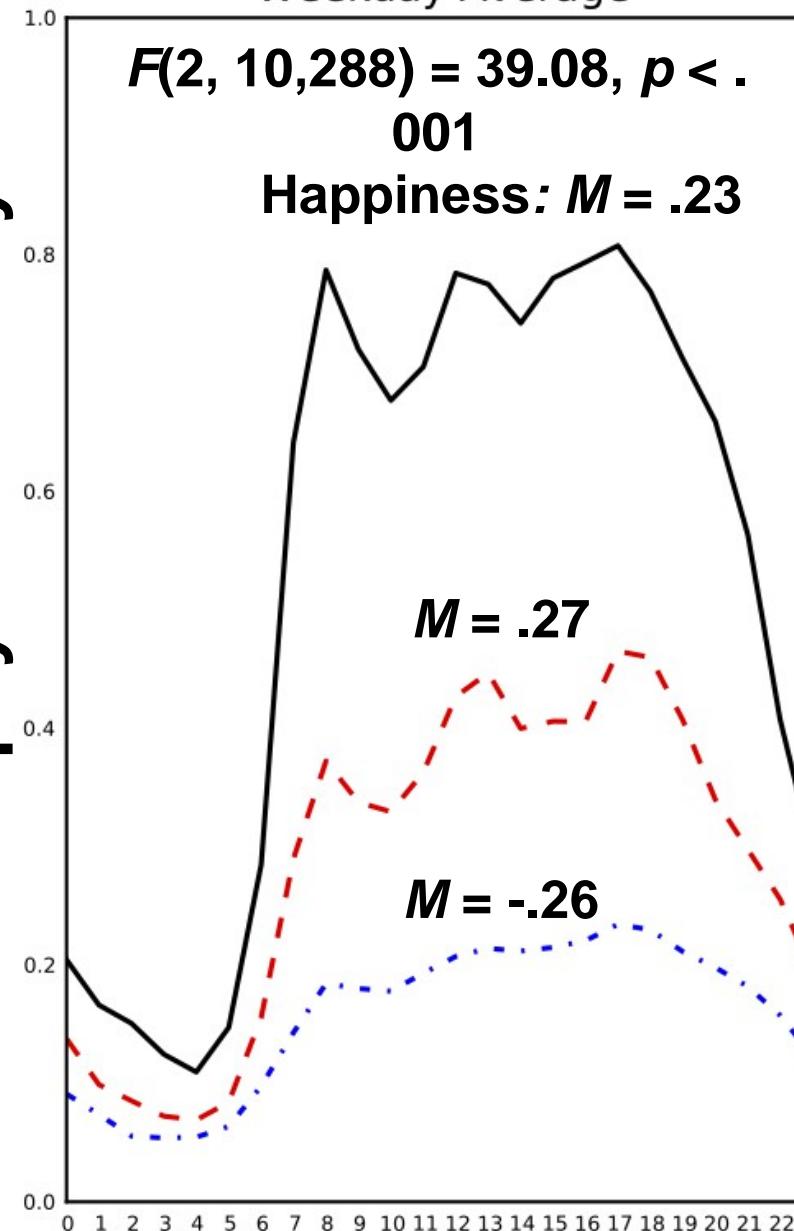
Low Activity



0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Weekday Average



Weekend Average

$F(2, 9,627) = 32.52, p < .001$

$M = .57$

$M = .22$

$M = -.14$



Jump to a Month



Health Experts Recommend Standing Up At Desk, Leaving Office, Never Coming Back

February 6, 2015



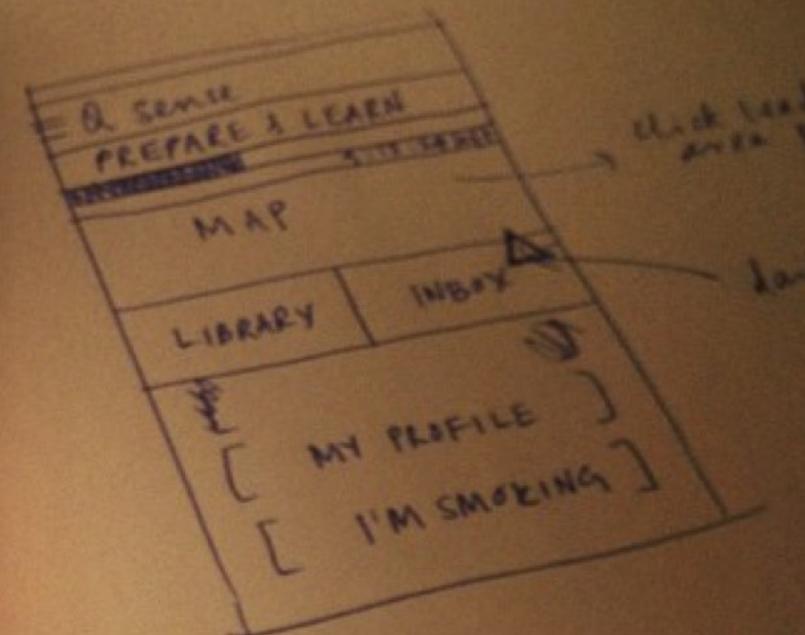
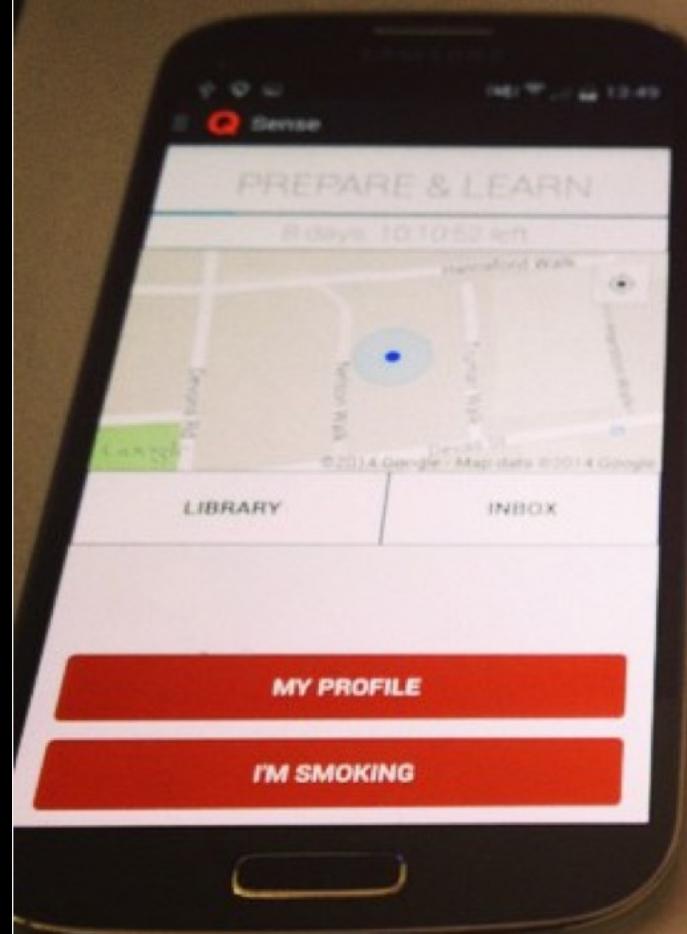
Case 2: Smoking Cessation

Naughton et al. (in prep). *The feasibility of a context aware smoking cessation app (Q Sense): A mixed methods study.* 2015.

“cue-induced cravings: intense, episodic cravings typically provoked by situational cues associated with drug use [...] smokers exposed to smoking-related cues demonstrate increased craving [...]”



Ferguson, Shiffman. *The relevance and treatment of cue-induced cravings in tobacco dependence*. In J Subst Abuse Treat. April 2009.



16:54 21:01 11:07

Hello, neal.

PREPARE & LEARN

20 days, 23:58:44 left.

My Profile I'm Smoking

Ok, Neal! The first stage is "Prepare & Learn."

Next

2/4: Cravings and Urges.

How strong was the urge to smoke just before you lit up?

Very Strong
Slight Extremely Strong

Submit

22:00 MONDAY 15 SEPTEMBER, 2014 | **Settings**

Wi-Fi GPS Vibrate Screen rotation Bluetooth

Notifications Clear

Q Sense 22:00 How was your day today?

Google Nelson Walk

You have 40 reports in this area. Click below to explore your data.

Stress Levels Mood Levels Craving Levels Smoking Situations

08:51 08:57 08:56

Emotion Sense

EMOTIONSENSE

Click on 'Profile' to complete a Demographics survey!

Profile Emotions

How do you feel?

My Emotions

Time Of Day

Location SMS Patterns Accelerometer Phone Screen Microphone Call Patterns Personality Sociability

Survey Stats

Page 1/10 To what extent do you feel:

1. Calm? Very much
2. Anxious? Somewhat

Submit

21:18 MONDAY 15 SEPTEMBER, 2014 | **Settings**

Wi-Fi GPS Vibrate Screen rotation Bluetooth

Ongoing

Connected as a media devi.. Touch for other USB options.

Notifications Clear

e Emotion Sense 21:11 How do you feel?

vodafone UK

Time Of Day

Alert Excitement

Negative Positive

Depression Sleepy Relaxation

Data: Last 30 days.

Colours

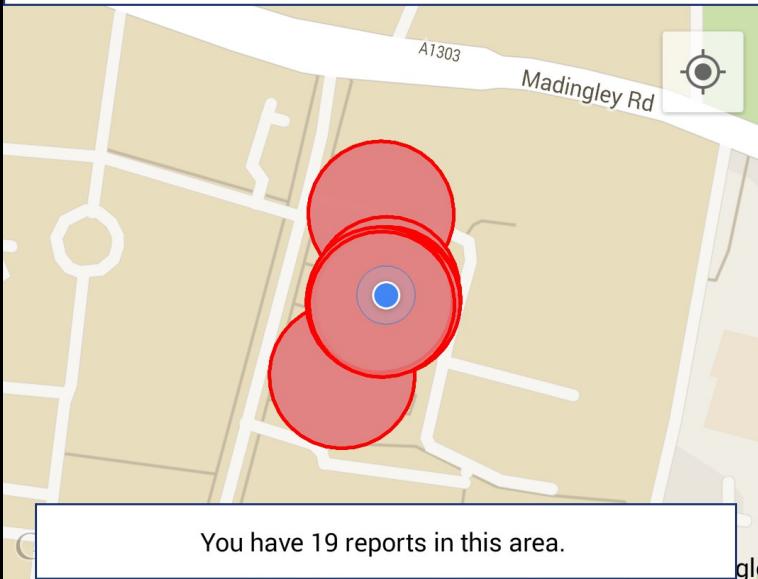


16:35

☰ Q Sense

PREPARE & LEARN

5 days, 7:24:23 left.



LIBRARY

INBOX

MY PROFILE

I'M SMOKING

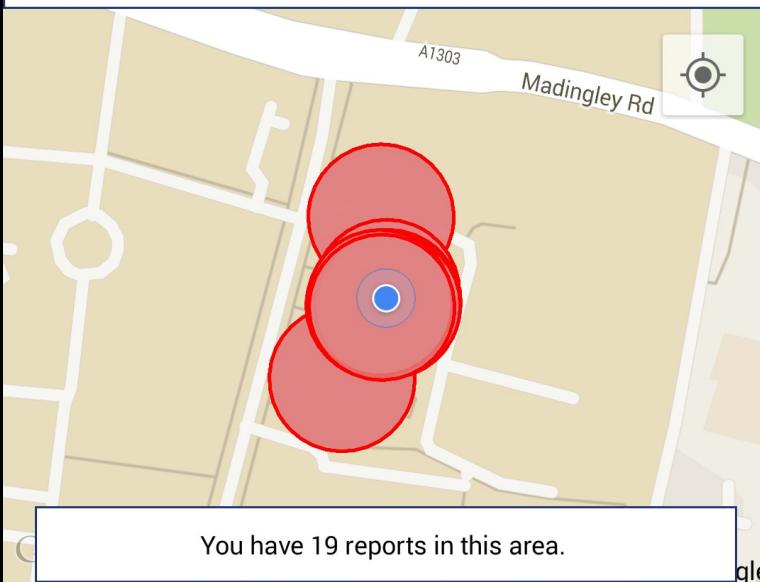


16:35

☰ Q Sense

PREPARE & LEARN

5 days, 7:24:23 left.

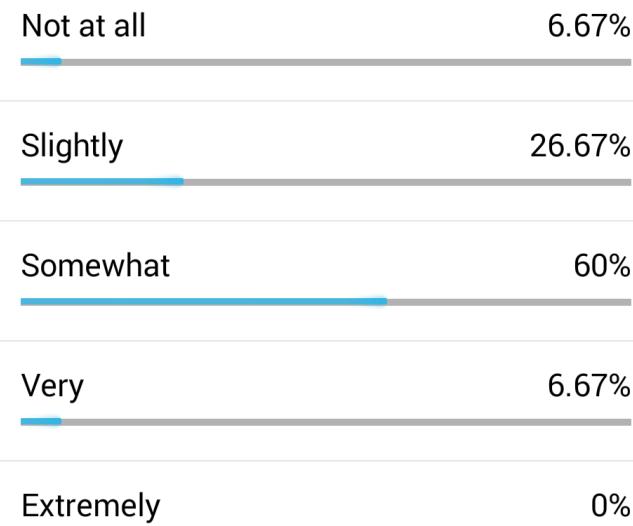
[LIBRARY](#)[INBOX](#)[MY PROFILE](#)[I'M SMOKING](#)

16:36

Stress Levels

Your ratings for how stressed you felt just before smoking.

Based on your reports, stress seems to be part of why you smoke.



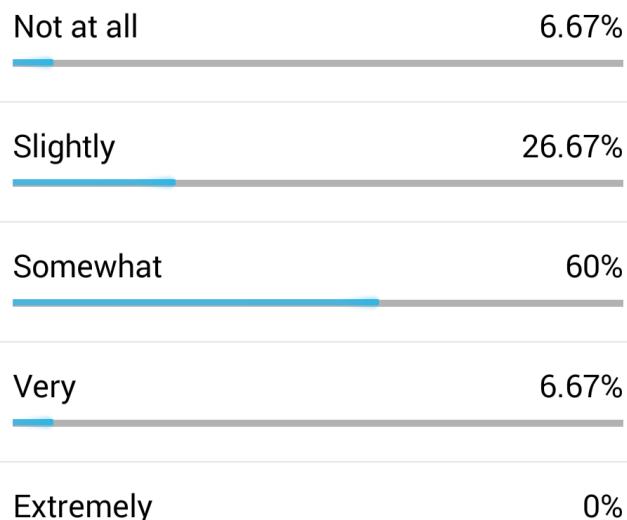


16:36

Stress Levels

Your ratings for how stressed you felt just before smoking.

Based on your reports, stress seems to be part of why you smoke.



Stress, Depression, Urges, Situation, Social (Other Smokers).

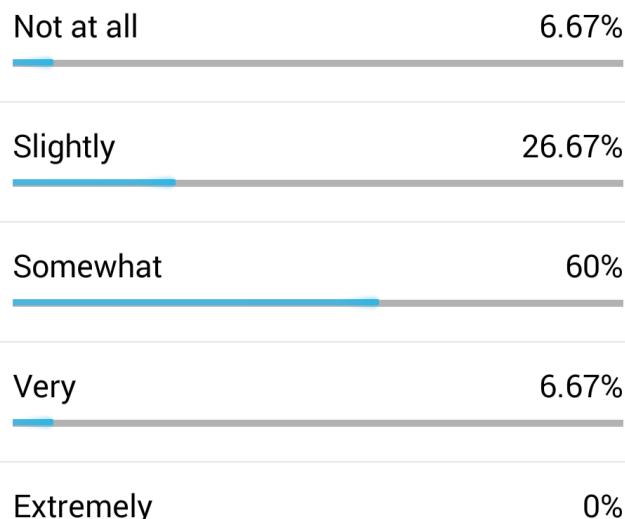


16:36

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MAKE LIFE EASIER

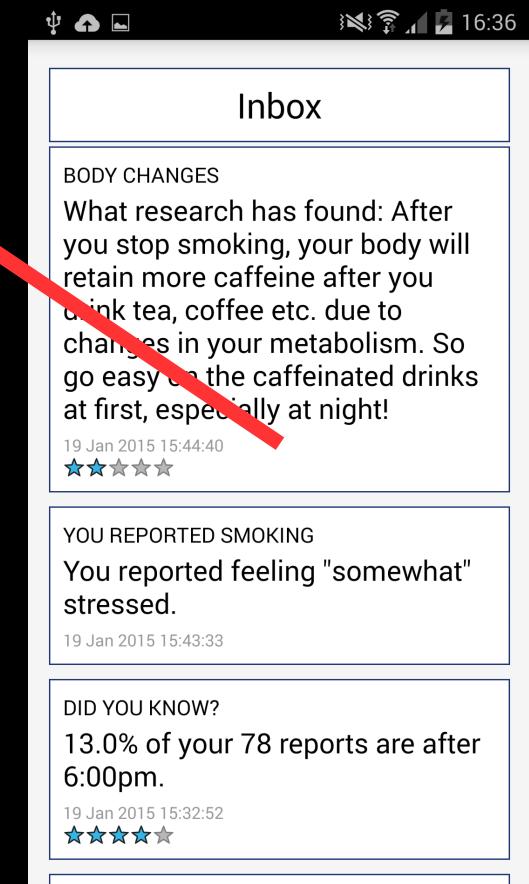
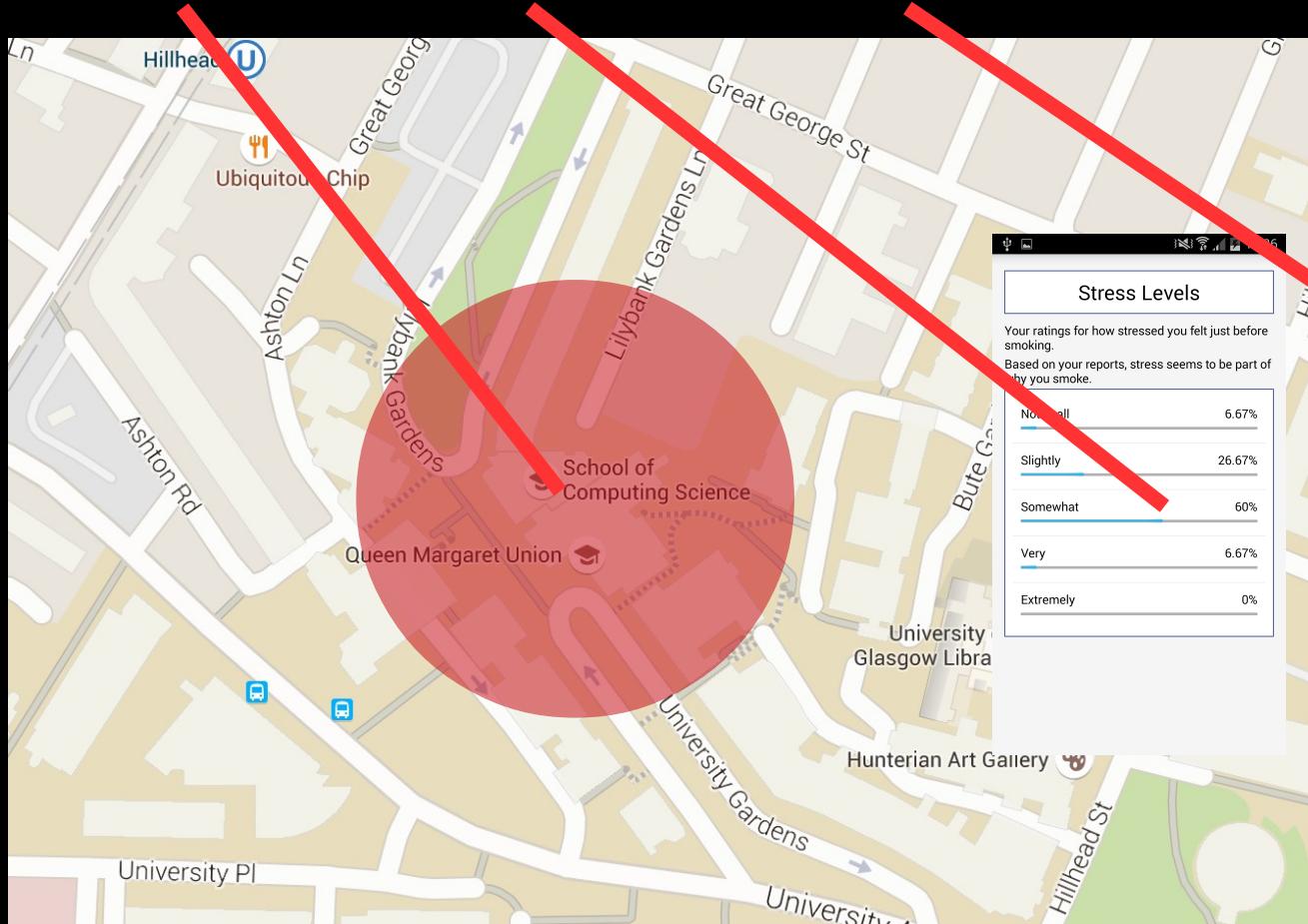
Quit tip - when you start your quit attempt make life easier by replacing your smoking routines e.g. try chewing gum or mints instead of smoking when socialising.

18 Dec 2014 16:30:28



EXAMPLE

Your location + your profile = tailored support



SCIENCE

STEAM



08:57



16:36

My Emotions ?

View

Time Of Day

Location

SMS Patterns

Accelerometer

Phone Screen

Microphone

Call Patterns

Personality

Sociability

Survey Stats

Inbox

BODY CHANGES

What research has found: After you stop smoking, your body will retain more caffeine after you drink tea, coffee etc. due to changes in your metabolism. So go easy on the caffeinated drinks at first, especially at night!

19 Jan 2015 15:44:40



YOU REPORTED SMOKING

You reported feeling "somewhat" stressed.

19 Jan 2015 15:43:33

DID YOU KNOW?

13.0% of your 78 reports are after 6:00pm.

19 Jan 2015 15:32:52





08:57



16:36

My Emotions ?

View

Time Of Day

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08:57



16:36

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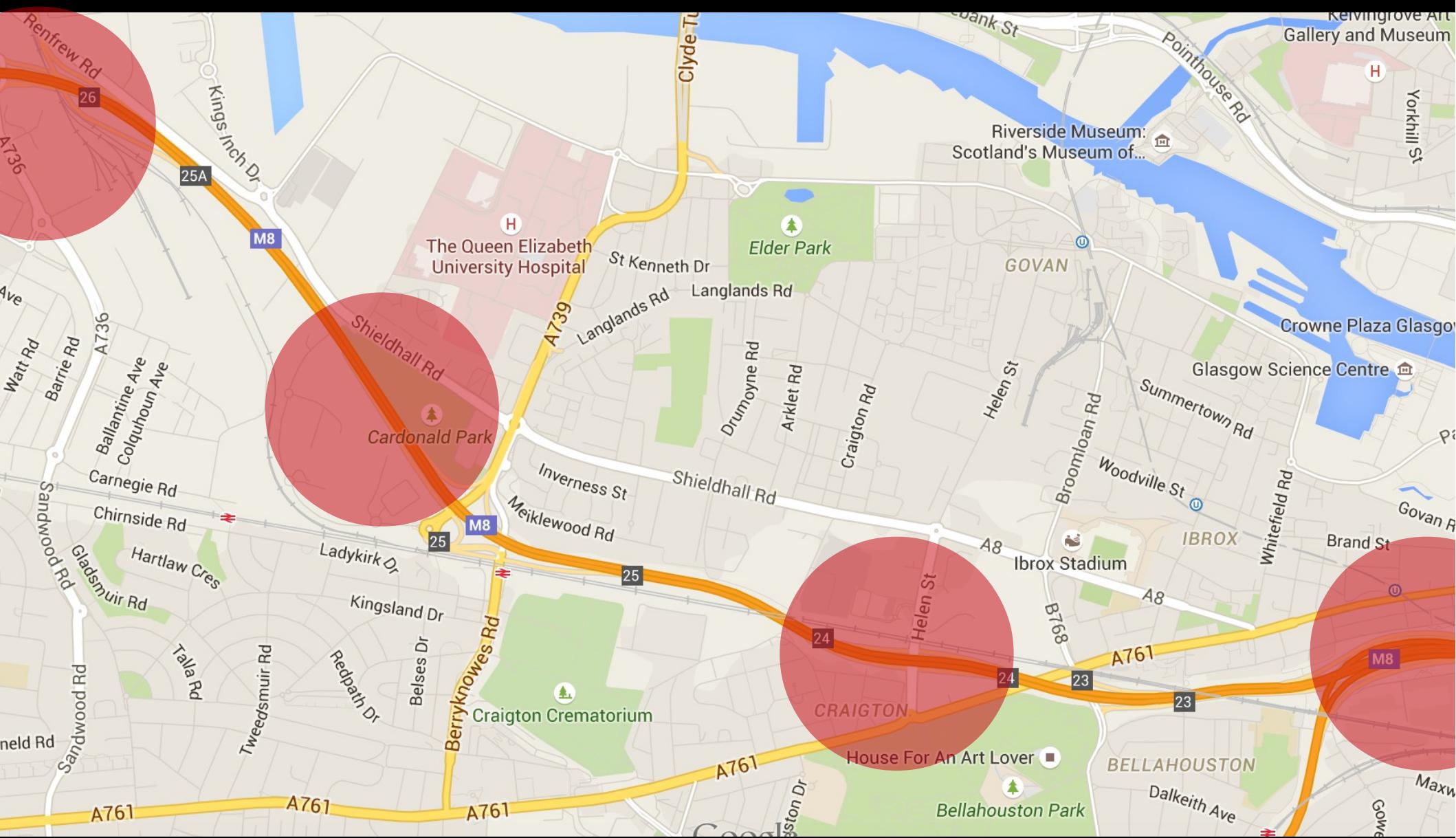
19 Jan 2015 15:43:33

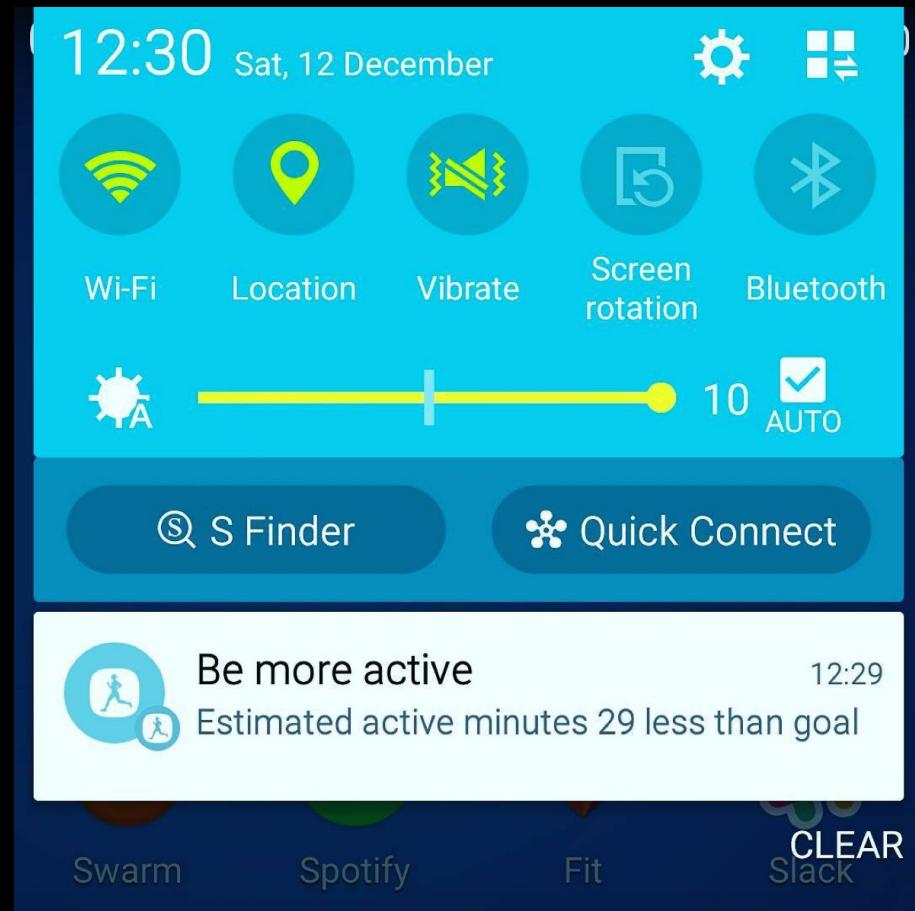
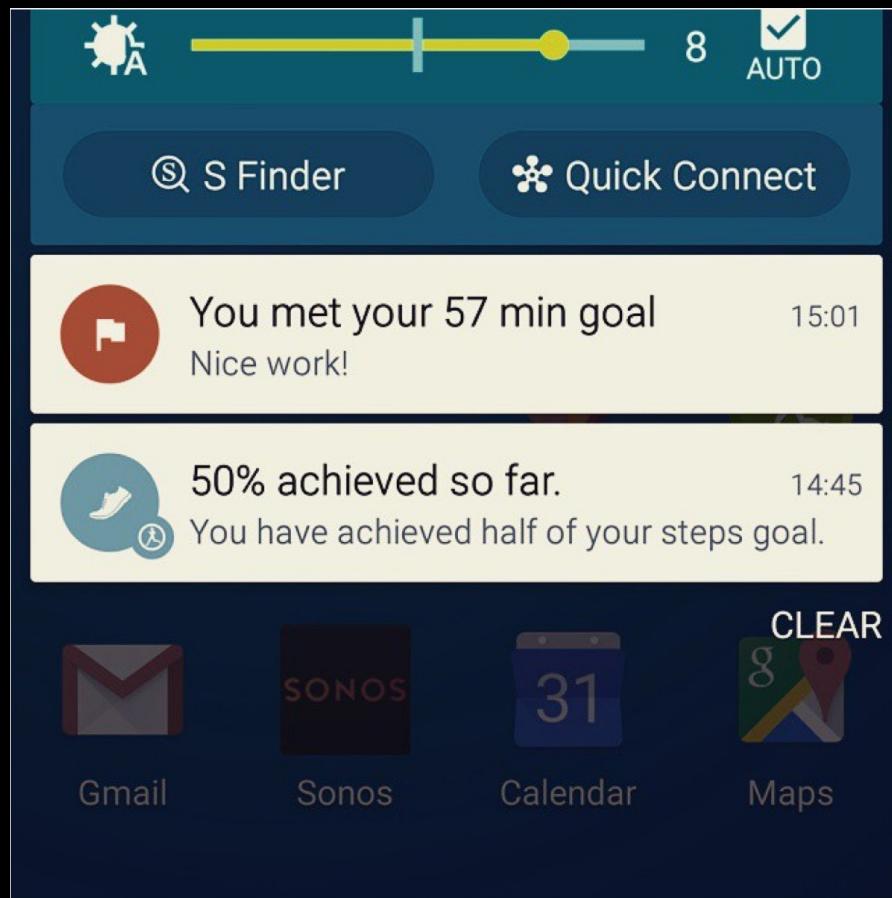
DID YOU KNOW?

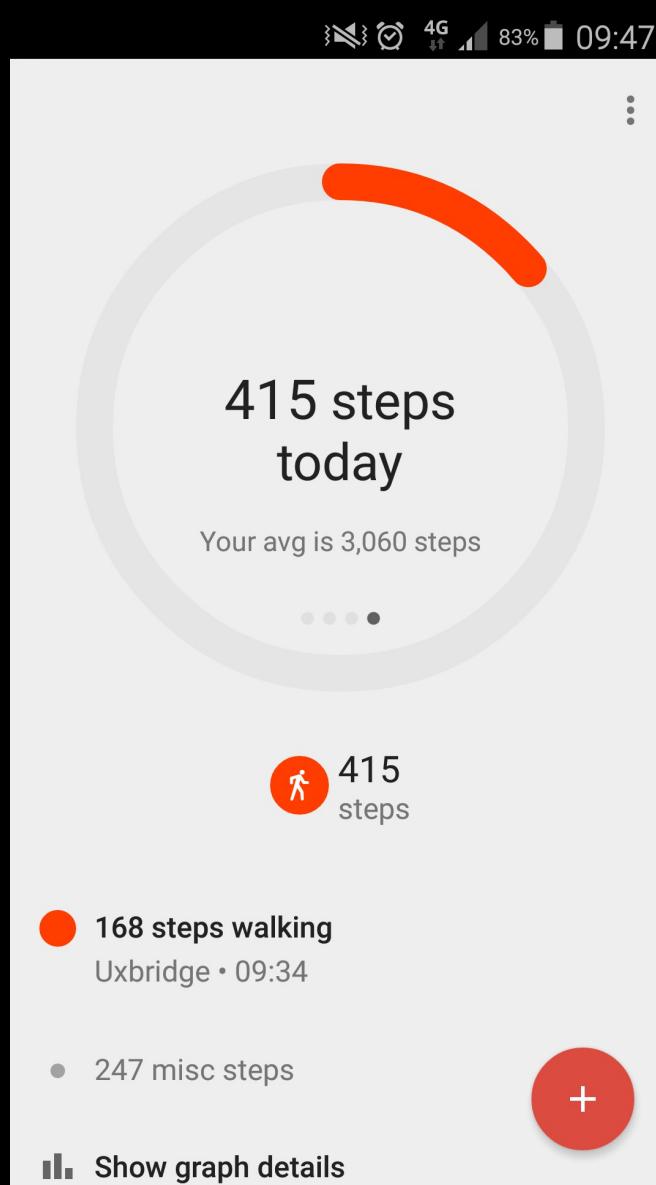
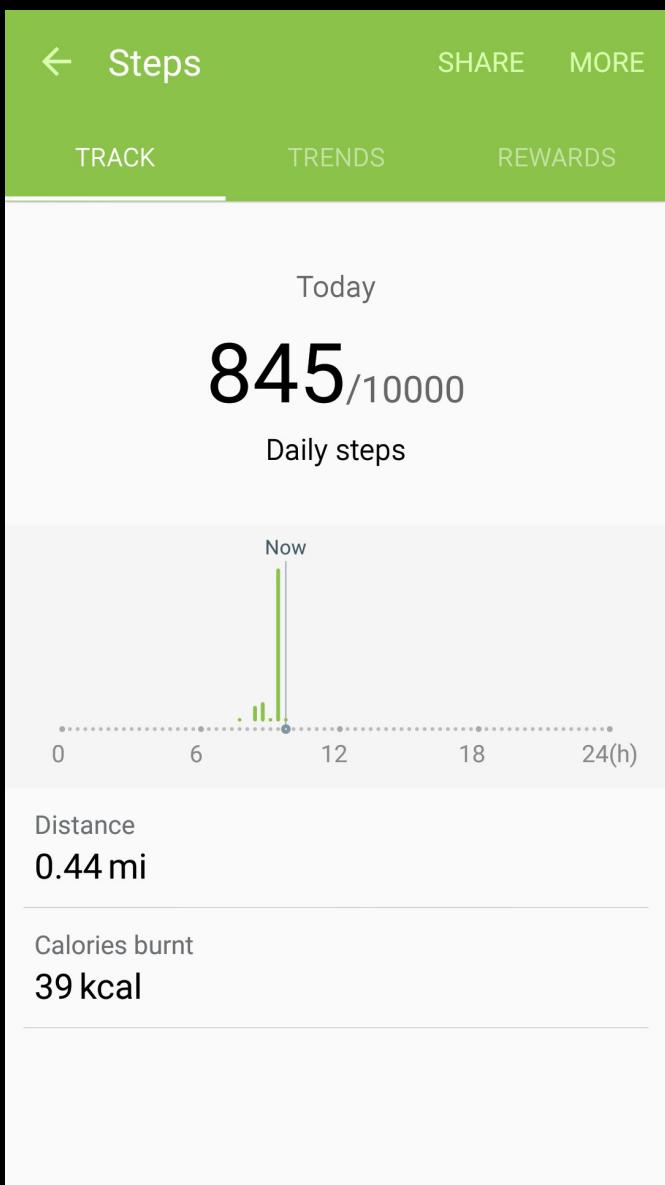
13.0% of your 78 reports are after 6:00pm.

19 Jan 2015 15:32:52





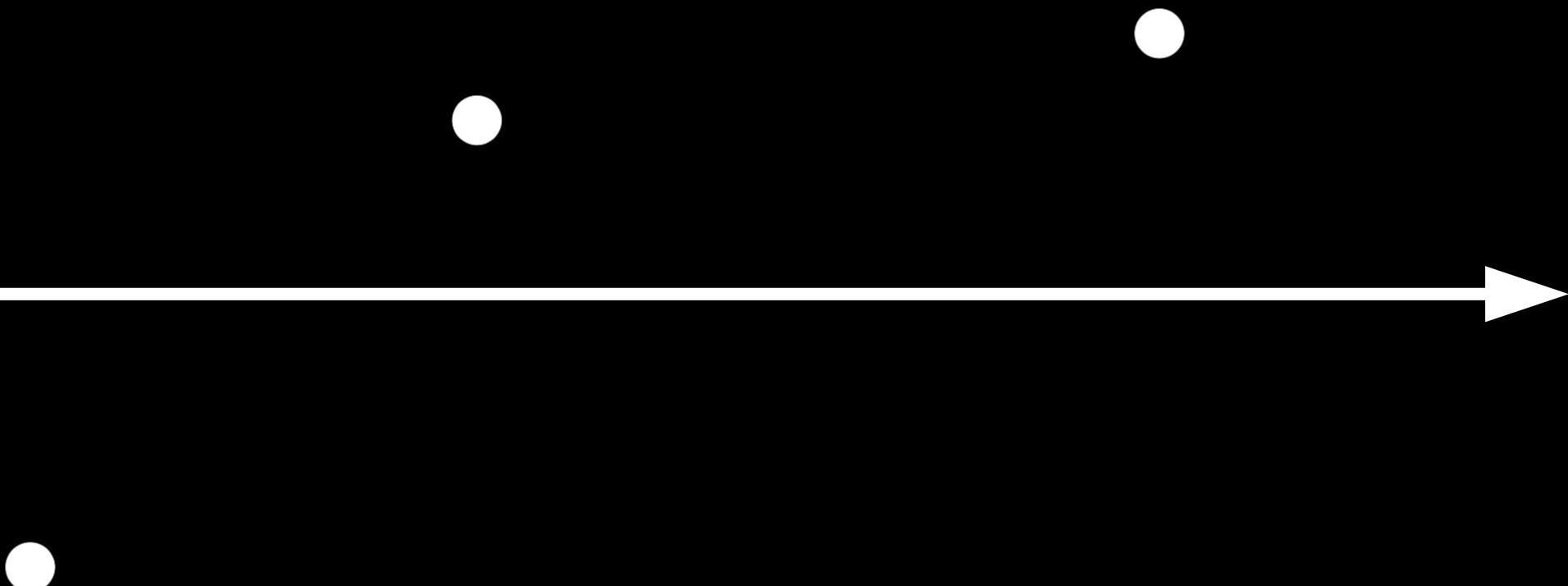




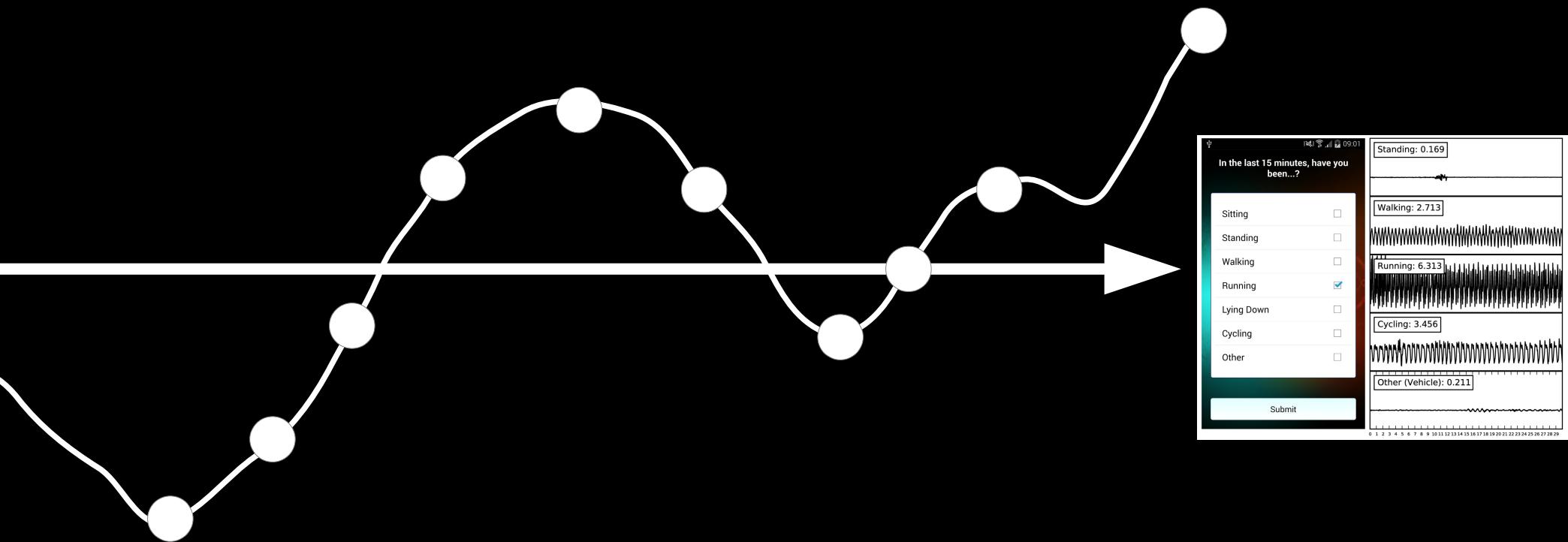
Day view Steps

Sat 14 Nov	10,216 steps
	10,216 steps
● Cycling	20:38
● 535 steps walking	Puerto Vallarta • 20:00
● 379 steps walking	Puerto Vallarta • 19:26
● 277 steps walking	Puerto Vallarta • 18:20
● 726 steps walking	Puerto Vallarta • 17:17
● 546 steps walking	Puerto Vallarta • 08:43

Current health monitoring methods:



Smartphones



NO MATTER WHAT LIFE THROWS AT YOU
There is
Jiu Jitsu
TATAMI FIGHTWEAR

Happier and Healthier.. with Smartphone Data

@neal_lathia
Cambridge Science Festival

