ECE 1778:
Creative Applications for Mobile Devices

Lecture 3

September 30, 2016

Why We're Here

- To bring together people from different disciplines to build an interesting & creative mobile/wearable application

- To learn how to do this & actually do it!

Today

1. Logistics/Organization of Course & Project
2. Assignments P2 & S2
3. Idea Brainstorming and Creativity Inspiring:
   - Case Studies of Apps
4. Project Group Forming

Logistics

Assignments: Bringing you Up To Speed

- S1 and P1 were due last night
- S2 and P2 are due next Thursday at 6pm
  - Are posted on the main course website

- There will be two more assignments after that
  - Assignment #3 will be due October 20
    - except S3 part 1 is due October 14
  - S3 and P3 are also posted now

Project Stages 16f

1. **Forming Groups**
   - Done by end of next week, hopefully sooner. (Poll)
2. **Project Approval-in-Principle**
   - Done via email –send short description to me; will respond fast
   - Due October 7th prior to class; must have approval to proceed
3. **Project Proposal/Plan**
   - Document Due October 13th
4. **Proposal & Plan Presentations**
   - October 20 & 21
   - **NOTE EXTRA LECTURE Thursday Oct 20, 6-8pm, SF 1101**
5. **Spiral 2 & Spiral 4 Presentations**
   - 2: November 4/11 4: November 18/25
6. **Final Presentations**
   - Weeks of December 2/9
7. **Final Report Due December 14th**

Groups Need to be Formed Soon!

Programmers	Specialists
28	11

- Counts comes from assignments [P1 and S1] submitted + external specialist count (3)
- 43 People still registered in course, so numbers don't add!
- Groups: 1 Specialist + 2 Programmers
- Just a 3 groups 'formed' as of this morning
  - Must send me email to 'form'
- Will provide time today to help form groups

Send Me Group Info When Formed

- Send email to me:
  - Jonathan.Rose@ece.utoronto.ca

- The email **must** contain (please read this):
  - Names of all students and student numbers
  - Department & Field of each group member
  - Degree being pursued by each group member (M.A., Ph.D., M.A.Sc., M.H.Sc., M.Eng, M.S.A.C., etc.)
  - **Indicate who is Programmer, who is Specialist and if someone is serving as both**
  - Mobile platform you plan to do the project on
    - Android, iOS

Next Project Step:

Approval-in-Principle

Approval-in-Principle: October 7th

- Once your group is formed, you must fairly quickly come to a idea of what you're going to do
- This week you should be kicking around ideas between yourselves, myself and TAs
  - We will go back and forth as necessary
- Your group must have my approval of the general idea of your Project by Friday October 7
  - Start now! Will be able to use part of this class to have informal discussion of topic with team and myself & TAs

What to Send for Approval

1. **What & Why:** A few sentences describe what the project is and how it is motivated.

2. **Expertise Link:** Make clear how this app fits within the expertise of the Specialist and what the contribution the project makes to the Specialist's field or research

3. **Name:** Give your App a Name
   - name should convey the essence

How to Describe Your Topic?

- Key is to say **what** & **why**
  - engineers tend to think about ***how*** too soon, be warned
  - You do will need to think about how to make the ***what*** *feasible*, but not in first description for someone else to understand

- Could be the completion of this sentence: “The goal of our app is to …”

Good Example Description

- **What**: The goal of our App is to help train surgeons to gain fine motor skills by measuring their movements and providing feedback on the movement quality.
- **Why:** Surgical training is difficult, and lacks quantitative feedback.
- **Specialist Expertise:** Training to be Surgeon, currently taking 1 year off to do M.Ed.
- **Name:** STAN “Surgical Trainer and Navigator”

- …. **How:** accelerometer attached to hands to measure fine motion quantitatively

A Little Lie

- This is the description at the end of the project
- It didn't start out this way, it needed refinement
- This refinement process is an essential part of learning

Poor Example Description

It's a customizable cloud-based student/teacher homework and dynamic scheduling app that learns how and when students do their homework, rewards task completion, pushes reminders and adjusts scheduling according to need. It also allows teachers to create ubiquitous learning exercises and to push AR enhanced homework to students. We also hope to build in a GPS-based study group and knowledge building capability. It sounds like a lot but my coders believe they can pull it off. We have prioritized elements and are confident that the core elements can be coded. *I will send you the required Specialist summary later this week.*

What is Wrong with it?

1. Hard to say **what** it is – it is many things, and lacks focus.

2. Doesn't say **why** (e.g. What problem is being solved, why a specific capability is needed/worthy).

3. No name! (This group had real trouble with names)

4. No connection to what the Specialist's expertise is.
   - Last part in italics was the specialist saying he would get around to this **next week!**

How To Send in Approval-in-Principle

- Send an email to me – Jonathan.Rose@ece.utoronto.ca
  - Just one per group
- Send as soon as ready, want all approved by October 7 if possible

- Need to get statement back from me: “Your Project has Approval-in-Principal”
  - There may be some back and forth between us
  - Over these years, there has been a fair amount of revision

Step After Approval-in-Principle:

Proposal/Plan

Proposal/Plan Due Oct 13 @ 6pm

1. Reprise Goal, make more precise
   - What & Why
2. Rough design of what the **user** of the App sees
   - Mock-ups of screens
   - https://moqups.com
     - From Specialist Assignment 2
     - Any drawing package will do
3. **Block Diagram** overview of planned code
   - Top down description of the major pieces
   - With short description of each
   - Should be linked to the screens
   - I will discuss creation of block diagrams next week

Plan, continued

4. Statement of Risks/Issues
   - What roadblocks/issues/challenges do you foresee?
   - App-wise, programming-wise, hardware-wise, ethics-wise
5. What do you need to learn that you don't know
   - all members
6. **Important:** Specialists
   - Submit a 500 word essay on
     1. How App relates to field of Specialist, and
     2. How the Specialist will contribute to project
        - Need to be an active participant throughout
        - How will you do that?

Proposal/Plan Document

- length: 1500 words max
  - not including Specialist essay (#6)
  - include word count, penalty for overage

- Seeking clarity, not quantity of words
  - Omit needles words

- Specialist should Submit to Portal, under “Specialist Assignments” look for **Proposal-Plan**
- Worth 10% of grade
  - including in-class presentation done following week
- Due Thursday October 13th at 6pm

Week After That: Prop/Plan Presentation

- October 20 (extra lecture) and 21 (regular lecture)
  - Concise, clear presentation by all groups of proposal/plan
  - 5 minute presentations, followed by discussion/questions

Assignment P2 – for Programmers

Fragments, Containers, Select, Lists and Files

See:

http://www.eecg.utoronto.ca/~jayar/ece1778/assignments.html

Assignment P2

- Goal is to learn about
  - Fragments (Android)
  - Lists – a very common way to display information
  - Files – persistent storage
  - Basic UI design
- App for recording list of favourite movies
  - Create a list of movie titles
    - Record year movie made and name of 1 actor in it
    - Store List in a File
    - Be able to retrieve a previously stored file & Display
- **Due next week, Thursday October 6th at 6pm**

Key Note for Programmers & P2

- This is a lengthy assignment for graduate-level programmers – at least 8 hours of work.
- If your background isn't strong enough, it will take quite a bit longer
- This assignment often causes programmers to realize that this course is too much work for them
  - It's only Assignment 2, and there are 2 more assignments to go
  - And the real work starts with the project!

- So: get to work on it **Today** and make sure this course is for you.

Note & Demo

- 8/10 of grade is for functionality
- 2/10 of grade is for quality of User Interface/Experience

- **Demo** of prior year's P2 (which was different, and about food, not movies) can be found here:

https://www.dropbox.com/s/o3xd4qlopr12lbo/P2.mp4?dl=0

iOS Developers

- Assignment points to relevant chapters from
  1. iPhone iOS 7 development book (for Objective C)
  2. iPhone iOS 9 development book (for Swift)

- How many iOS people at this point?
- Opinions of Swift vs. Objective C?

Assignment S2 – for Specialists

Practicing Creativity, App Design Principles, Moqups, Critical Feedback and Thinking

See:

http://www.eecg.utoronto.ca/~jayar/ece1778/assignments.html

Design of Apps from UI Perspective

UI = User Interface

- i.e. how does it look to the human?

1. Learn **moqups** tool basics by going to website and reading help (look also for youtube instructional videos)
   - Demo: https://moqups.com
2. Learn some user/app visual 'design' basics:
   - Android:
   - Apple: Here and Here
3. Interview Potential Users & Get Feedback
4. Engage Your Own Critical Thinking

Goal: Create App that Uses *Emotion Reco*

- Given the following capability: software that can look at a *video*, identify the faces of the people in the video, and determine the *emotion* they display, one of
  - neutral
  - happy
  - sad
  - angry
  - fear
  - anticipation
  - surprise
- Given this, invent interesting app that makes uses it
  - Can't be the simply reporting of emotion

App Using Emotion Recognition

1. Design the app, and mock it up using **moqups**
2. Describe App (500 words, what & why)
3. Also give 400 words on the design
   - Describe the design principles you're using in the decisions you make to the design the app (from Part 2)
4. Present it to 3 people, and get their feedback on it
5. Do a critical analysis of it

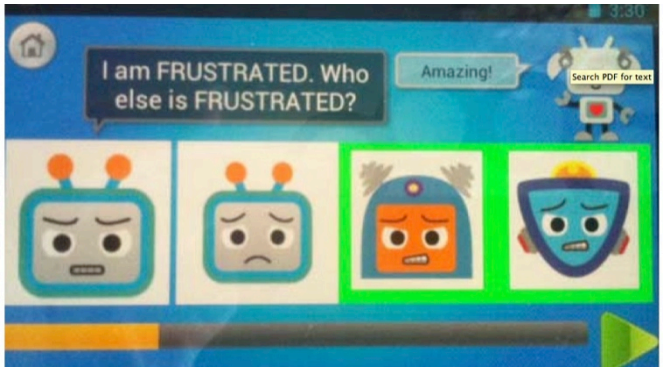
- **Due next week, October 6th at 6pm.**

Previous Projects and Applications

To Provide some context for your project and
to Help with Creative Process

EYEdentify

Teaching Emotion Recognition to Autistic Children



Rebecca Dreezer
Cindy Lau
Alexandra Makos

April 2012

Goal

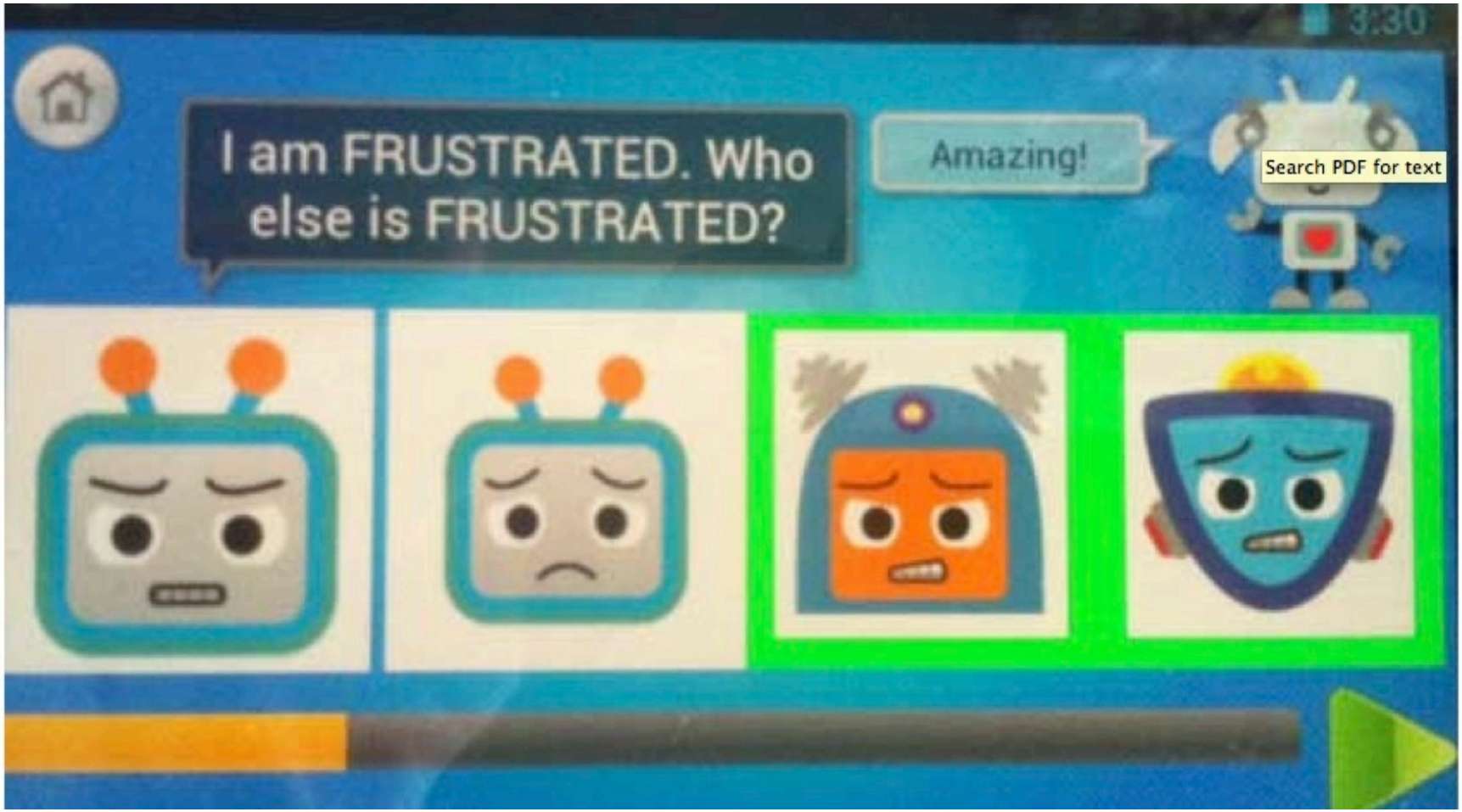
- App to help autistic kids learn to recognize 4 emotions:
  1. happiness
  2. sadness
  3. confusion
  4. frustration

- A simple matching game
  - With an engaging user experience

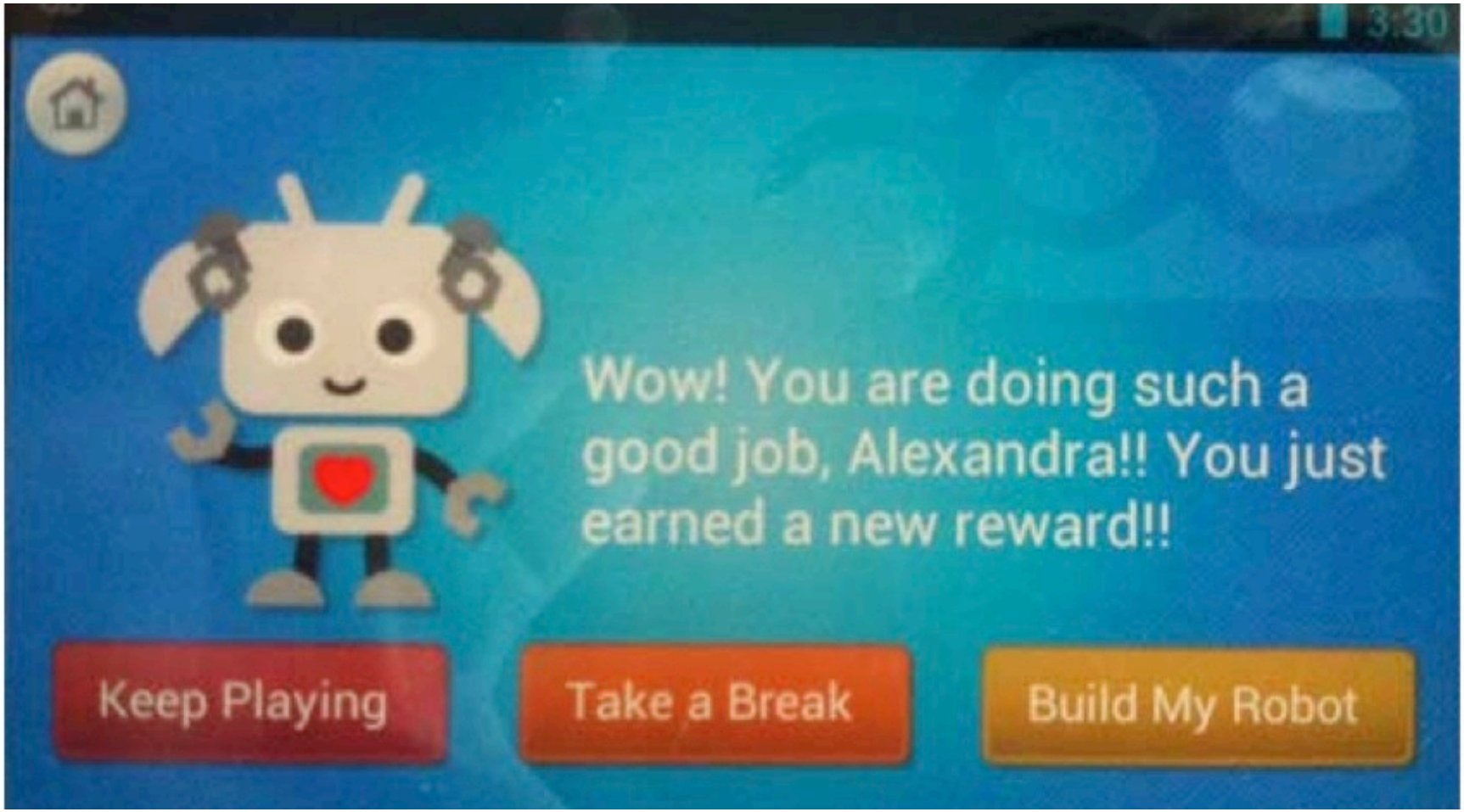
Based on Research

- Have 3 classes of “faces” that can be identified by players

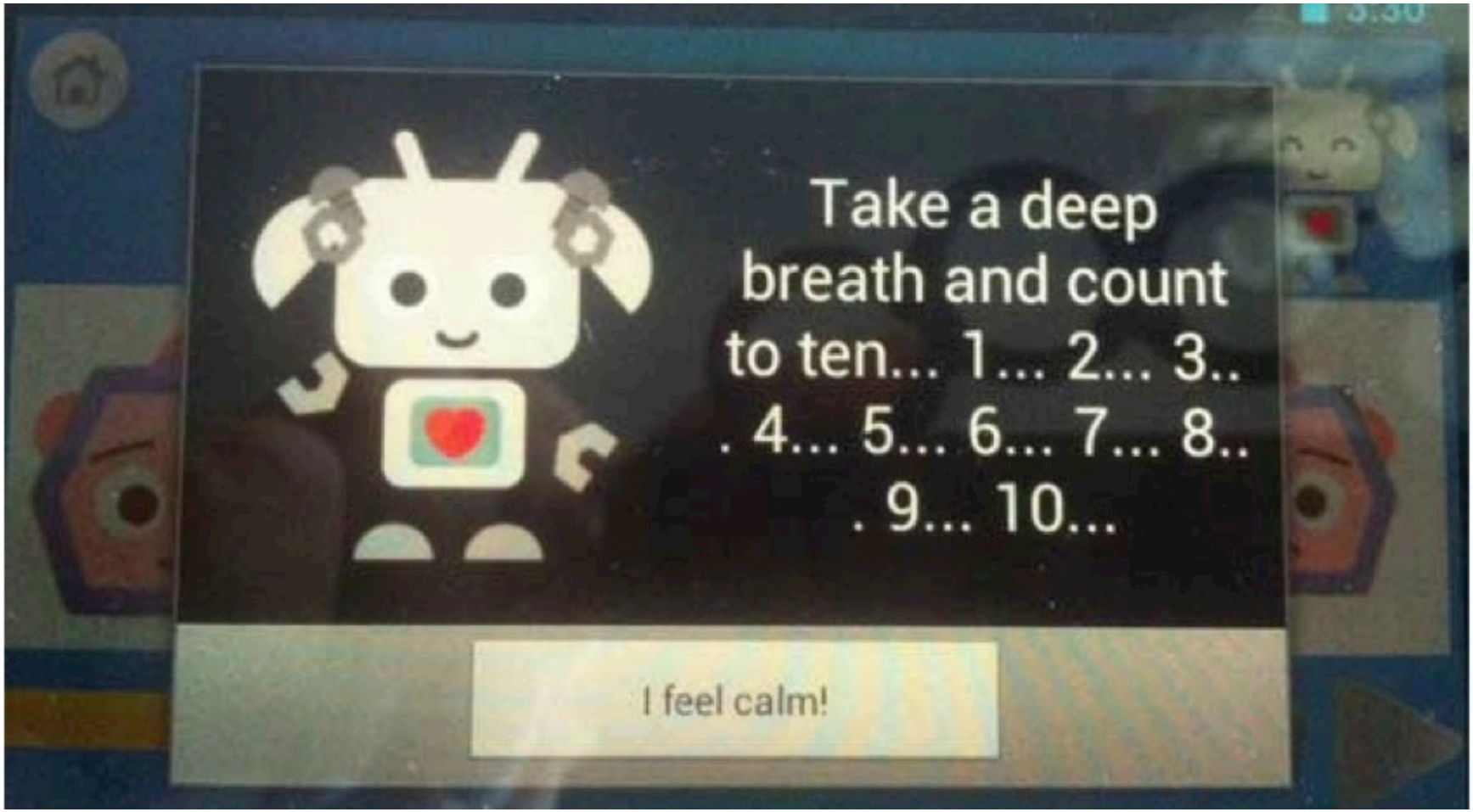
Games Screen



Choices


Wow! You are doing such a good job, Alexandra!! You just earned a new reward!!
Keep Playing
Take a Break
Build My Robot

Accelerometer Detected Frustration



EncountAR

Interacting with Museum Exhibits

Scott Pollock
Sheng Xu
Tony Zhou

April 2012

Museums & Art Gallerys

- Struggling to stay relevant
- Many being put online

- Scott's idea (from others): be able to interact with an exhibit
  - Leave 'postings' on the exhibit itself, in virtual world

AR = Augmented Reality

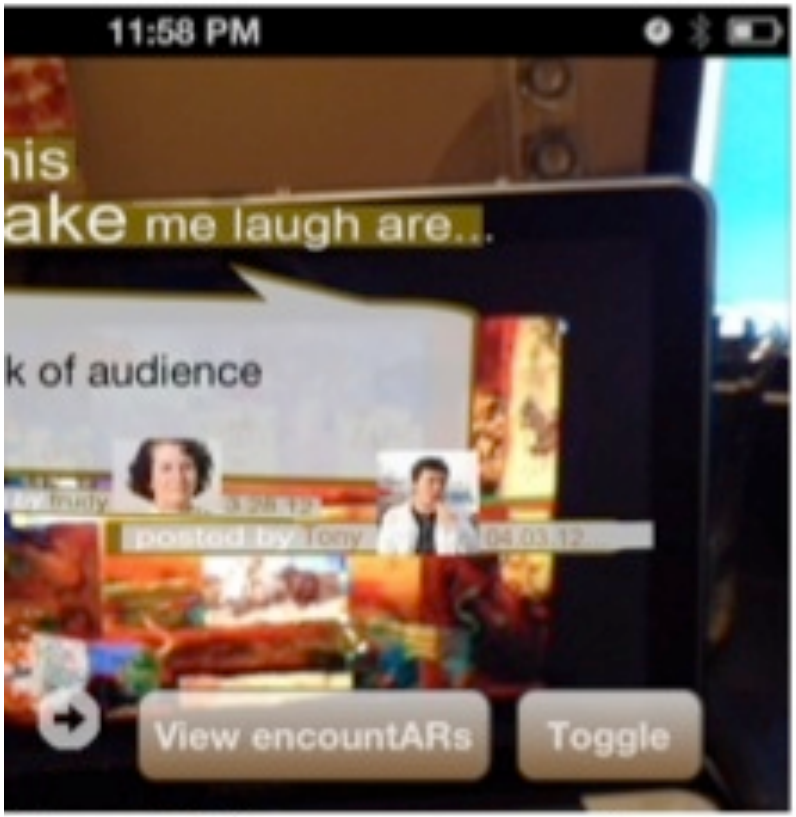
- View the world through the camera/screen
- Add in extra things on top

- Add picture from somewhere else?

For Example


encountAR
found
i
want to ask
the photographer who took these…
Why do we choose to ignore genocide?
posted by Anne
2.13.12
hung by Scott
2.13.12

User Annotation of Exhibits



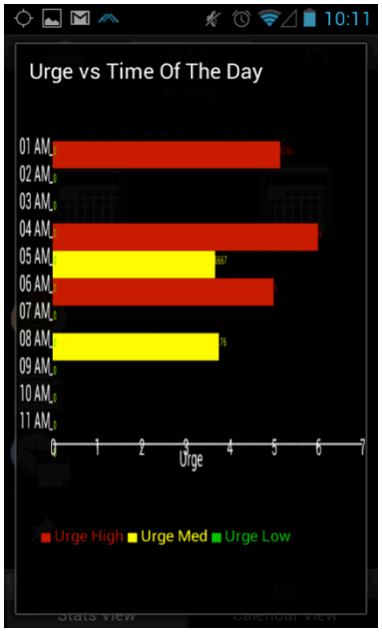
(LEFT) AUGMENTED REALITY VIEW, (RIGHT) ENCOUNTAR R

Discussions

(Left) EncountARs View, (Right) EncountAR Thread V

Mindful Me

Journaling for Addiction and Intervention



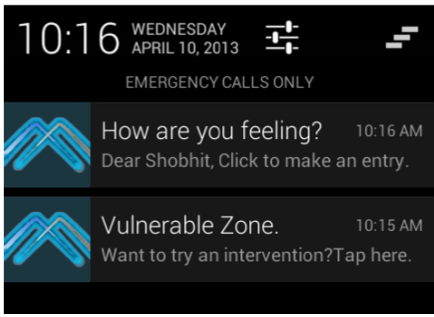
Elizabeth Glenn Guy
Shobhit Puri
Yvonne Chen

April 2013

Addictions ruin Lives

One Method in Addiction Treatment

- Is to write down cravings in a diary
  - Identify vulnerable *contexts* → determine ways to resist/avoid
- **Problems** writing on paper/book:
  - Invasions of privacy
  - Tedious
- **Solution:** use mobile device to aid journaling
- Increase journaling frequency → efficacy:
  - Easy to use interface
  - Automatic location identification/data processing
  - Data visualization & vulnerable location identification



The Big Idea

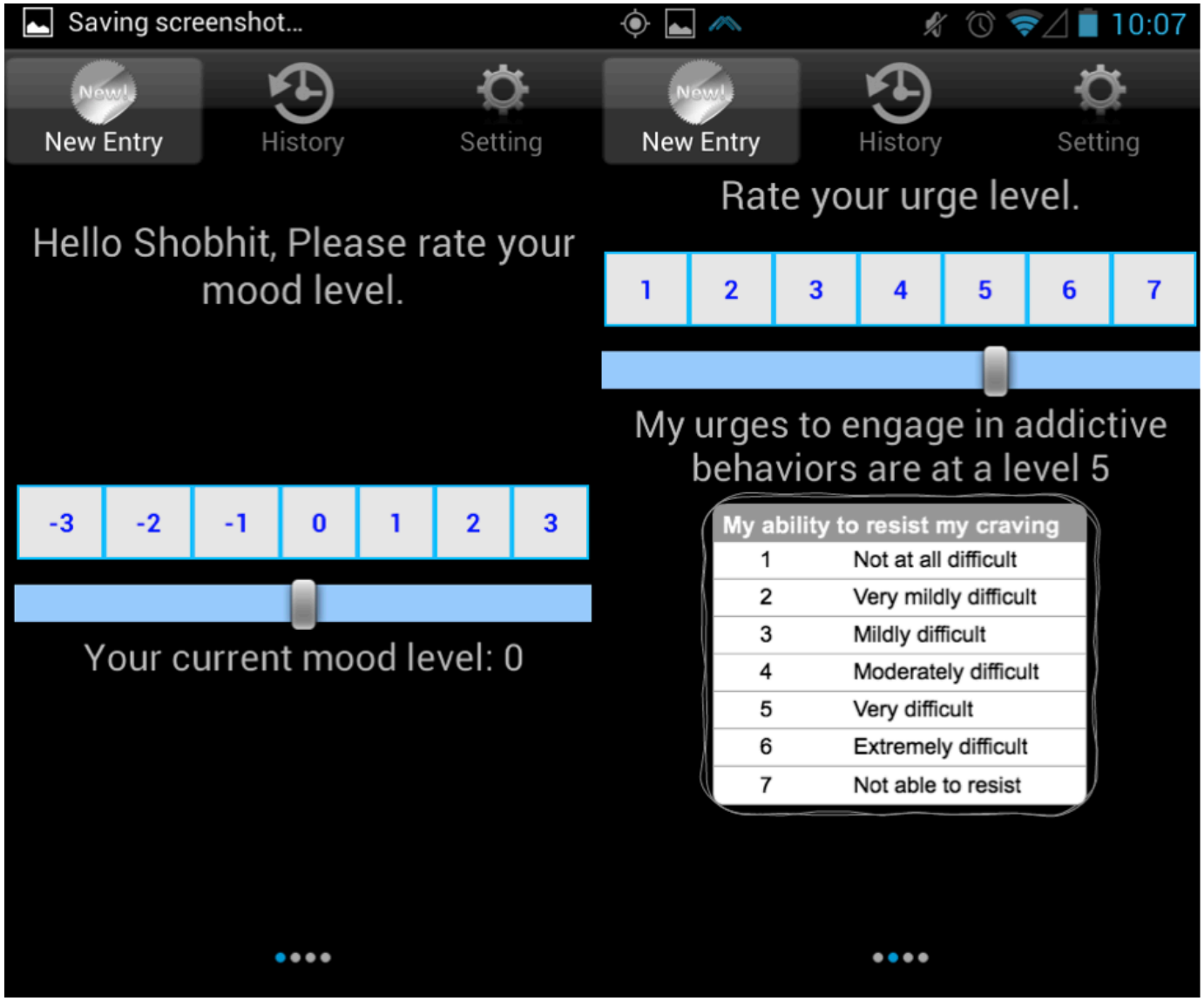
- With a phone, you can not only record the issues/ cravings, but it can record:
  - Where you are
  - How you were moving
  - What you were hearing
  - Perhaps what you were seeing
- It could learn that a certain location is a problem for you (e.g. near a Bar that an Alcoholic frequents)
- It (the phone itself) could then **Intervene!**
  - **If it thought you were heading towards a relapse**

Interventions?

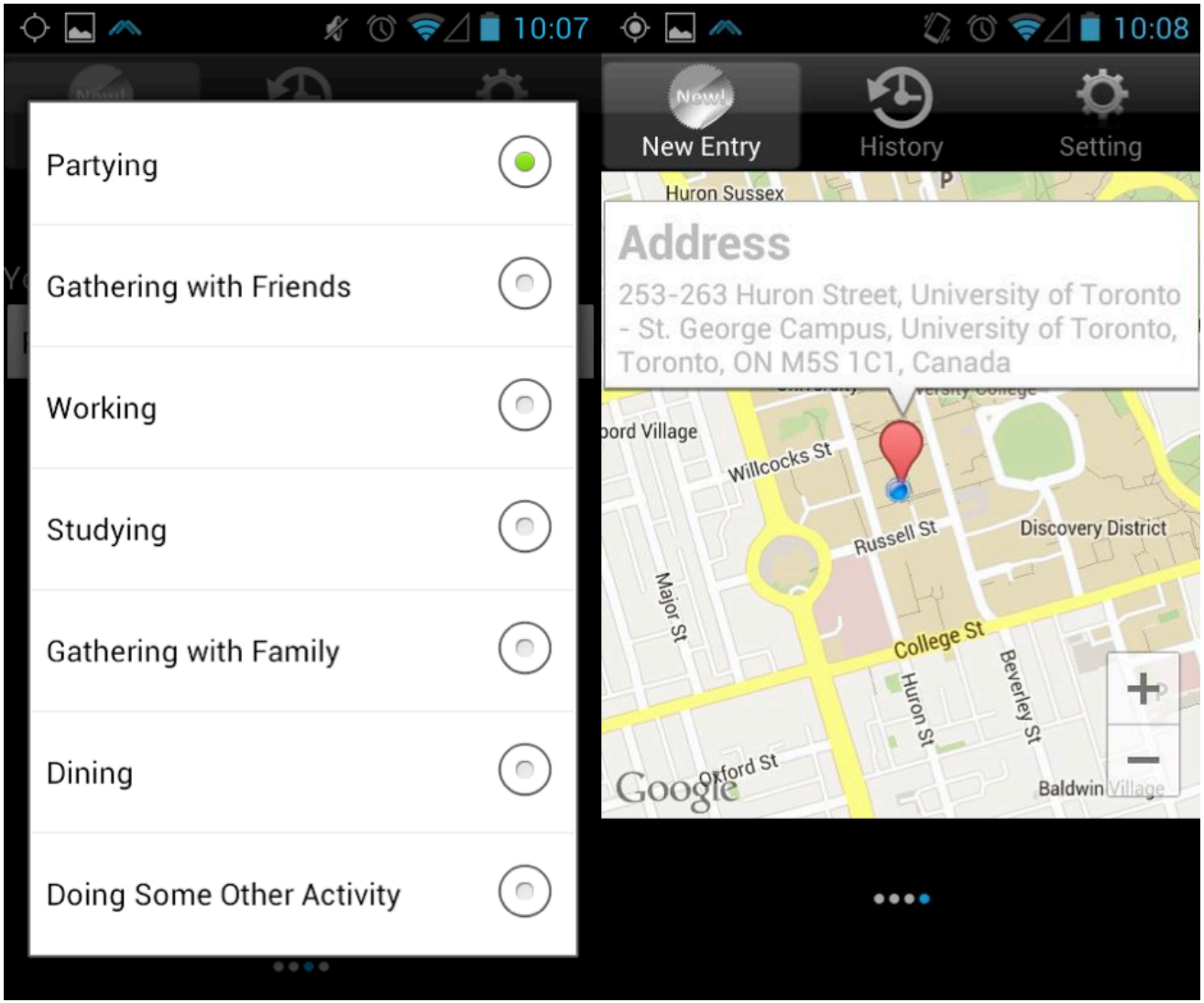
- Call your Alcoholics Anonymous Sponsor **for you**
- Play a song
- Send you a text
- Play a game
- Help with breathing exercises

- Many other possible ideas!

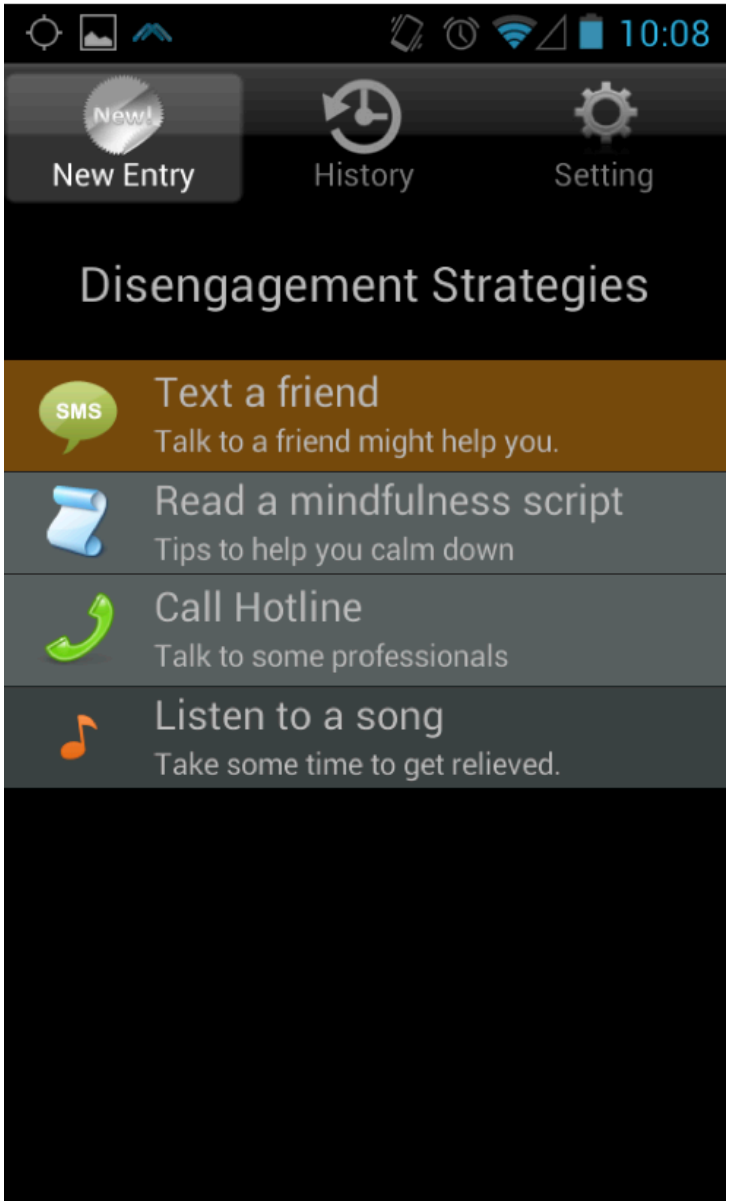
Journal Screens

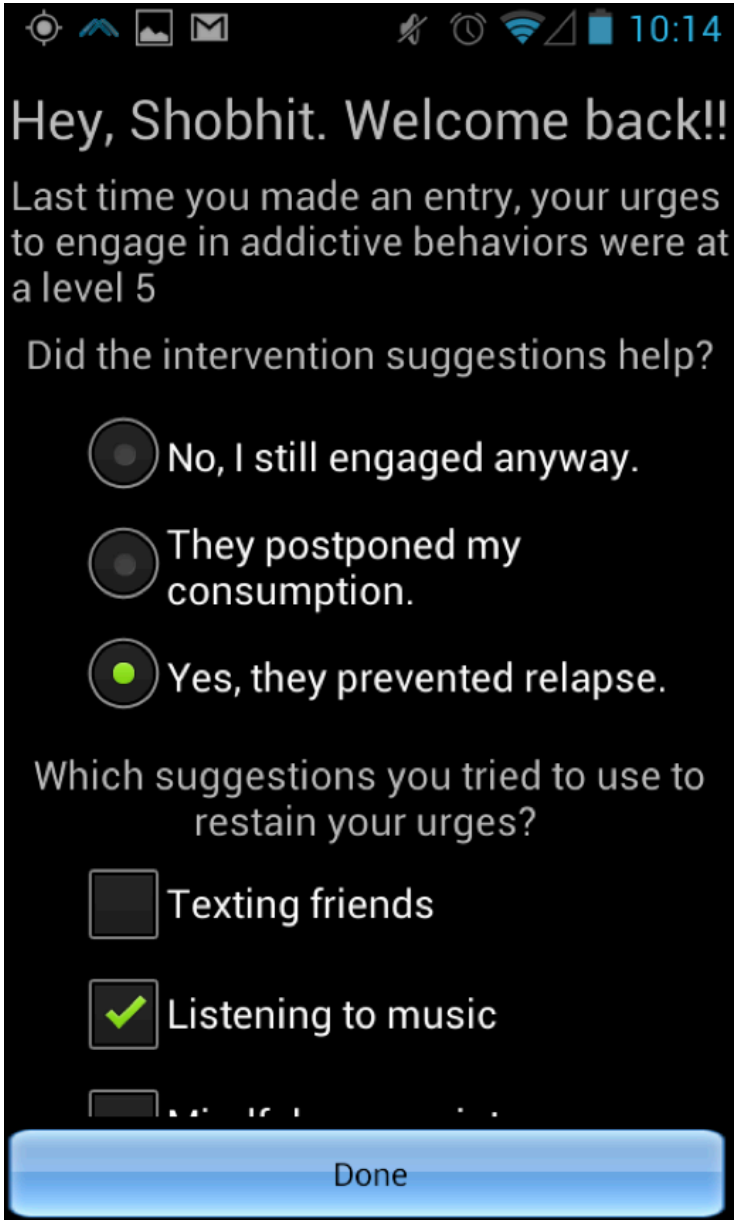


Locating & Specifying Activity

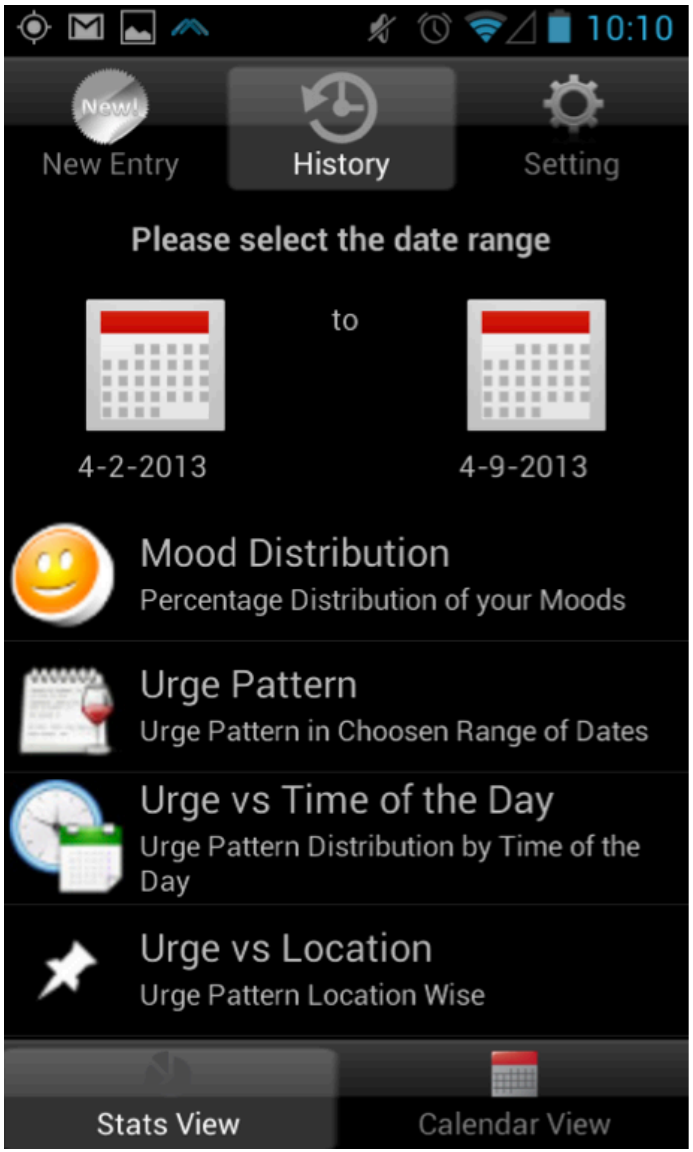


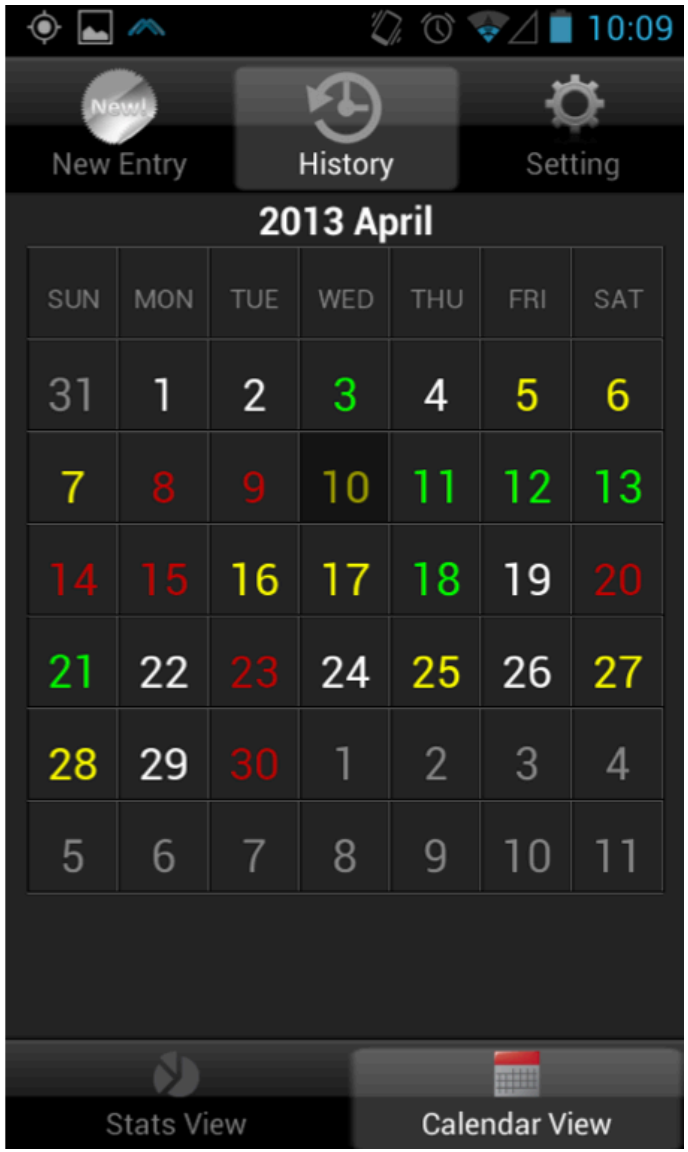
Intervention Suggestions



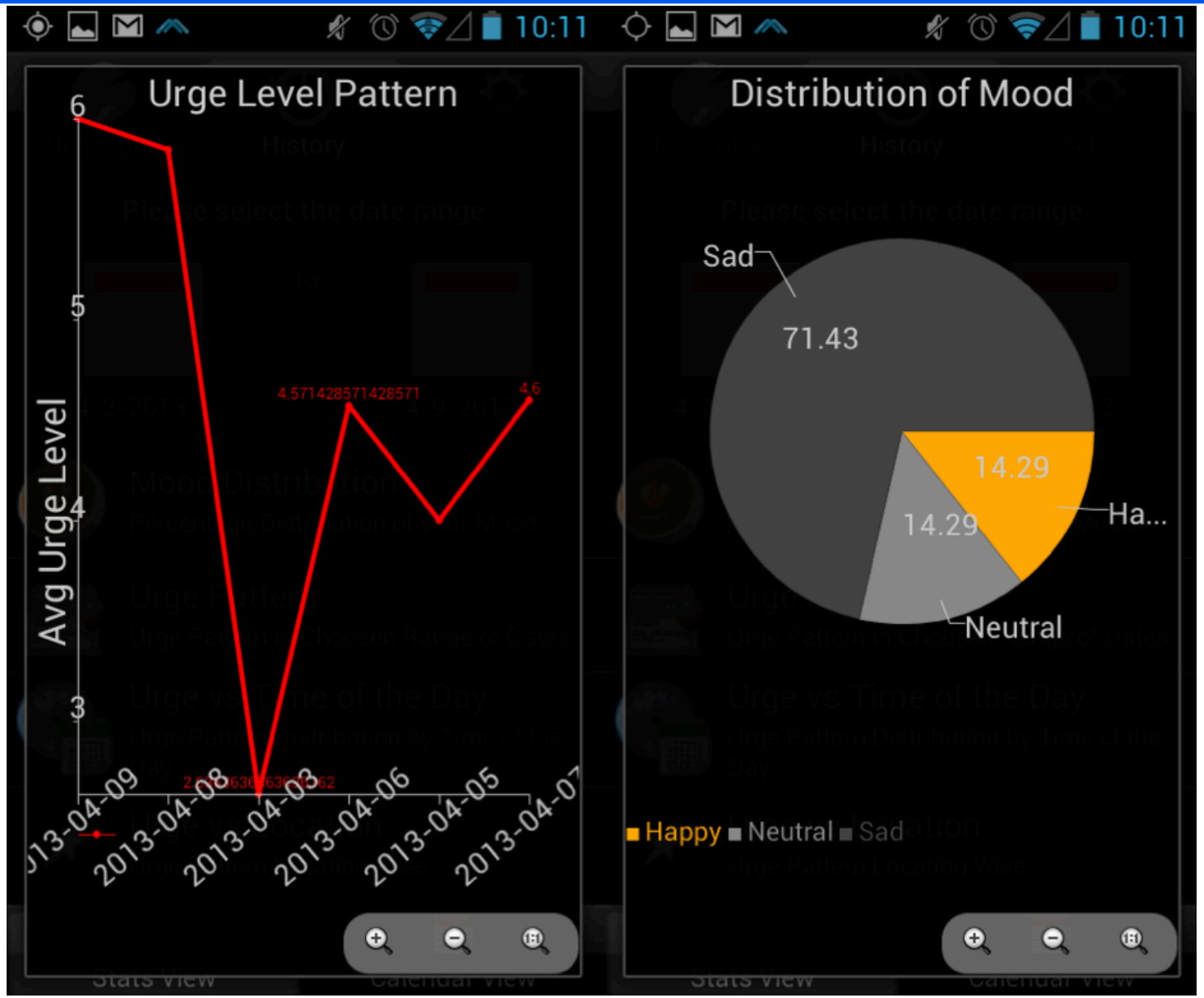


Data Collection



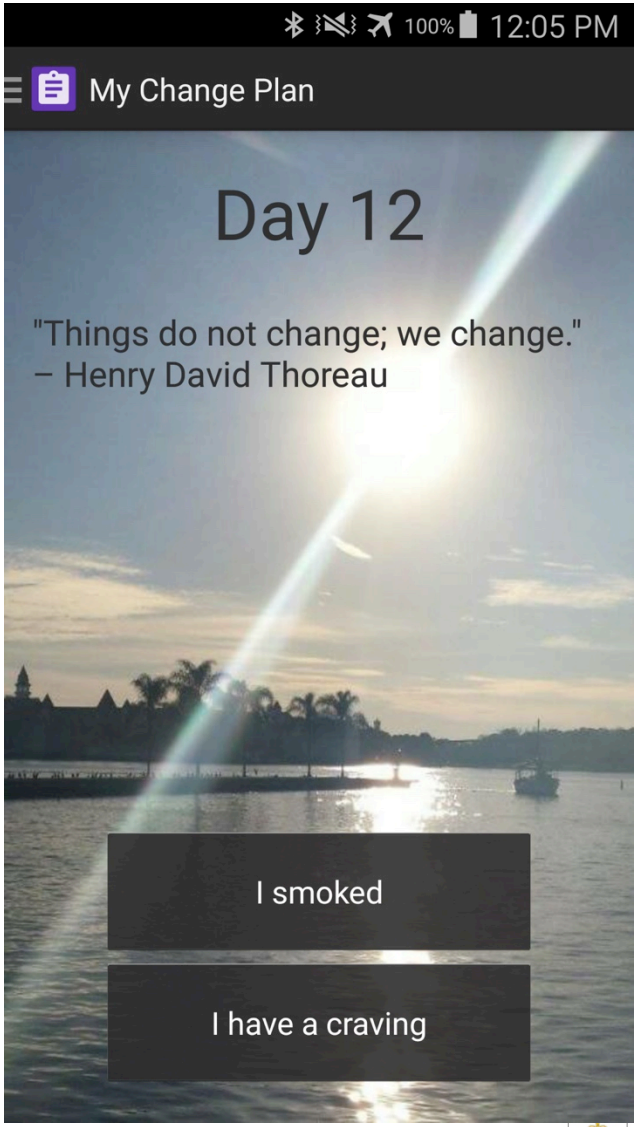


Data Display



Follow-up Research: Smoking Cessation

- ‘Mindful Me’ was a general addiction app done in the course
- These past 2.5 years, we launched a specific project in helping people to stop smoking
  - In collaboration with Nicotine Dependence Clinic, part of CAMH
  - Are currently testing with clients of clinic
    - For general feedback



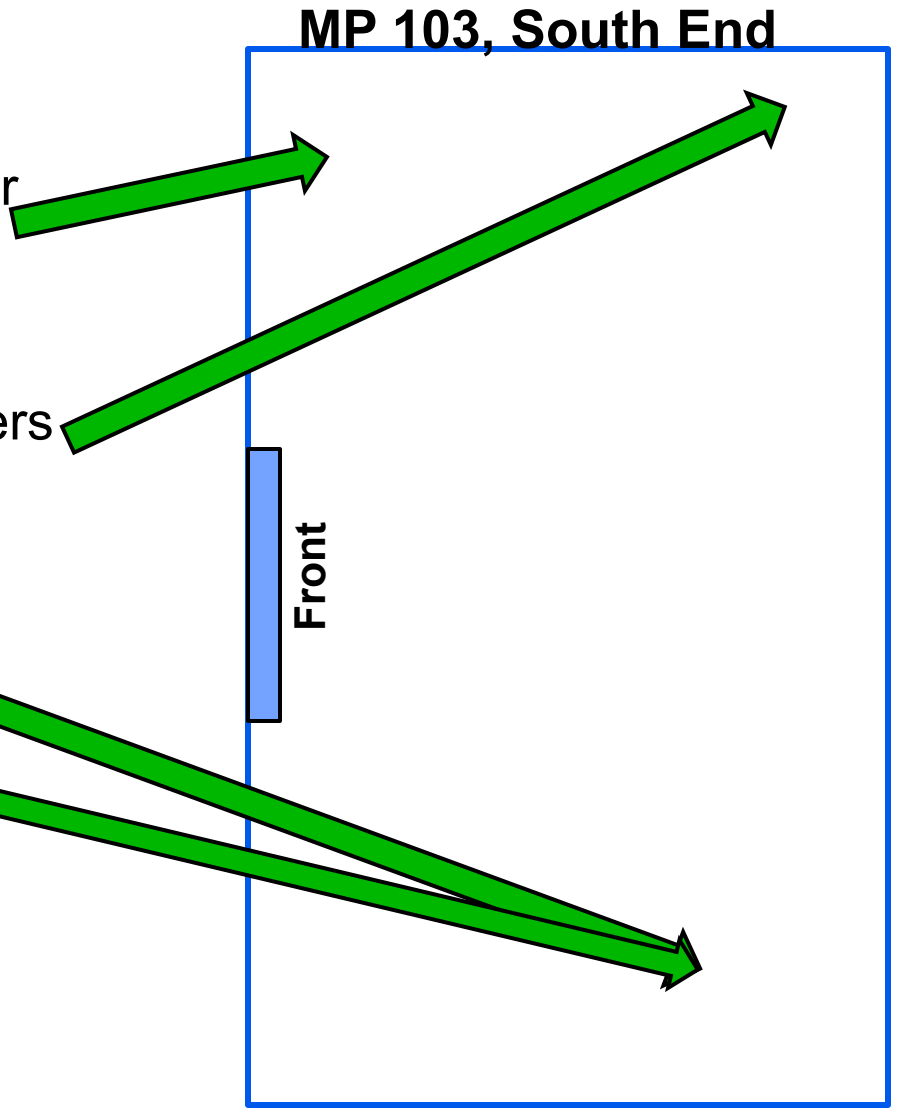
Now:
Group Forming Time and/or Topic Discussion

First: Unafiliated Specialists

- Who missed Tuesday night event:

Four Kinds of People Now

1. Already in full Groups
   - Take this time to discuss your topics
2. Un-paired Programmers
   - Form groups of 2 programmers
3. Paired Programmers
   - Need Specialist
4. Un-grouped Specialists
   - Need paired programmers



Apt To Learn

Using Phones in the Theatre

Arlynda Boyer
Abderahmane Allalou
Zohaib Alam

April 2016

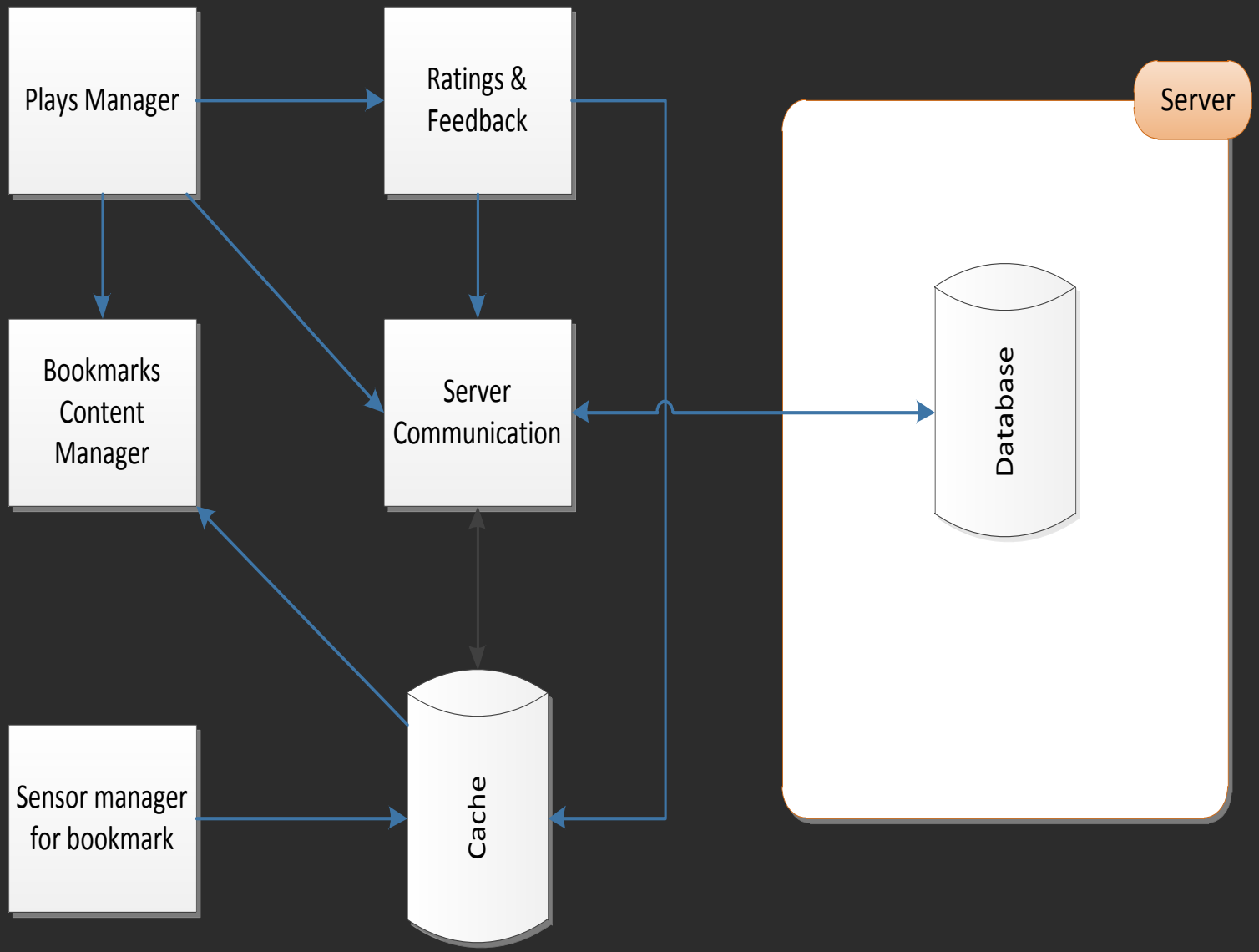
The Problem

- Theatre patrons are not very compliant with turning off their phones when asked before the show
- Plays are interrupted by chimes, buzzes, and beeps, which are disturbing to actors and other audience members and which diminish the experience of the play for everyone
- Theatre audiences tend to be older and theatres need ways to embrace, rather than ban, technology and ways to reach out to new, younger playgoers

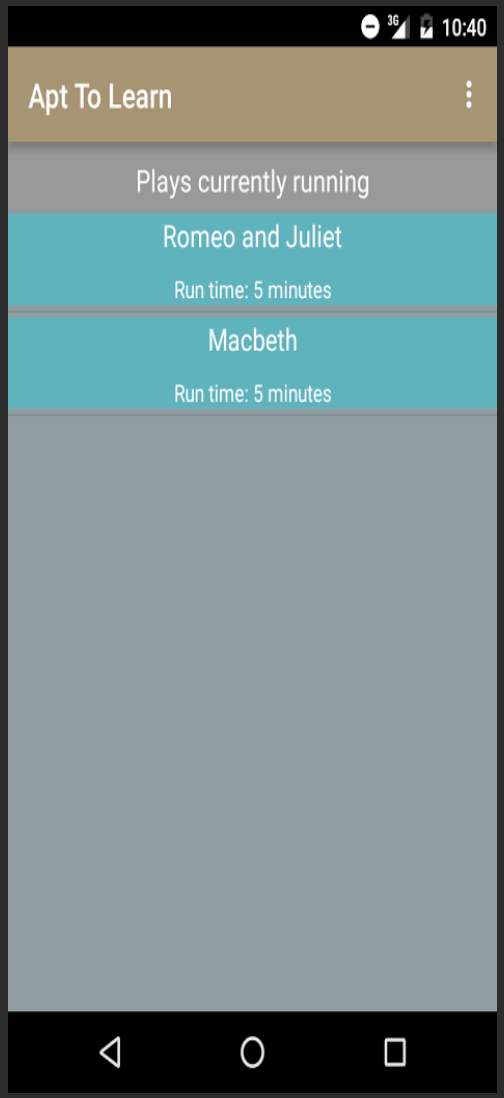
Our Solution

- Introduce mobile technology to the theater experience
- Theater goers can bookmark moments of live action, review them after the play, and learn more about the production they just saw and also about the play and about Shakespeare
- Feedback from playgoers is sent to server for researchers to analyze

Block Diagram



How it works



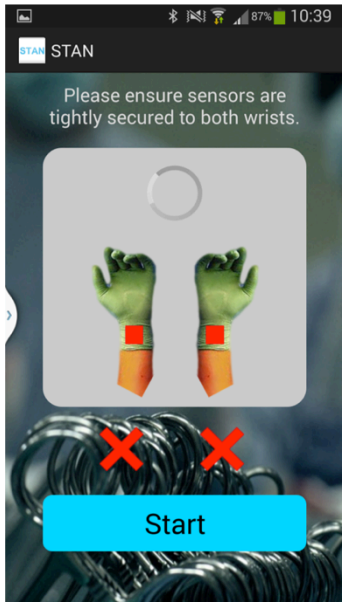
Live Demo:

- Users join the play on their phones, which is a recorded production synced by the house manager to that night's show; users can join at any point
- Users' phones are given a blank screen and set to silent
- Users bookmark moments in the play using double-tap
- After the show, users can view bookmarks on timeline, which are clickable
- Bookmarks provide detailed explanation of the scene

Why It Works

- Silent phones and dark screens are exactly the behavior theatres need from phones, while still embracing technology's ability to enrich their show
- Users do not have to turn off their phones
- Playgoers can learn more about the play and clear up moments of confusion
- Theatres can use feedback to better understand how audiences are perceiving the show and what they like or dislike about it

Surgical Trainer and Navigator (STAN)

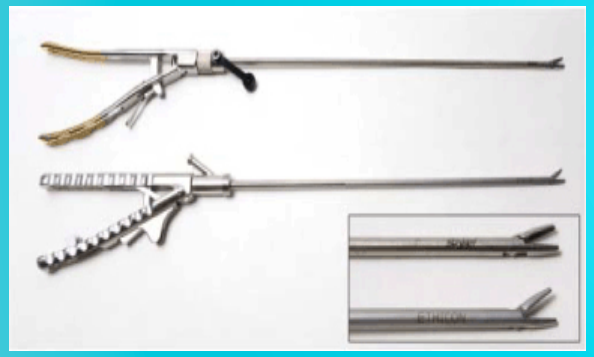


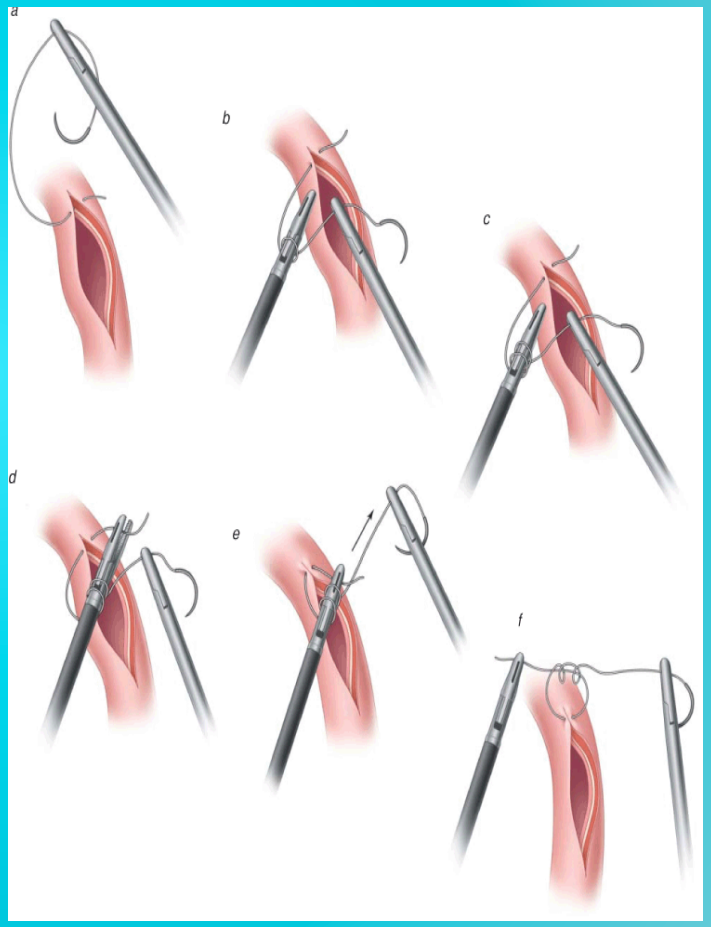
Dorotea Mutabdzic
Rorik Henderson
Kyle Tsang

April 2014

Learning to operate is like…

Until…





Currently technical performance is…

1 Below expectations

2

3 Meets expectations

4

5 Exceeds expectations

But:

Association for Surgical Education

Intraoperative assessment of technical skills on live patients using economy of hand motion: establishing learning curves of surgical competence

Ethan D. Grober, M.D. Med.*, Matthew
Mohammed Mahdi, Vanessa Bacal

The American Journal of Surgery 184 (2002) 70–73
Scientific paper

The relationship between motion analysis and surgical technical assessments

Vivek Datta, B.Sc. M.B.B.S.*, Avr
Ara

Surg Endosc (2013) 27:1468–1477
DOI 10.1007/s00464-012-2631-7

REVIEWS

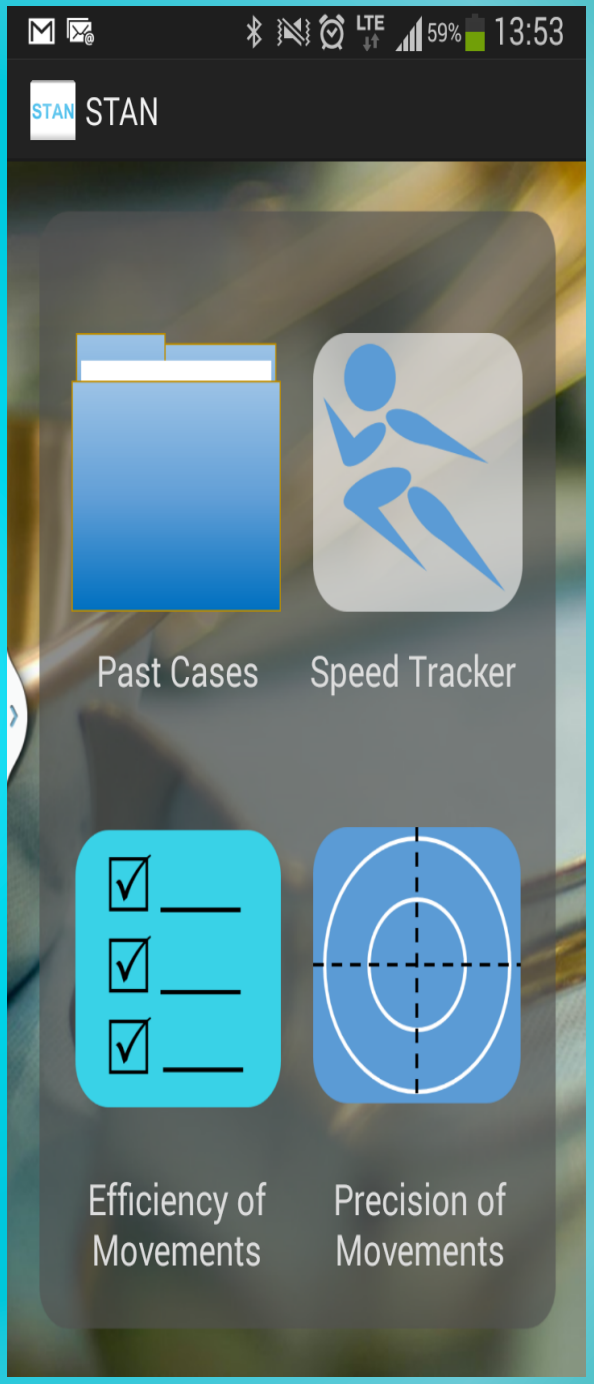
Is motion analysis a valid tool for assessing laparoscopic skill?

John D. Mason · James Ansell · Neil Warren · Jared Torkington

STAN

Tracks surgeons' hand movements

To Improve technical performance



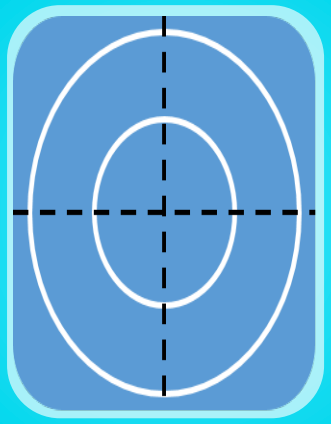
How does it improve performance?

Bluetooth sensors attached to surgeon's wrists

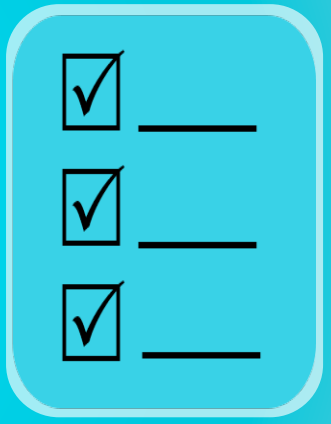
Track 3-axis accelerometer data to give feedback on speed, precision, and efficiency of movement

How does it give feedback?

Speed derived from time

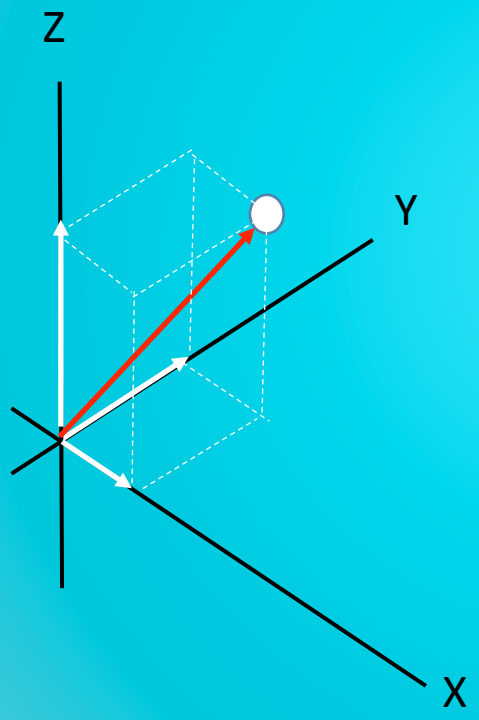


Precision derived from changes in acceleration



Efficiency derived from number of movements

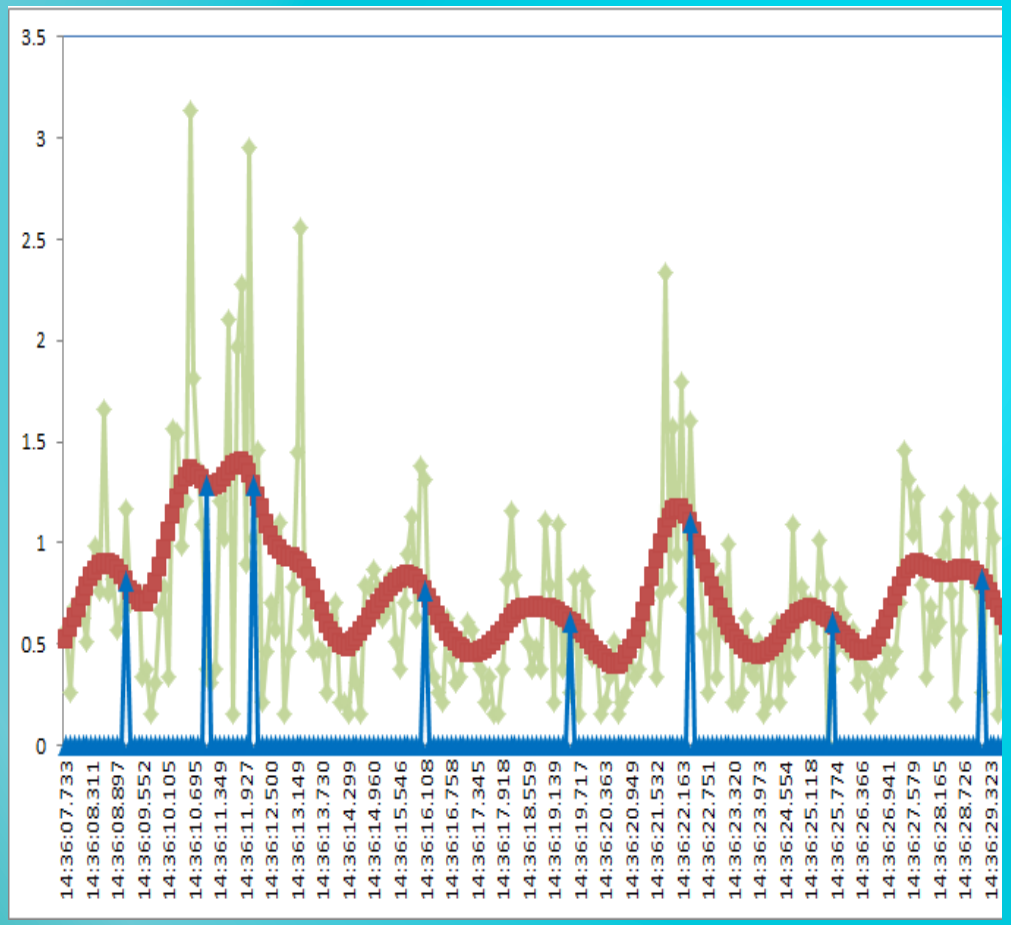
Precision



"Precision"

- controlled movements
- changes in acceleration

Efficiency



"Movement"

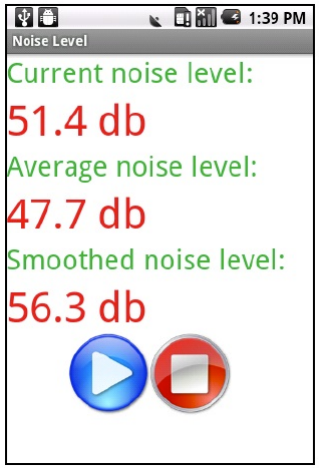
- Cluster of accelerations

Performance Categories

Category-Specific Tips

Junior level speed - “Try picking up the next peg with your free hand while putting down the previous one”

ECE 1778
WhimPer – A Noise Mapping App



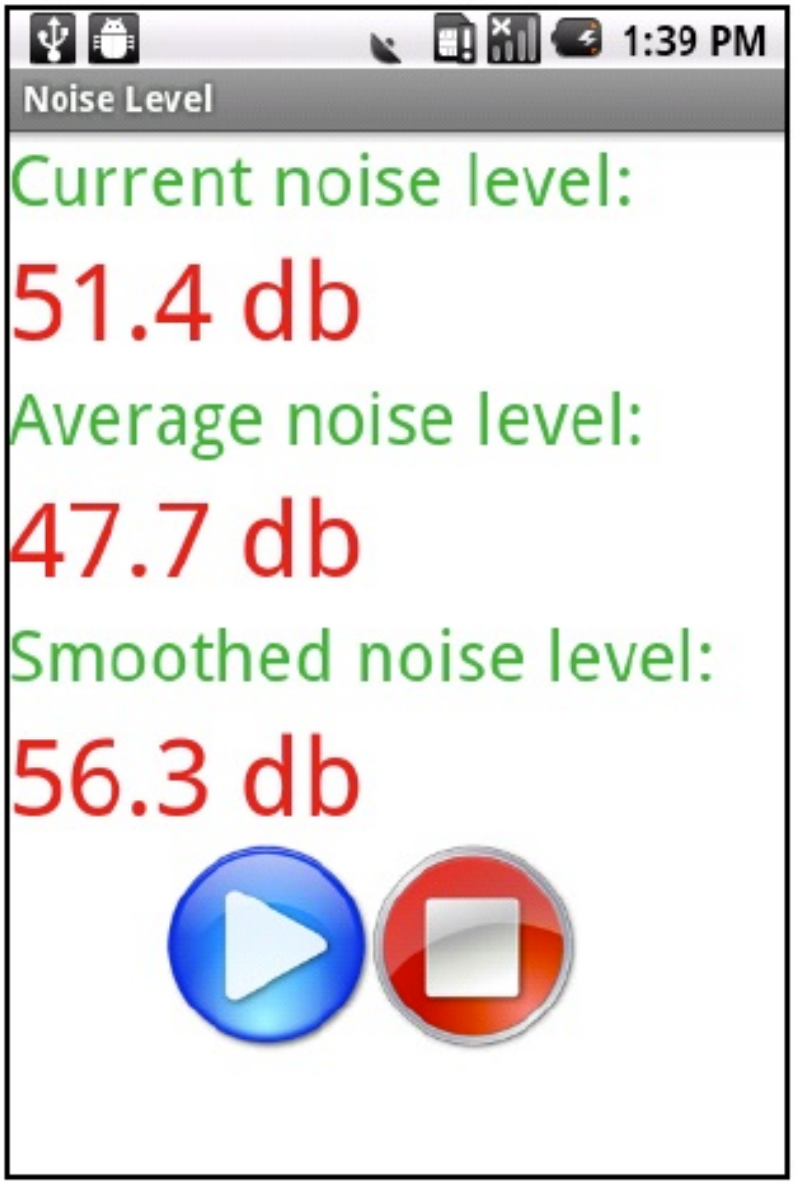
Yeliny Bonilla
Ali Sabti
Sajad Shirali-Shareza

April 2011

Whimper – Noise Mapping

- The issue: the world is full of noise, and noise pollution can reduce hearing
- The goal: create an app that can measure the noise at each location the phone ‘walks’ through
- Use this to create a Noise Map
  - Assuming more than one person uses it – crowd sourcing – a map of a city can be easily created.

Live Measurement Screen



Daily Noise Measurement v. Time

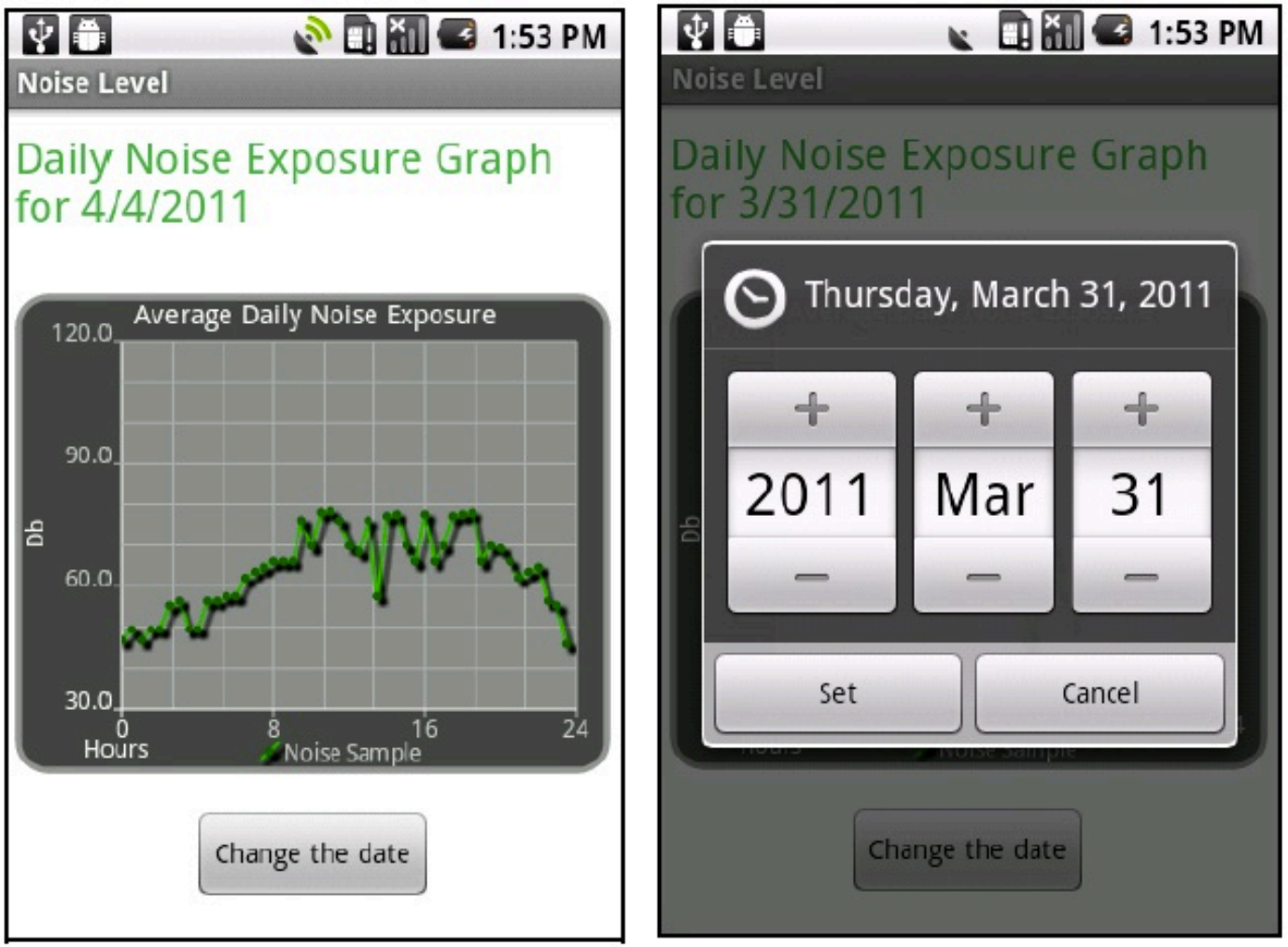


Figure 4. Noise exposure feature of the WhIMPeR application. The figure on the rights shows the ability to change the date for which the data is displayed

Noise Map

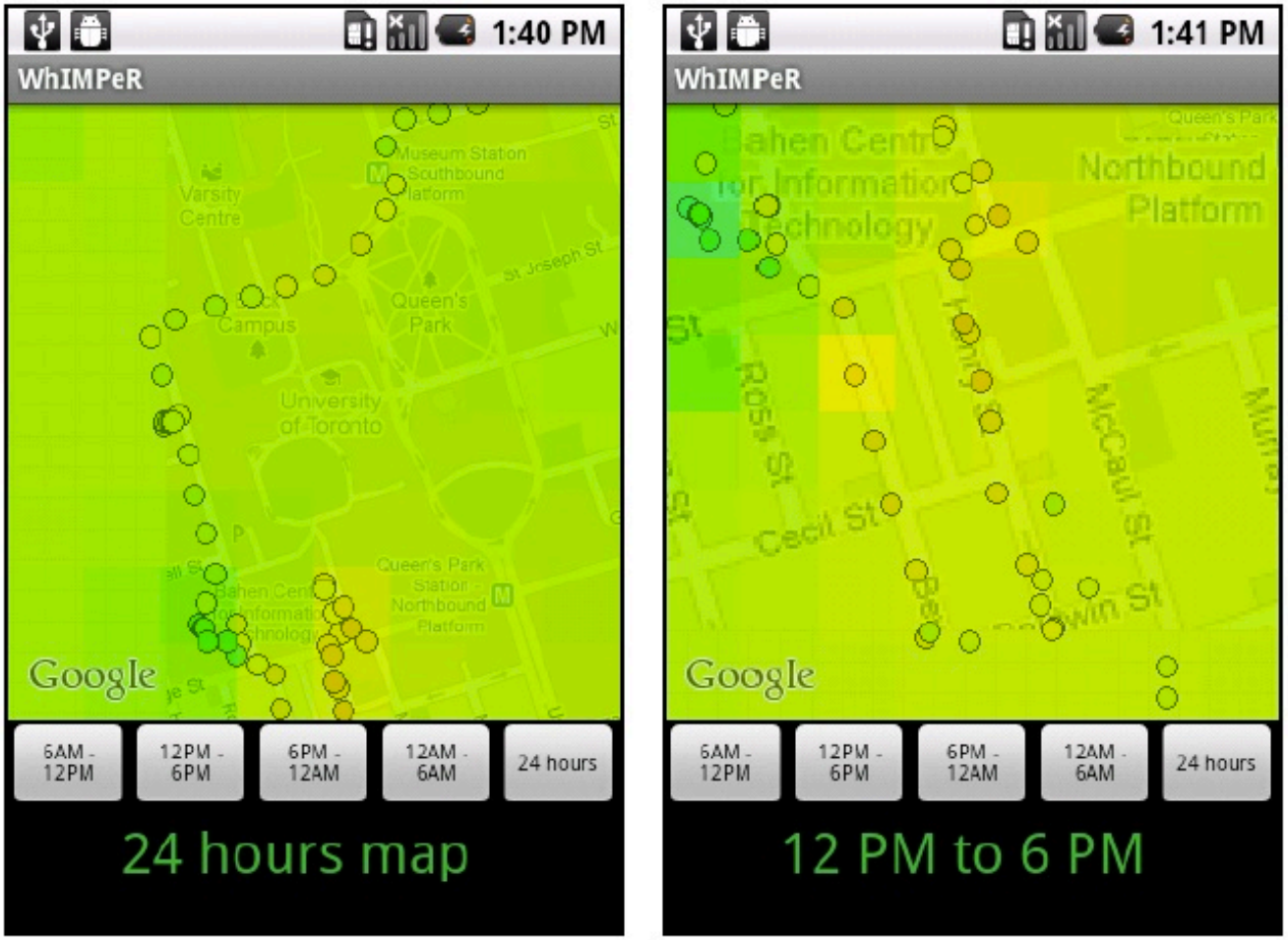
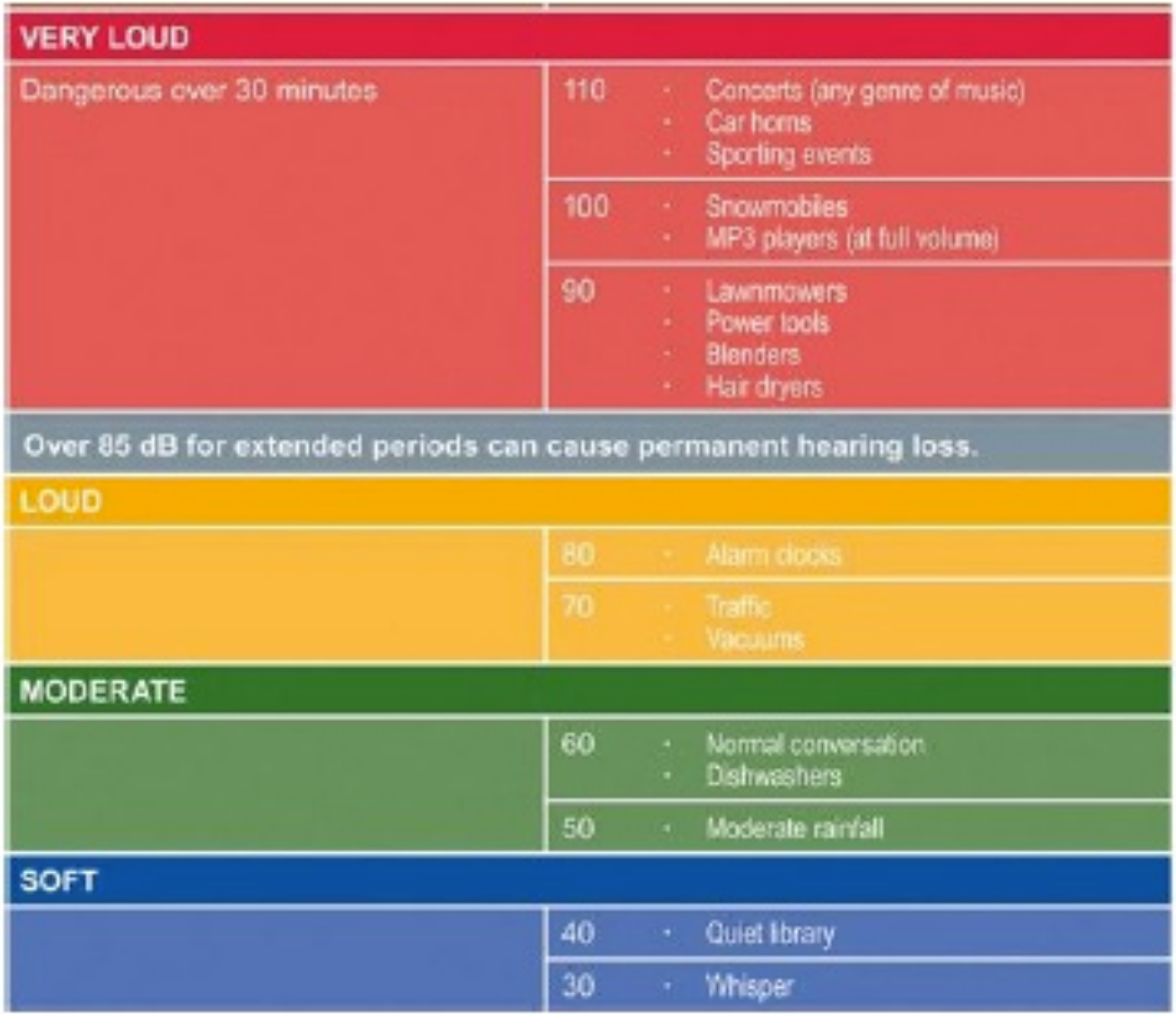
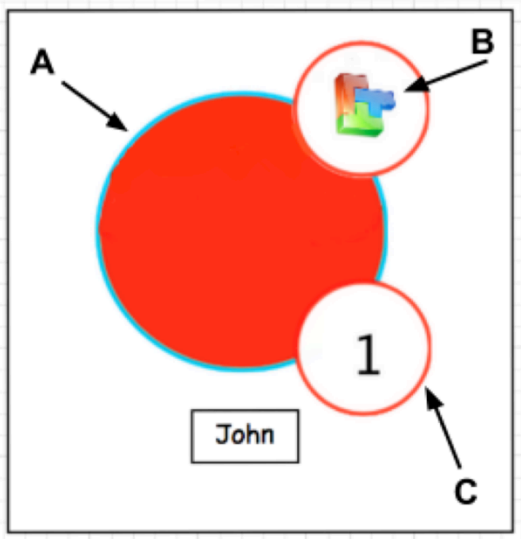


Figure 5. Noise map showing selected points of the noise data as well as a noise intensity overlay. The figure on the right shows the feature of time interval selection.

Noise Colour Code for Map



ECE 1778
Baton – Helping Teacher-Student Communication

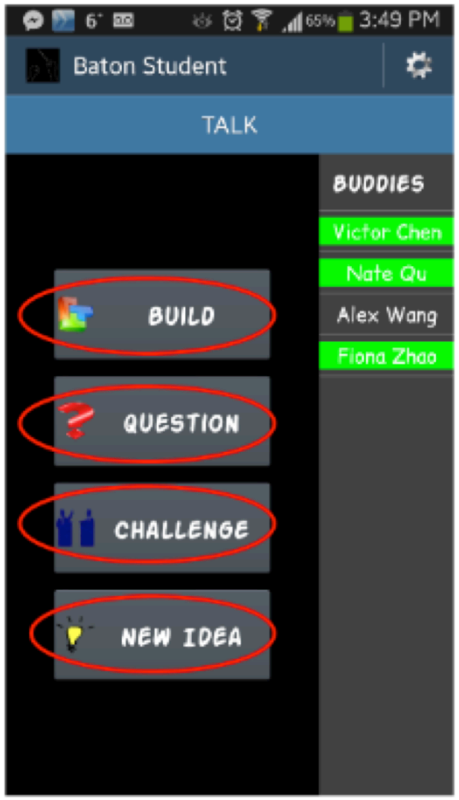


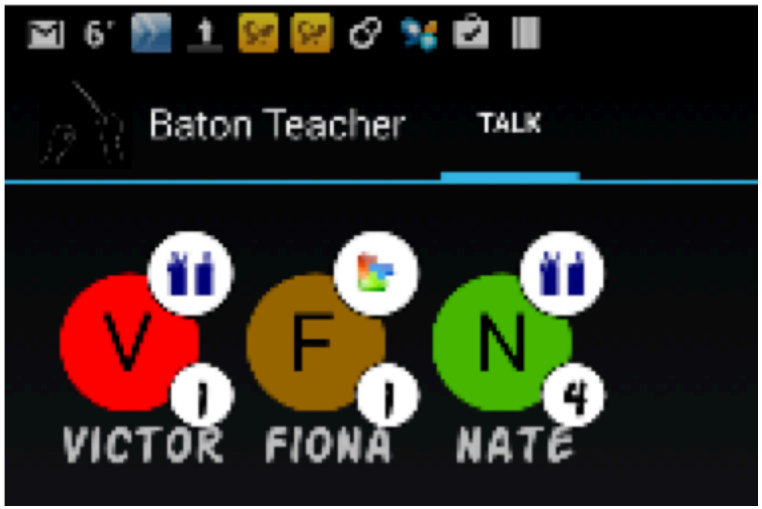
Zak Teitel
Victor Li Chen
Fiona Yi Zhao

April 2014

Putting Up Your Hand In Class

- Doesn't give the teacher much information about what you want to contribute to a fluid discussion
- What if the teacher could know more about your intent?



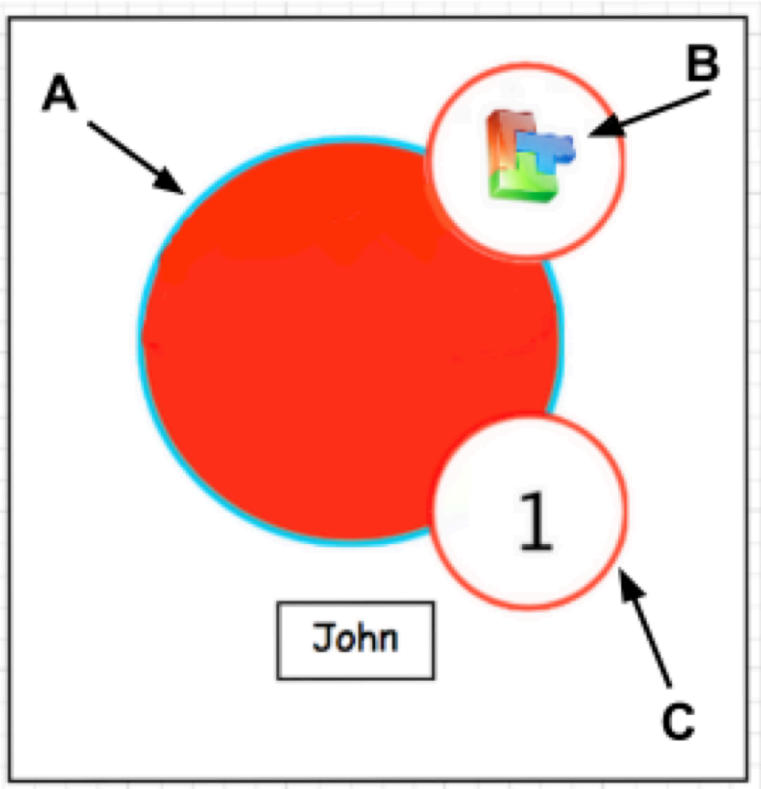


Information for Teacher

A. Main bubble offers a visualization of student wait-time. Student icons start green and the longer a student waits to participate, the redder their icon gets. You can see in image 3.1 that John has been waiting for quite some time. In user consultations, teachers indicated they wanted ambient awareness of wait-time via colour as giving them exact time measurements via a clock or stopwatch would have been “too much” to handle.

B. The upper bubble offers a visualization of “participation intent”.

C. The lower bubble lets teachers know how many times a particular student has participated in class.



3.1 Student Icon Breakdown

ECE1778
Winter 2014
Professor Rose

Creative Applications for Mobile Devices

April 9, 2014

UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

This Was a Great Project

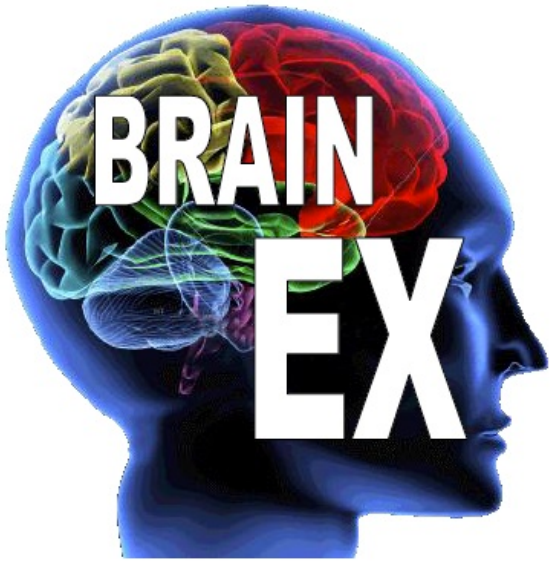
- Well described, novel
- Sufficiently Technical
- And a very interesting App

But….

- it didn't start out that way
- Zak, at the beginning, had no idea what was possible, and began with far more complex ideas
- The ideas didn't make a lot of sense at the beginning
- Through dialogue with programmers and us (myself, TAs) converged to something that worked very well

Key: creativity is messy; requires communication, evolution, iteration; kindness, reflection, then action

ECE 1778
BrainEx – Exercise for your Brain



Jinyoung Kim

Rowa Karkokli+

April 2011

Dementia & Brain Exercise

- Dementia is a cognitive disorder resulting in loss of memory, changes in personality, and loss of social ability.
- Prevention is the key since most types of dementia are permanent and cannot be cured.
- Research suggests brain exercise and activities that stimulate the brain may delay memory declines and can also reduce one's risk of getting dementia and related symptoms.
- The BrainEx application is designed for this specific purpose.

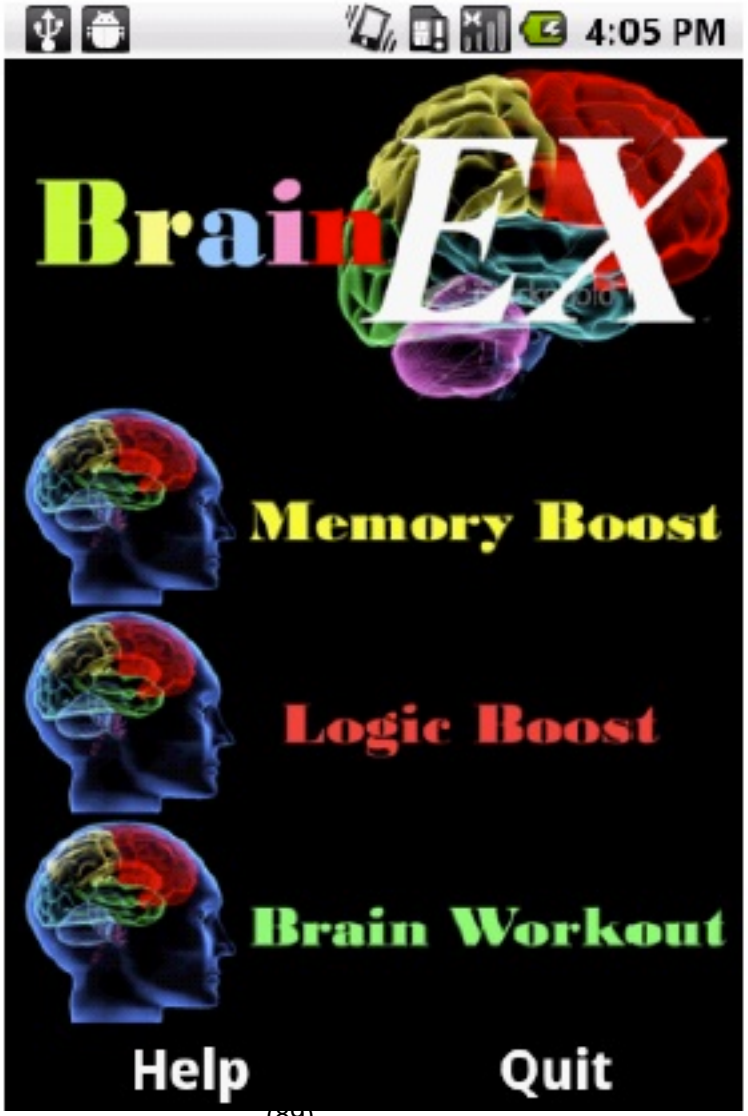
The Games

- Three games that stimulate the brain in different ways
  - allowing the user to choose a game of their interest.

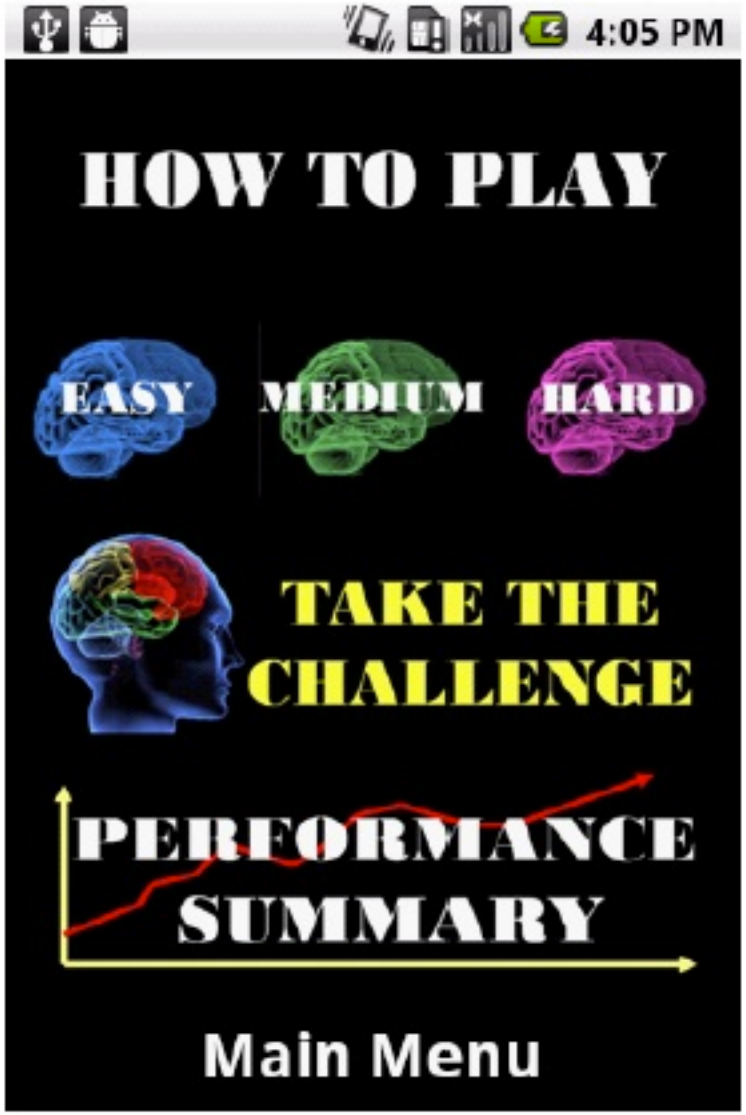
1. Game 1: designed to stimulate the user's memory,
2. Game 2: target the user's problem solving skills,
3. Game 3: targeting both memory and problem solving skills.

- Each game assesses the user's performance and speed and advances the game to increase the stimulation of the brain.

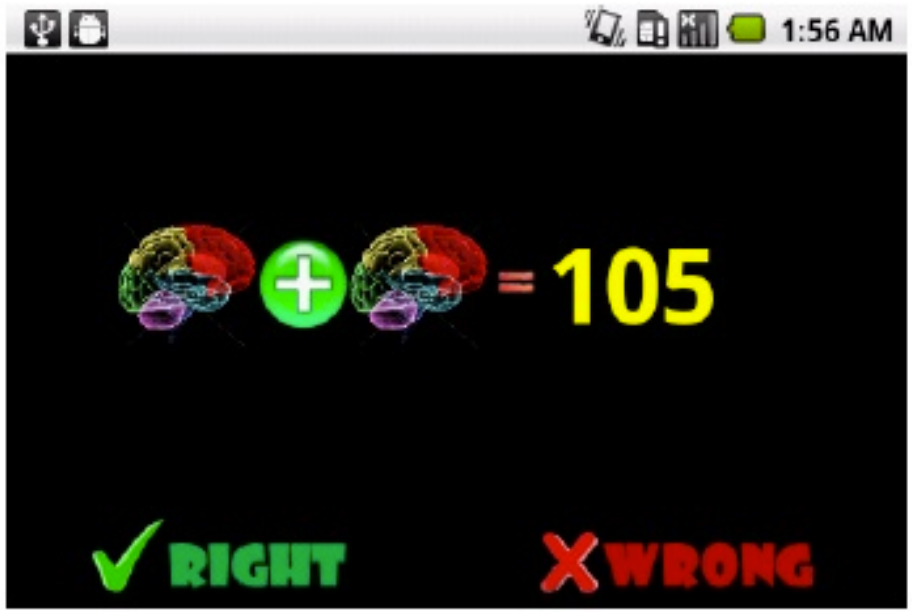
Starting Screen – Choose Game

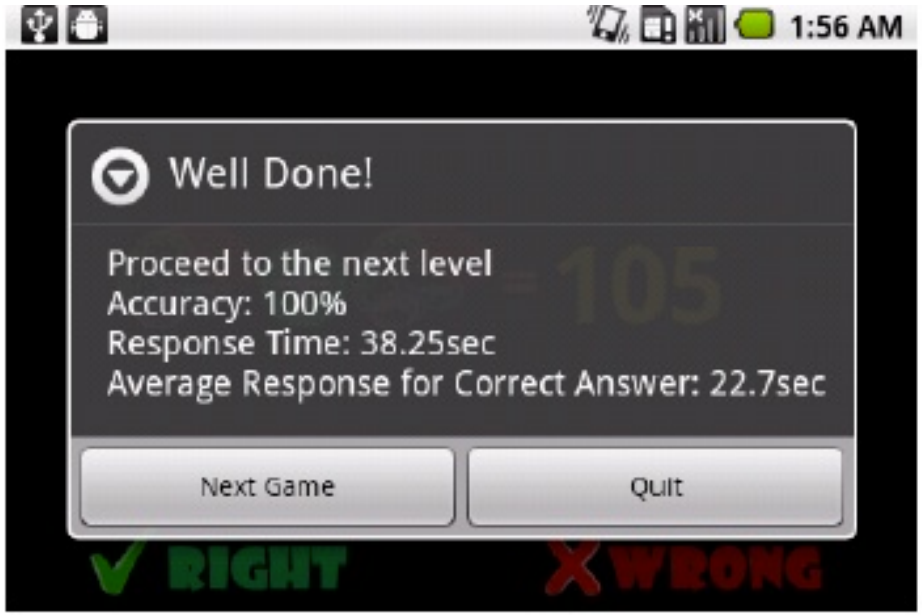


How To Play


4:05 PM
HOW TO PLAY
EASY
MEDIUM
HARD
TAKE THE CHALLENGE
PERFORMANCE SUMMARY
Main Menu

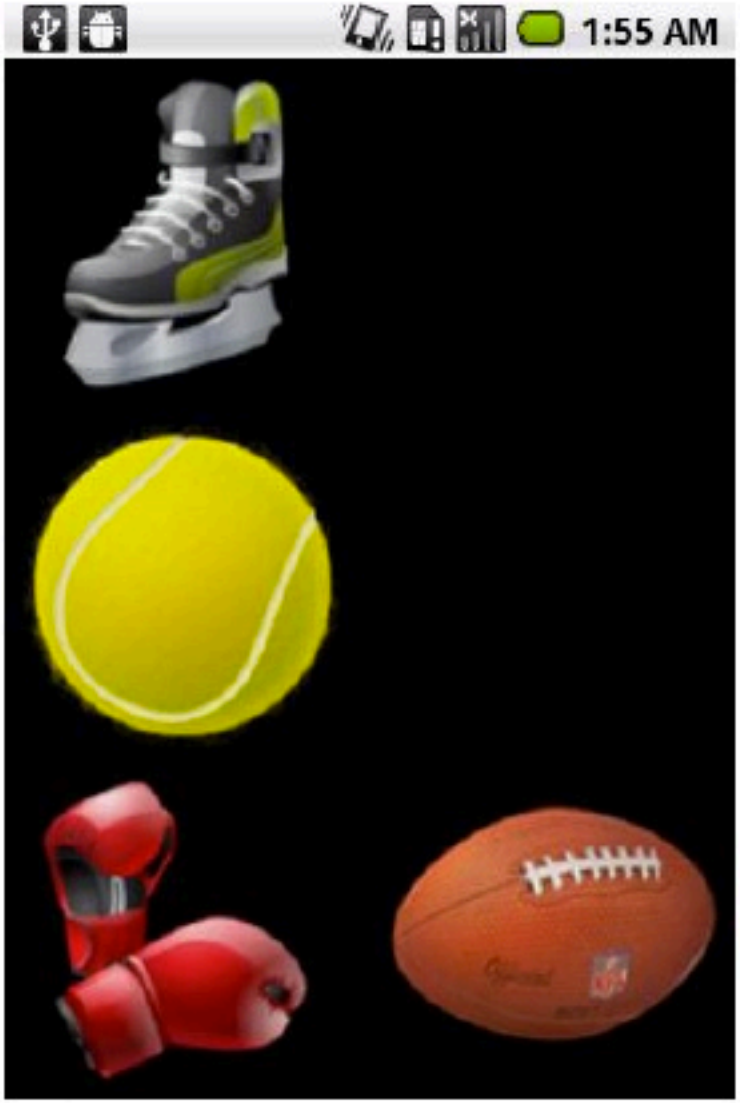
The Result

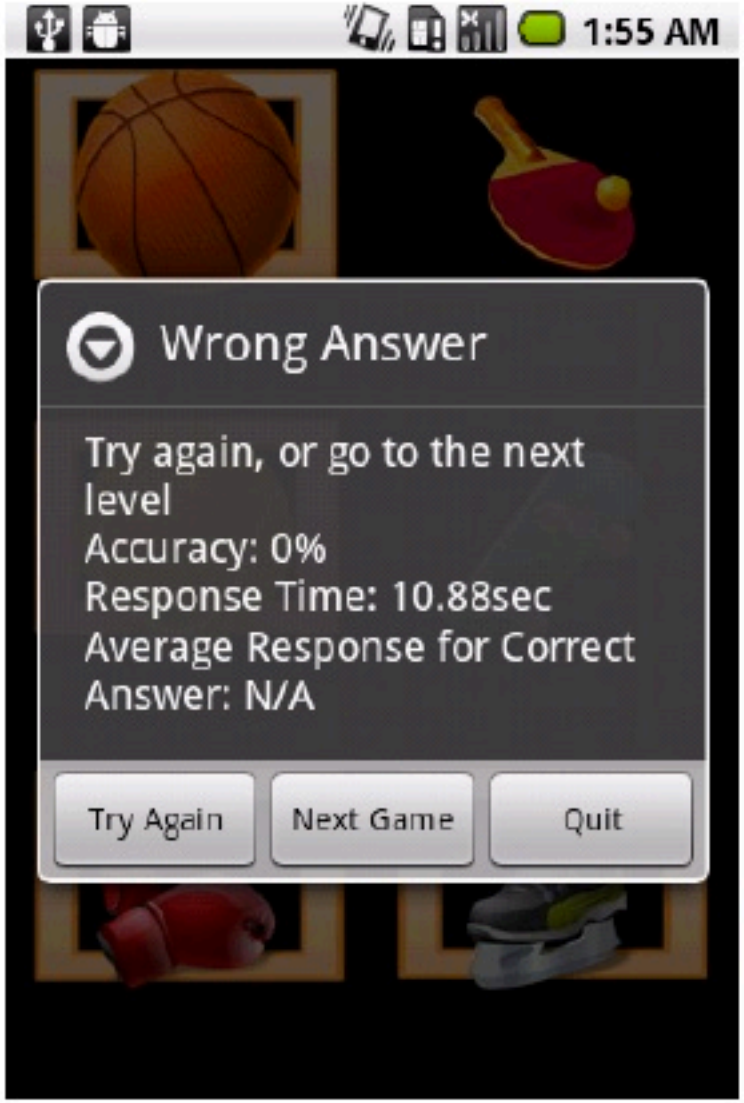

1:56 AM
=105
RIGHT
WRONG


1:56 AM
Well Done!
Proceed to the next level
Accuracy: 100%
Response Time: 38.25sec
Average Response for Correct Answer: 22.7sec
Next Game
Quit
RIGHT
WRONG

Number Calculation

Sport/Pictures





Summary of Results

APPnea: Sleep Apnea Detection

Phil Lam
Regina Leung
Thuva Sivayogan

April 2012

What is Sleep Apnea

- Sleep apnea is a common (and under-diagnosed) sleep disorder
  - characterized by periods of interrupted or shallow breathing during sleep

- Affects the quality of life of individuals
  - extreme fatigue and poor concentration
  - may also lead to other serious medical conditions
    - cardio/cerebrovascular problems with mortality rates as high as 35%.

Sleep Apnea, continued

- Key issues in Apnea detection and treatment:

1. Limited availability & high cost of clinical sleep Apnea detection method:
   - patient must spend a night under observation by technician and clinician in a “sleep lab.”
2. lab test is performed in foreign environments with multiple electrodes attached to the individual
   - may induce stress & cause inaccurate results.
3. CPAP (Continuously Positive Airway Pressure) is a commonly prescribed treatment for sleep apnea, but offers low rates of patient compliance. This is primarily due to the fact that the required mask over the nose and mouth is uncomfortable.

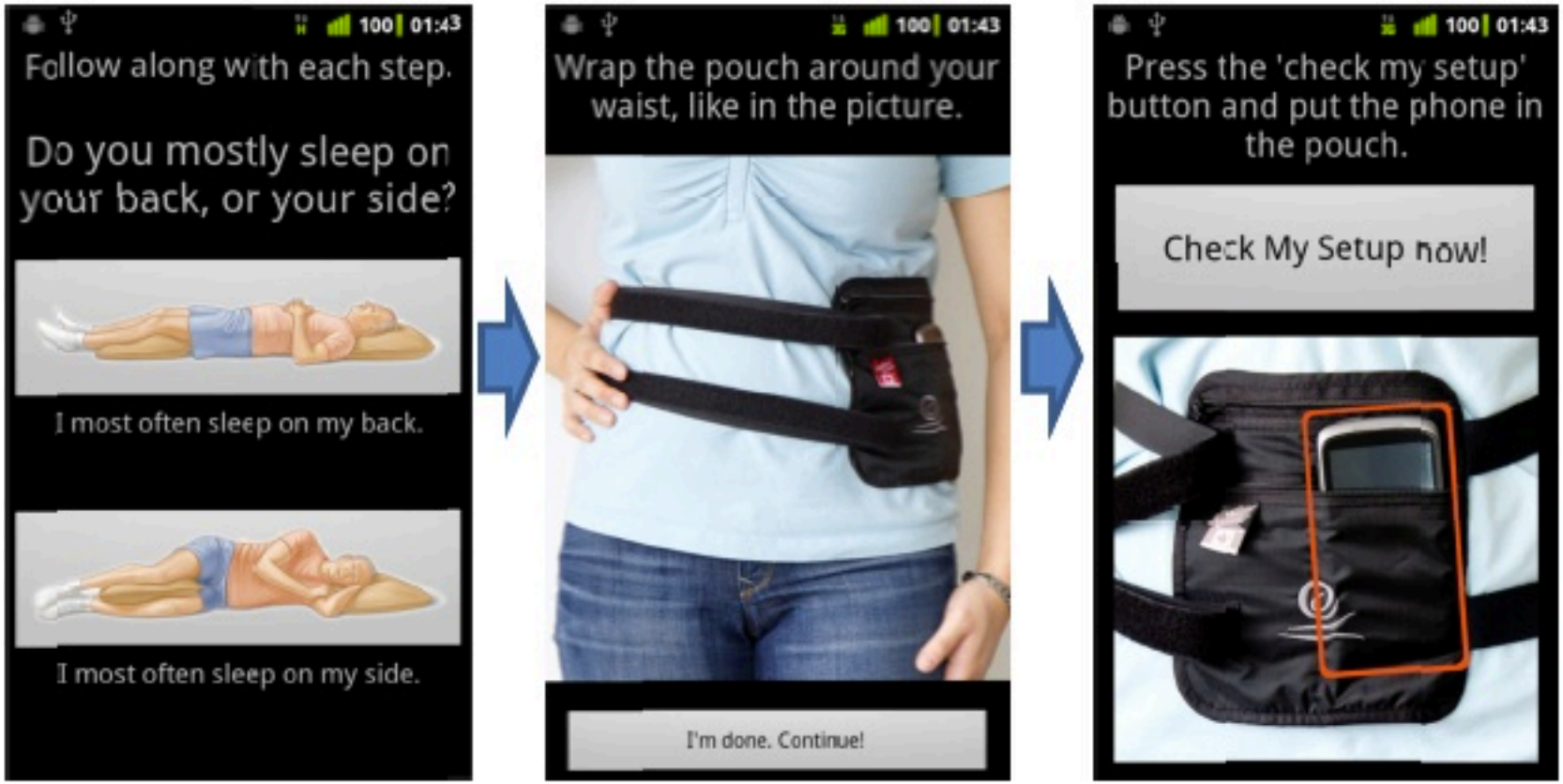
The App

- APPnea operates by detecting the rate of respiration with the phone's accelerometer.
- This is accomplished by using a pouch to attach the phone to the user's chest.
- Signal processing algorithms involving a combination of time domain and frequency domain techniques are used for the detection of apnea events.
- The number of sleep apnea events per night are recorded, saved in a log, and displayed back to the user in the form of a histogram for daily sleep apnea monitoring.

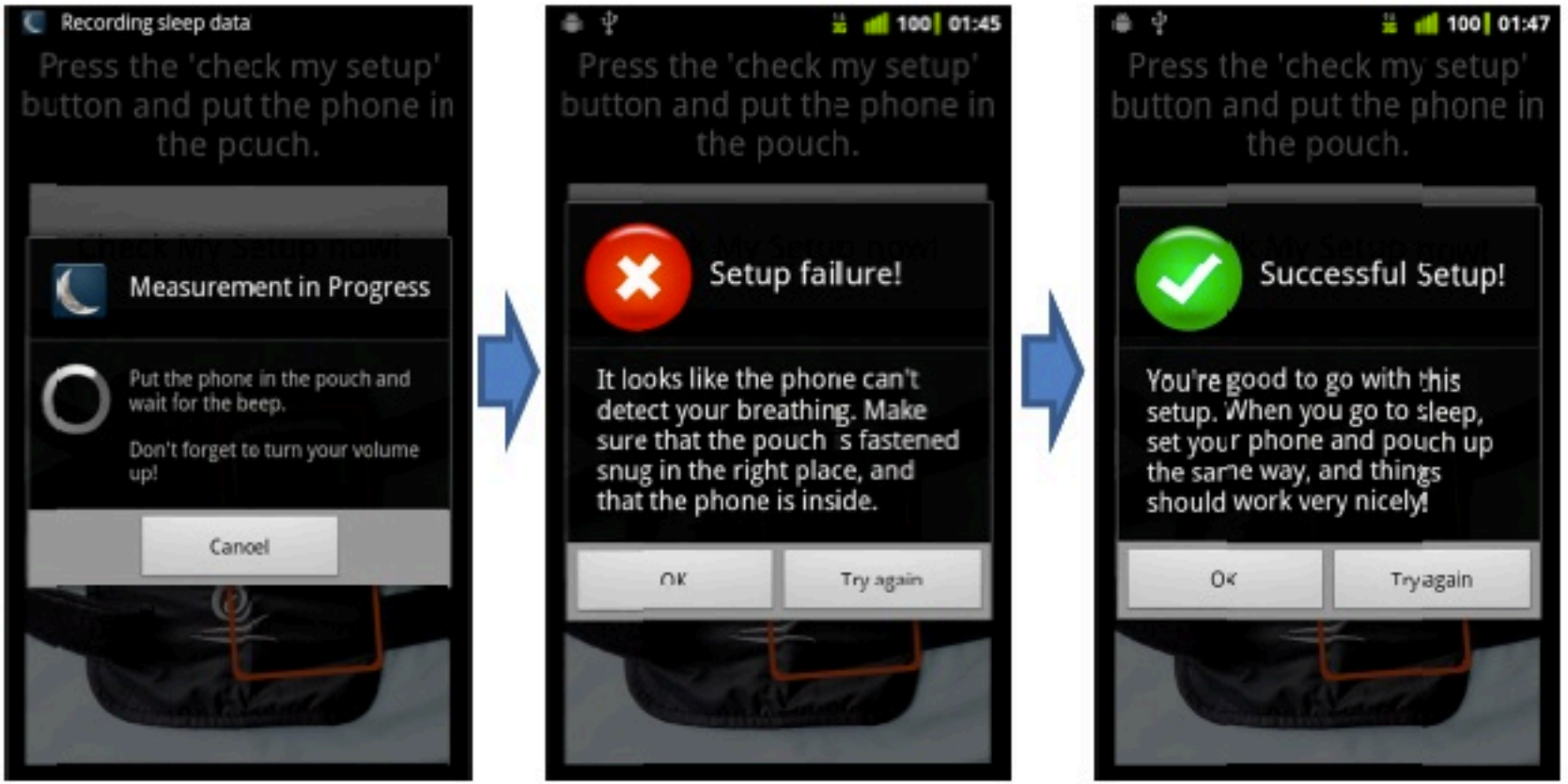
Detecting an Apnea Event

- Apnea: person stops breathing while sleeping
  - Assume this means the chest stops moving
- Strap phone to chest, and use accelerometer to calculate pitch and roll with respect to gravity
- Search for periods of no movement, ranging from 10 seconds to 2 minutes
  - Followed by 2 minutes of breathing

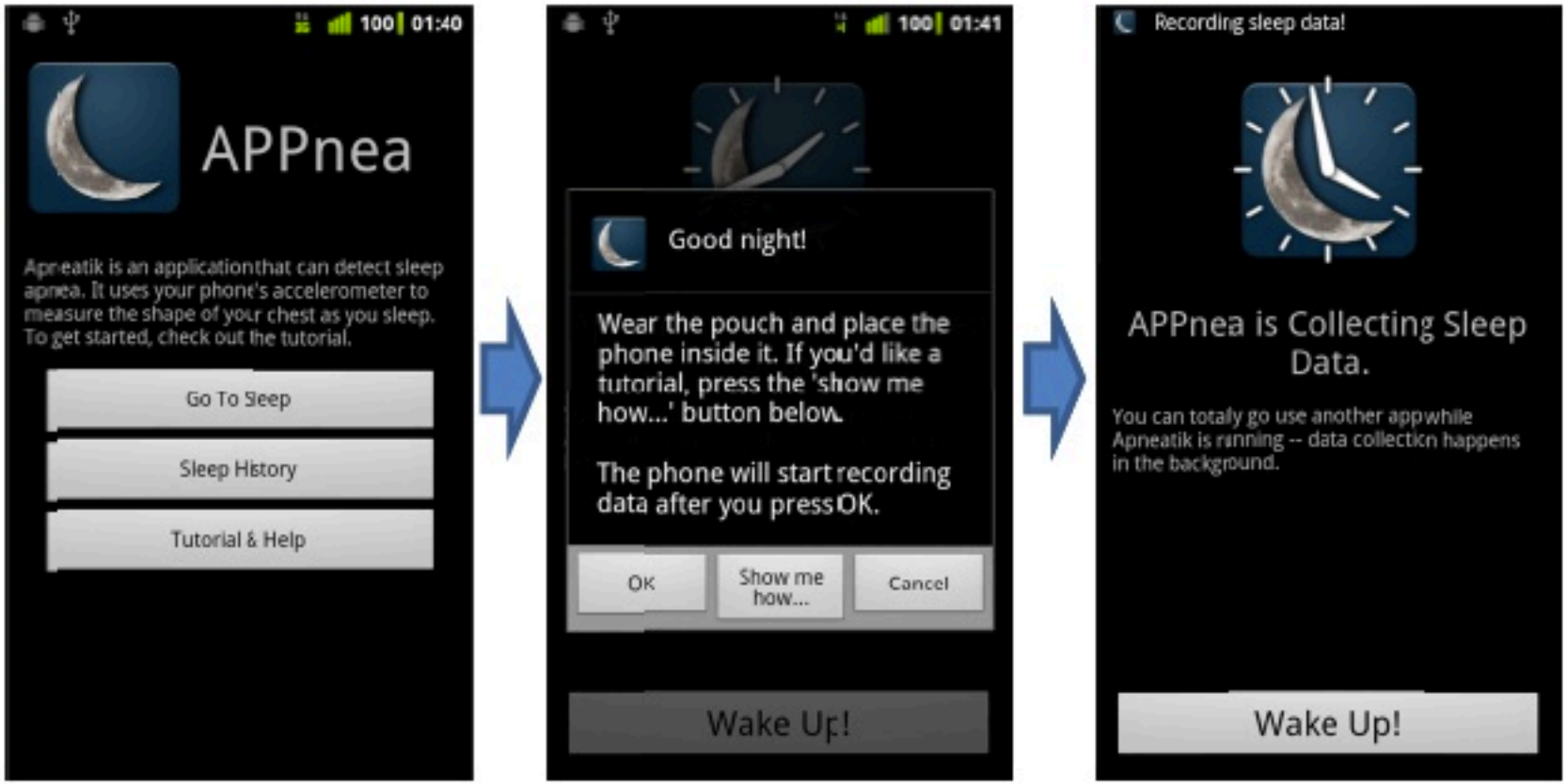
User Tutorial



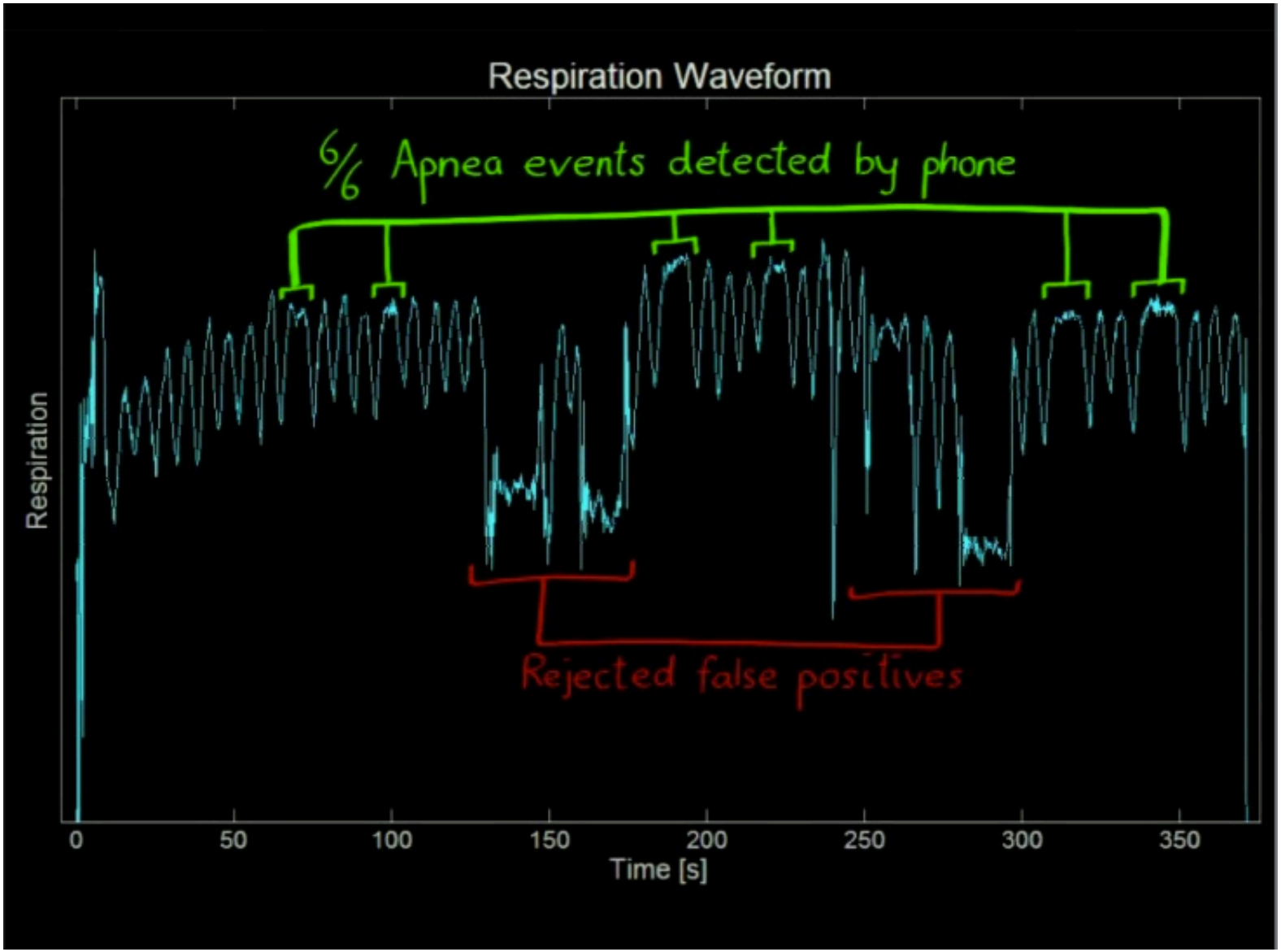
User Tutorial, cont'd



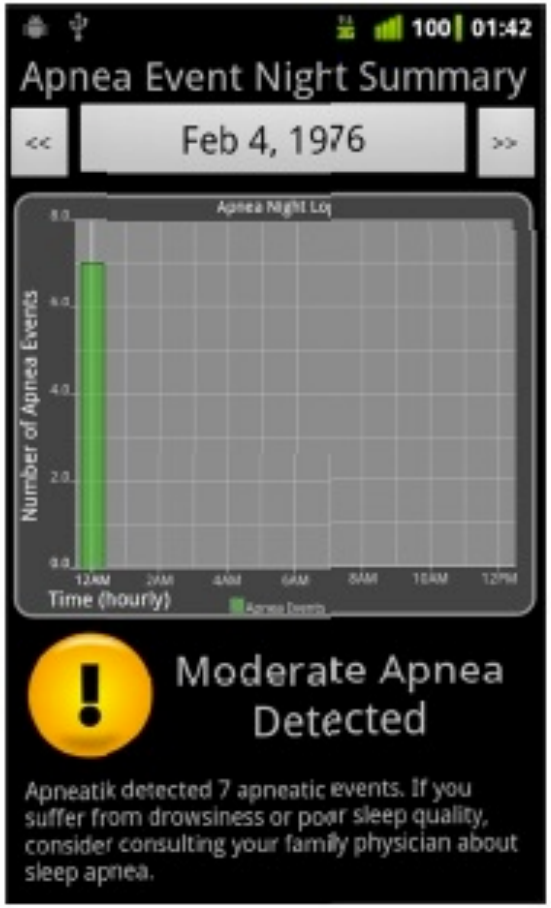
App Controls

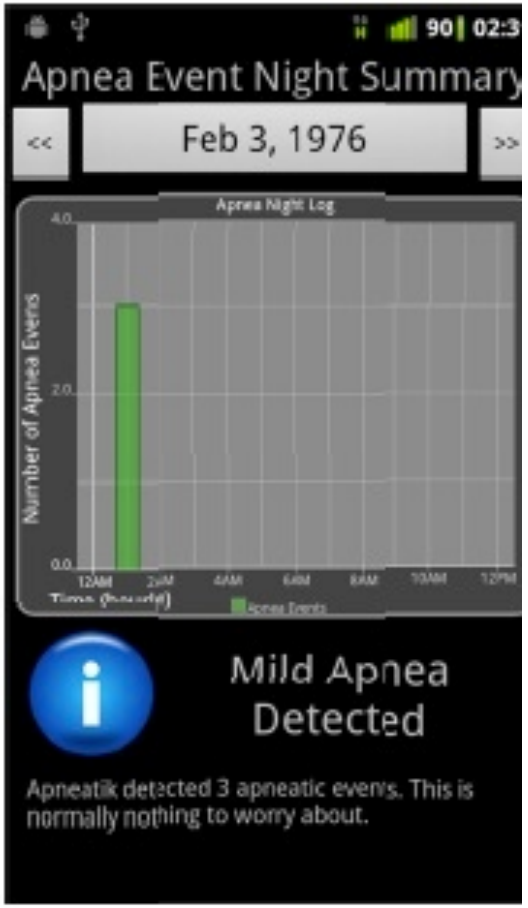


Example Collected Data



Output From App





Surgical Black Box

Reviewing Surgery & Detecting Errors

Ted Avery
Jill Cates
Eddie He

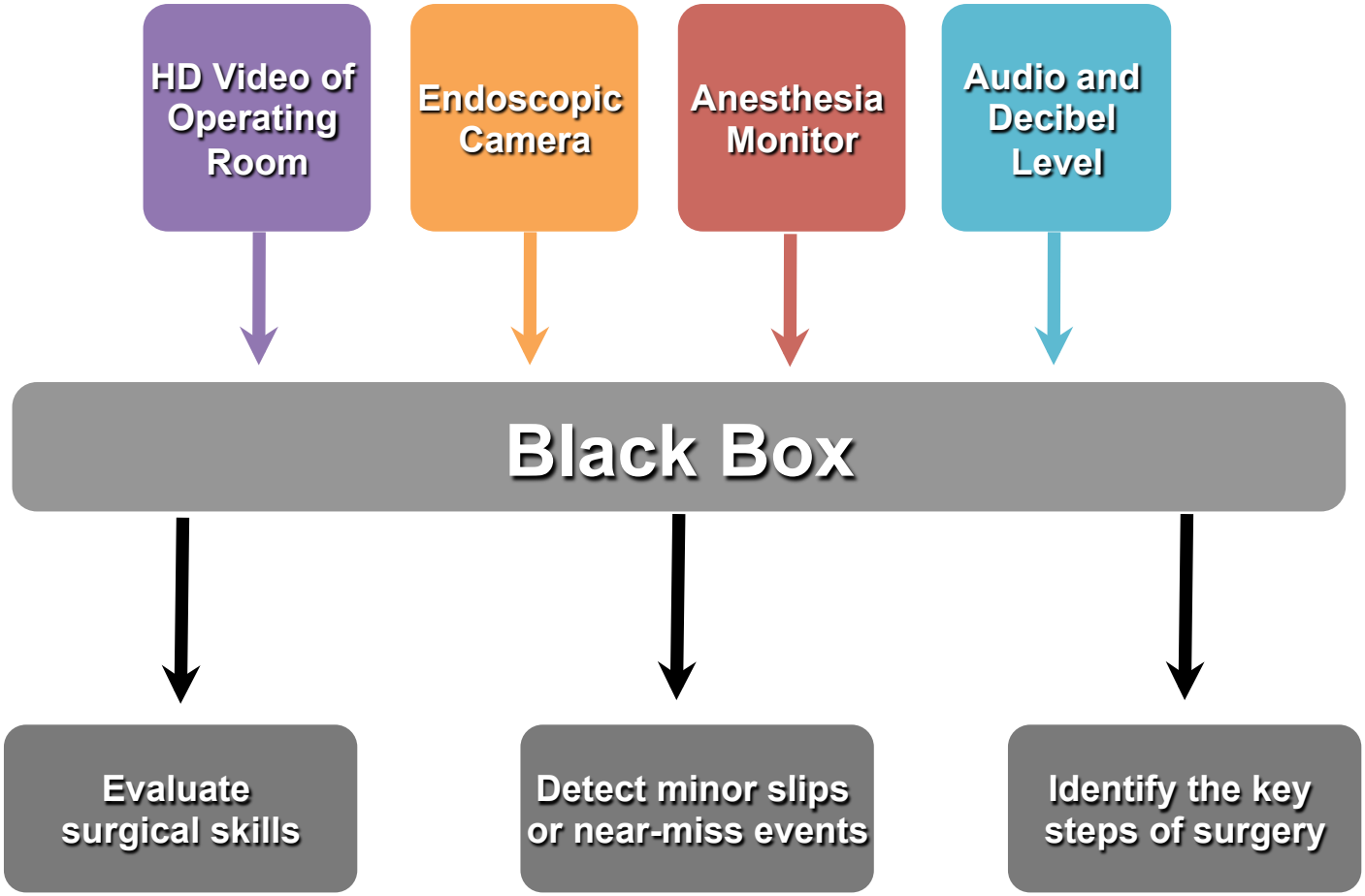
April 2012

Surgical Errors

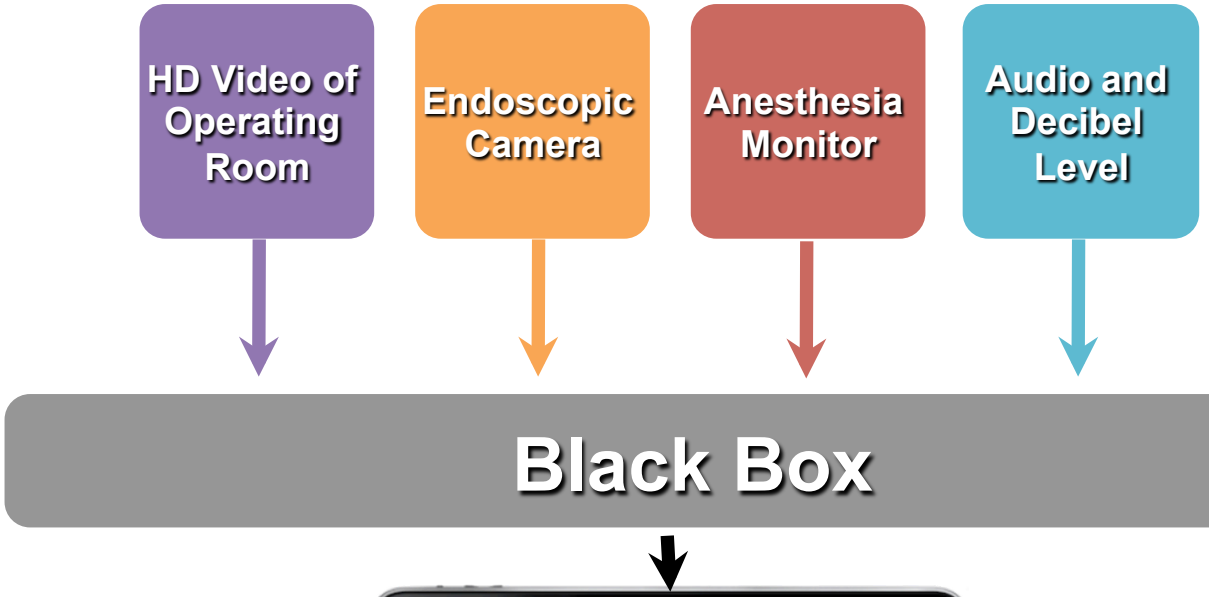
- In 2004, it was estimated that 9,000 to 24,000 Canadians die each year as a result of preventable medical errors
- Studies have shown that at least half of all surgical complications are avoidable

Baker GR et al. *CMAJ* 2004:170:1678-85 ; Haynes et al. *NEJM* 2009:360:491-9.

System


HD Video of Operating Room
Endoscopic Camera
Anesthesia Monitor
Audio and Decibel Level
Black Box
Evaluate surgical skills
Detect minor slips or near-miss events
Identify the key steps of surgery

Interim Goal

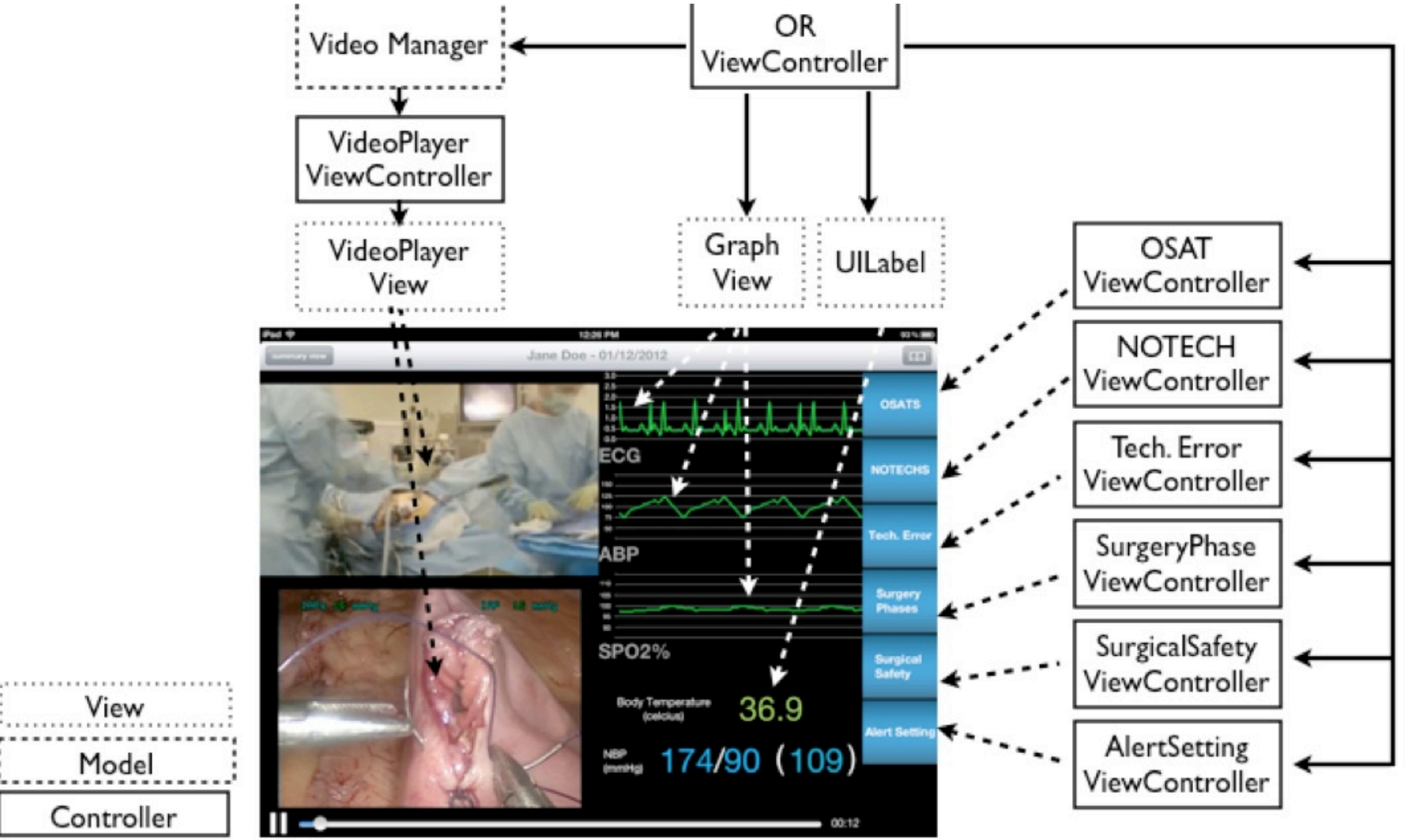


Live Mode
real-time streaming
to a remote location

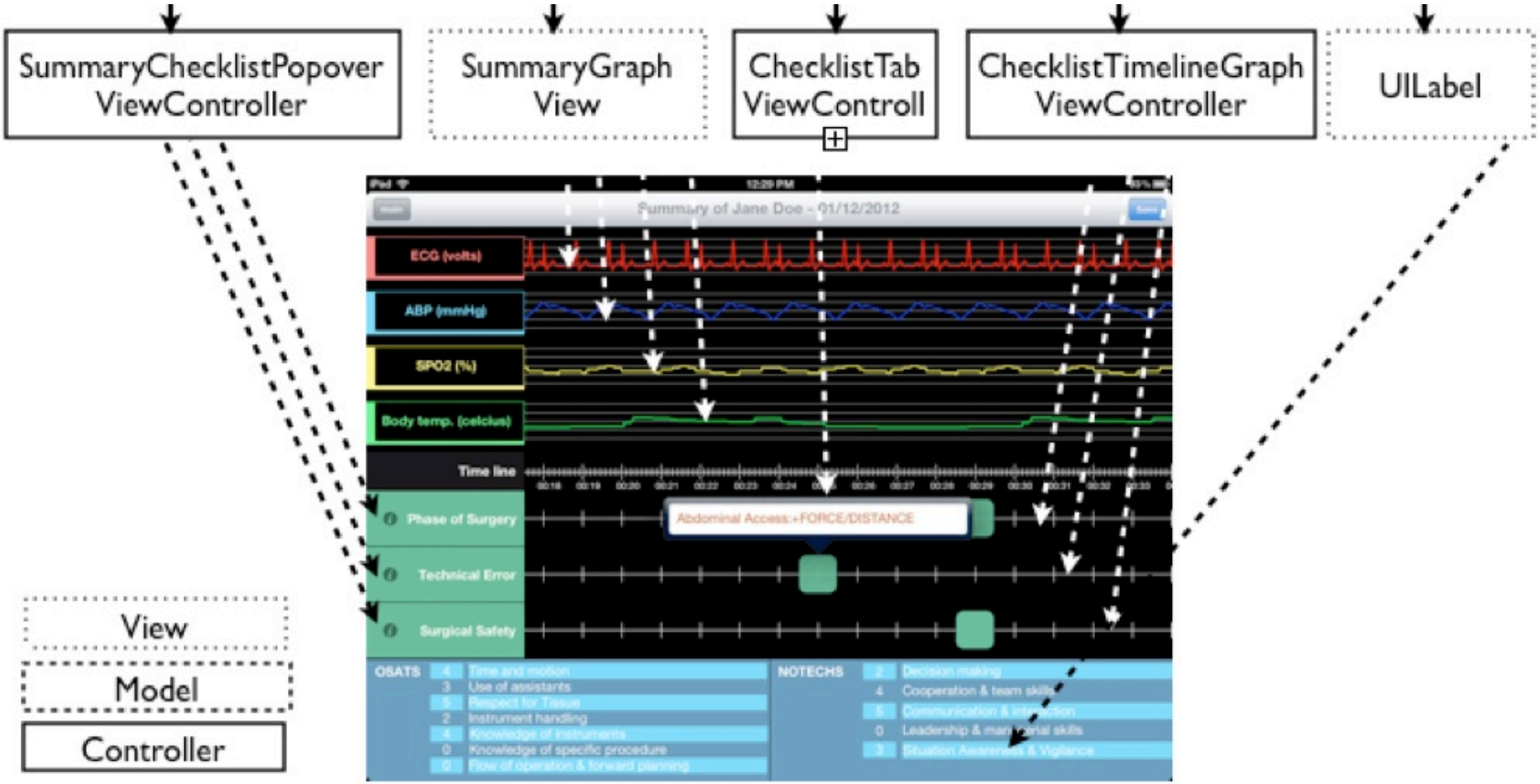
for ECE1778

Review Mode
post-operative analysis of a surgical procedure

Endoscopic Video and Data Views



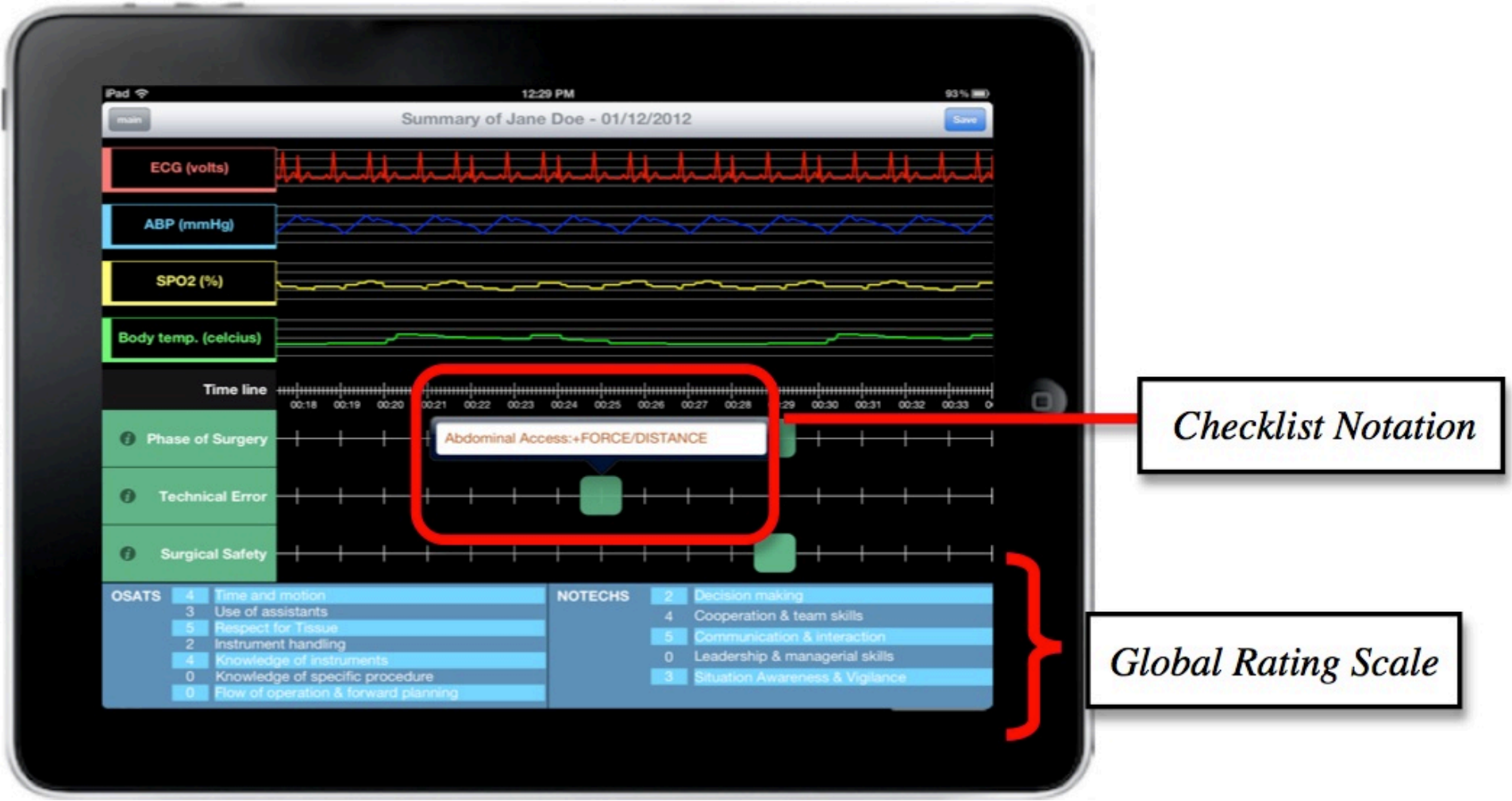
Data Time Line



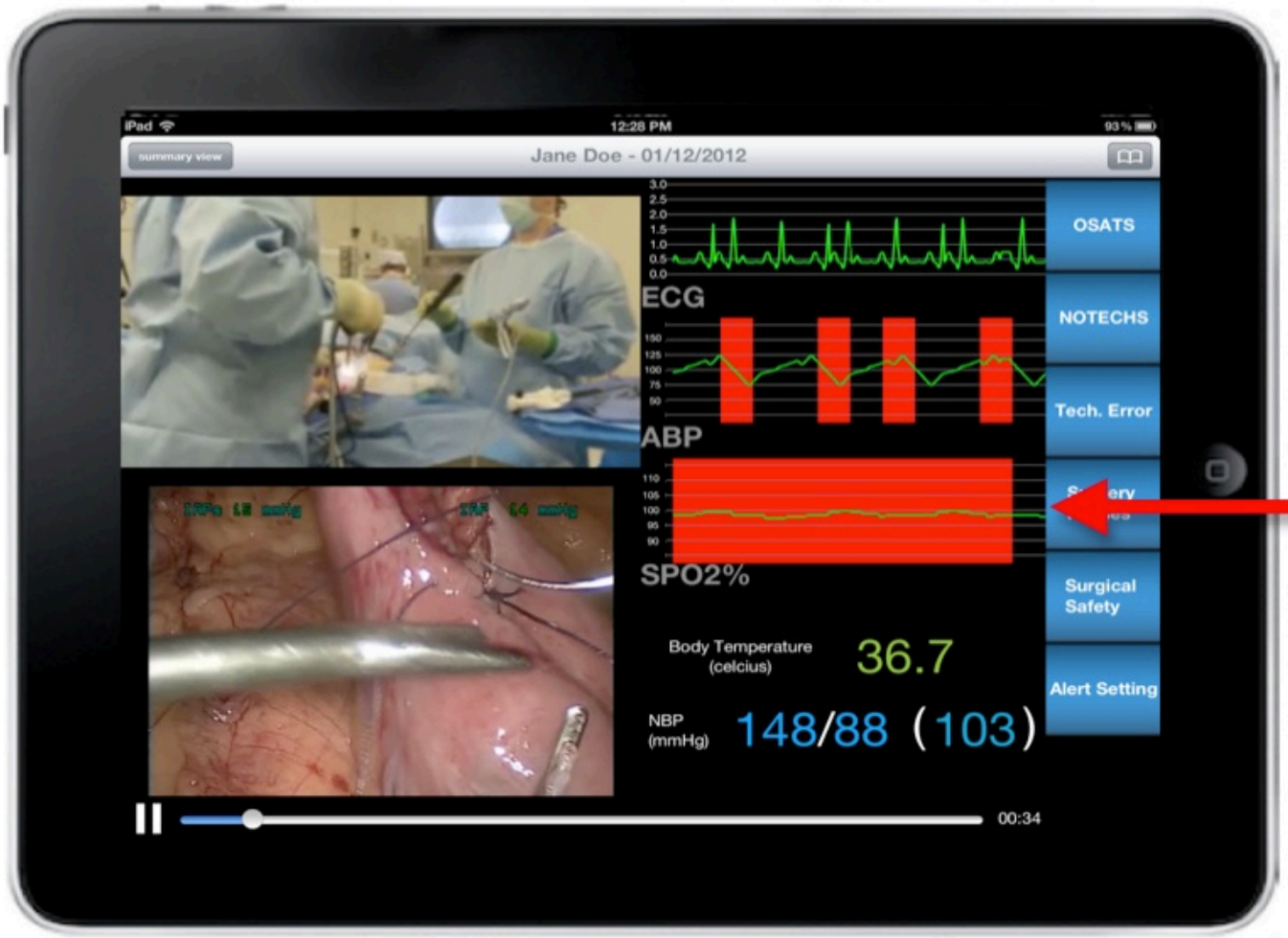
Annotation

Toolbar contains checklists and global rating scales (NOTECHS, OSATS)

Annotation – found mistakes!



Alerts



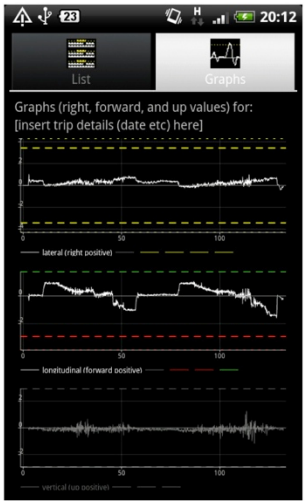
Alert: Arterial blood pressure (ABP) values have exceeded the threshold levels.

Testing with Surgeons

- Tested the app with 2 surgeons at St. Michael's Hospital
- 10-minute segment of a laparoscopic gastric bypass procedure
- Each surgeon produced similar annotations

DriveMod

Driver Behaviour Modification and Data Collection



Frances Awachie
Adrian Matheson
Matthew Thorpe

April 2012

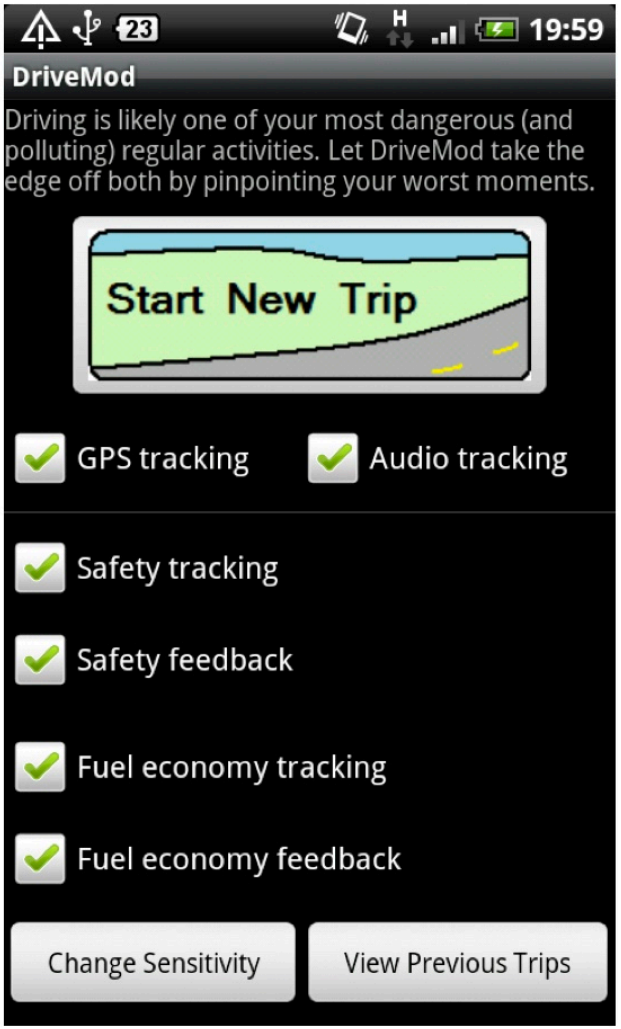
Bad Driving Kills People

- 1.2 million people per year killed globally (UN, 2004)
  - every tenth bed in hospitals is occupied by a victim of a motor vehicle collisions (UN, 2004)

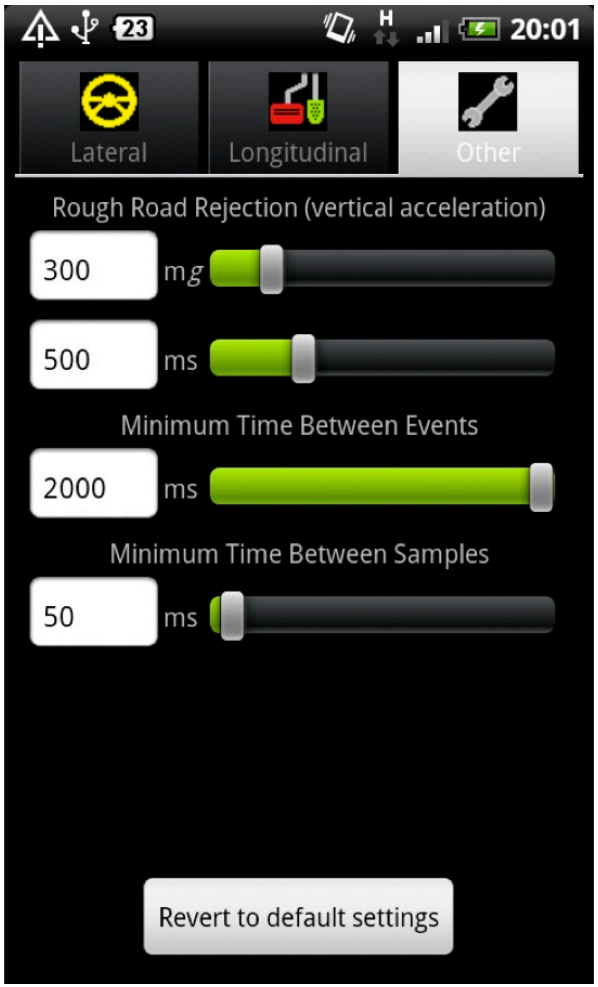
- 2,500 in Canada
- 34,000 in USA

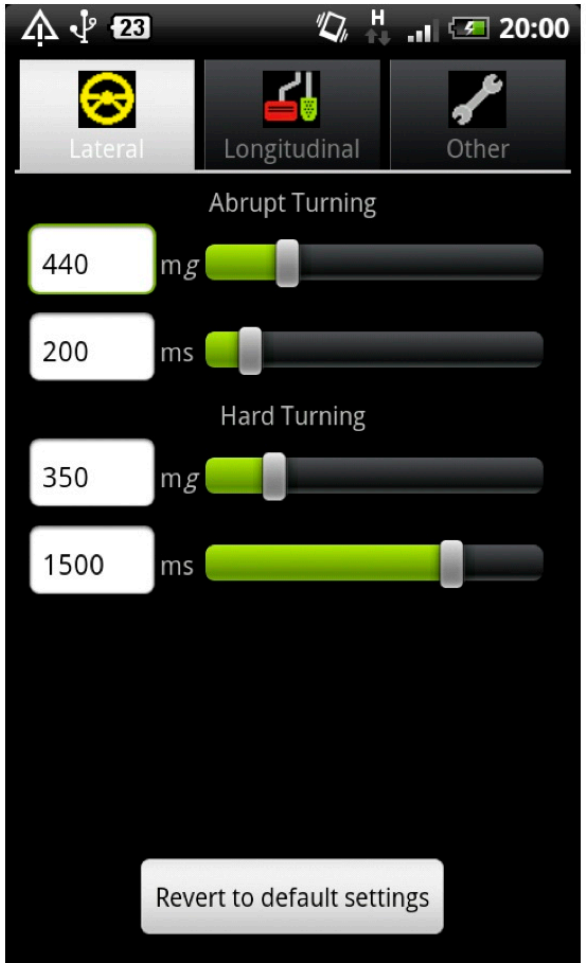
DriveMod Detects Bad Driving Events

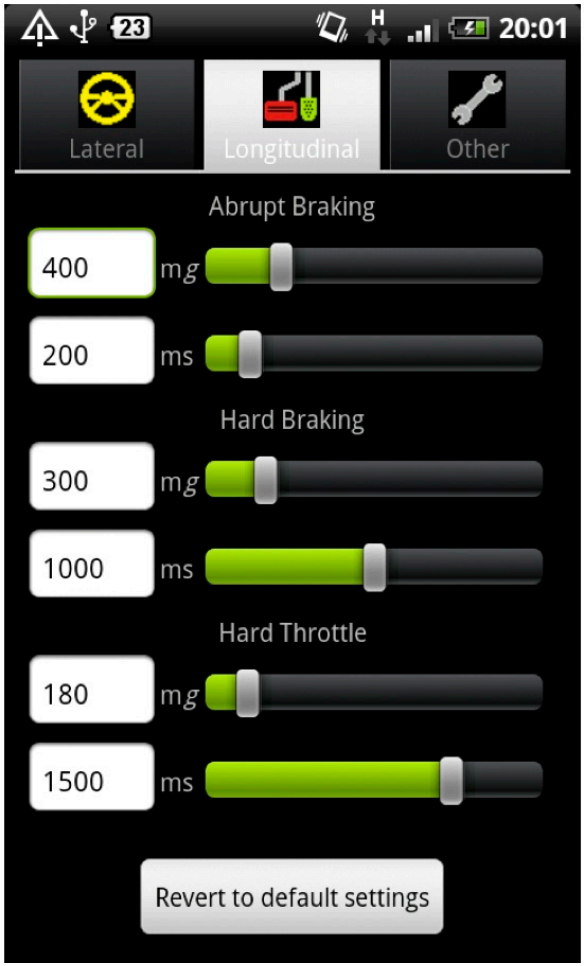
- Steering
  - Abrupt
  - Hard
- Braking
  - Abrupt
  - Hard
- Throttle
  - Hard



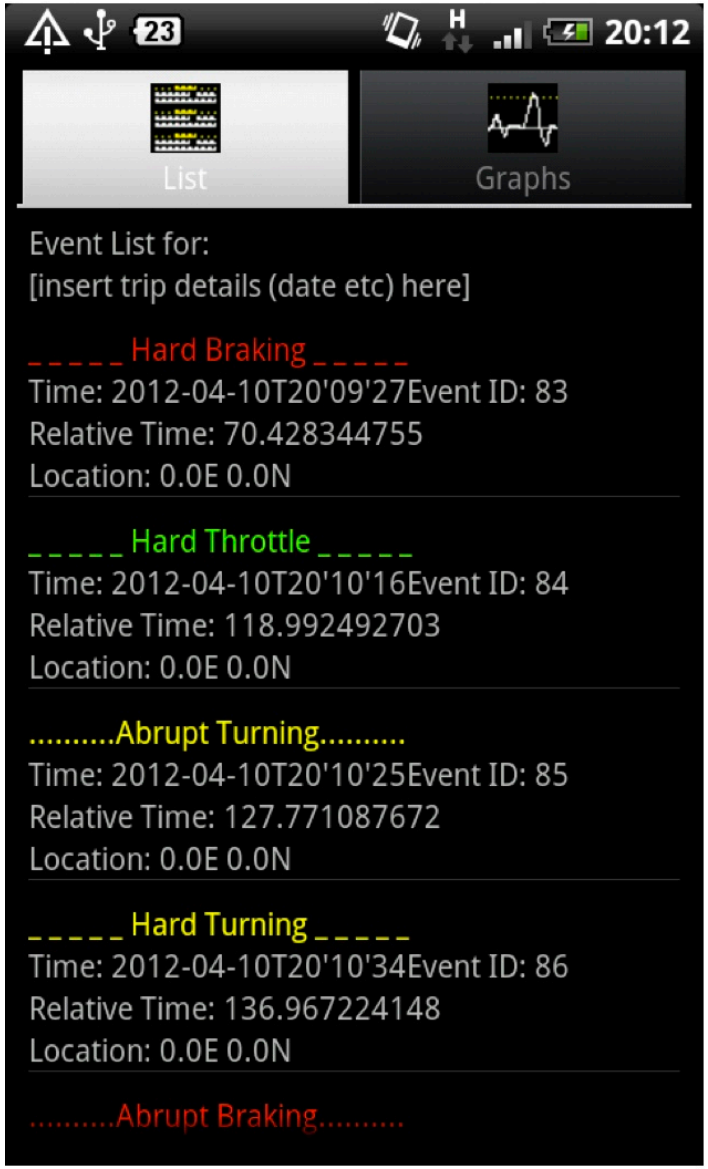
Set Thresholds to Detect Events

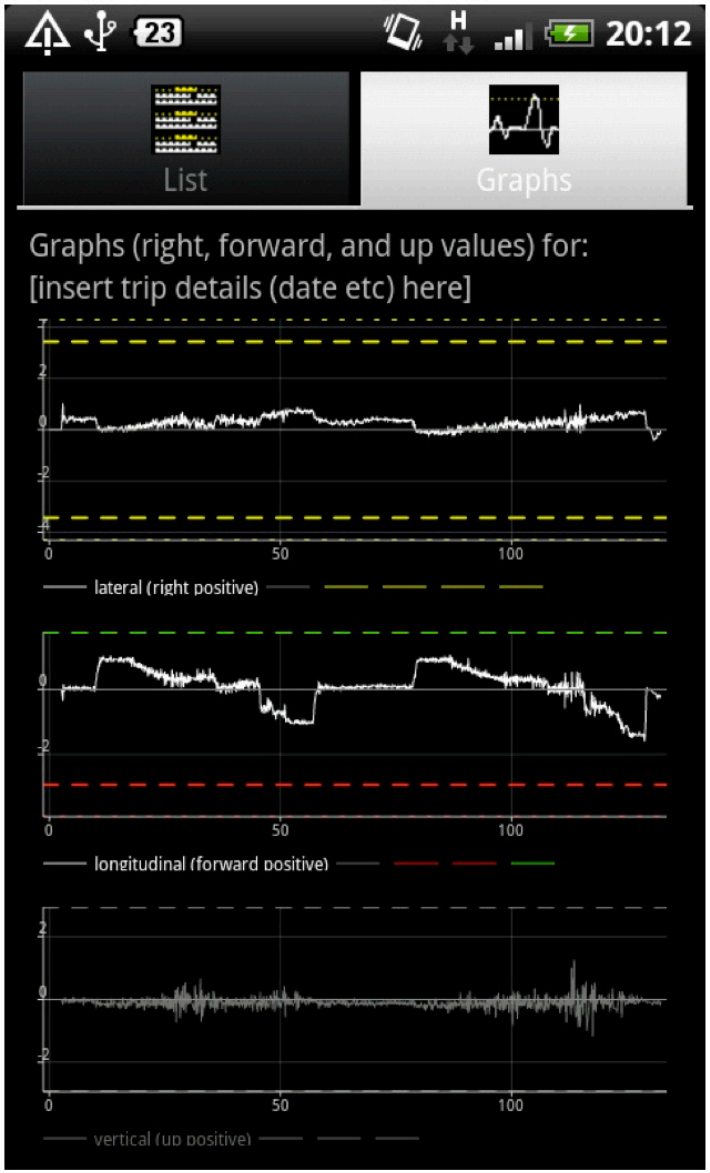






After Driving – See What Happened!





Now:
Group Forming Time and/or Topic Discussion

First: Unafiliated Specialists

- Who missed Tuesday night event:

Four Kinds of People Now

1. Already in full Groups
   - Take this time to discuss your topics
2. Un-paired Programmers
   - Form groups of 2 programmers
3. Paired Programmers
   - Need Specialist
4. Un-grouped Specialists
   - Need paired programmers