UTILIZING THE "QUANTIFIED SELF" TO MOVE FROM NICHE TO NORM

Strategies for incorporating modern technologies into assessment and evaluation

ALR 2014 Workshop

Genevieve Dunton
J. Aaron Hipp
Jana Hirsch
Peter James
Jacqueline Kerr

QUANTIFIED SELF

- The Quantified Self is a movement to incorporate technology into data acquisition on all aspects of an individual's daily life
- These data include diet, physical activity levels, sleeping patterns, and environmental features
  - $238 million digital fitness device sales in 2013
- Tools could become a powerful approach for collecting/tracking/analyzing data nationwide

Credit http://www.innovation-alliance.net/

QUICK SURVEY

- How many people in the room own a smartphone?
- How many use an app to track their physical activity?
- How many use a device to track their physical activity?
- How many have used these technologies for research / interventions?

WORKSHOP

- Introduce four technologies:
  - Ecological Momentary Assessment
  - Smart Trackers
  - Smartphone Apps
  - SenseCam
  - Crowdsourcing
- Use for assessment and evaluation
- Critically evaluate benefits and limitations to each technology
- Think about how you could incorporate into your own work

WORKSHOP SCHEDULE

- 3:05-3:35: Overview of each technology
- 3:35-3:40: Questions
- 3:40-4:10: Form groups to explore how to use these technologies to
  - answer research questions
  - measure the effectiveness of interventions
  - evaluate new policies
- 4:10-4:30: Presentations / Discussion
  - Current challenges and future directions for the implementation of these methods in research and practice

PRESENTERS

- Peter James
  - Harvard School of Public Health
- Genevieve Dunton
  - University of Southern California
- Jana Hirsch
  - University of Michigan
- Jacqueline Kerr
  - University of California San Diego
- J. Aaron Hipp
  - Washington University in St Louis

ECOLOGICAL MOMENTARY ASSESSMENT (EMA)

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Genevieve Dunton, PhD

University of Southern California

SPECIFICATIONS

- **Ecological**
  - Real-world environments & experience
  - Provides ecological validity
- **Momentary**
  - Real-time assessment & focus
  - Avoids recall bias
- **Assessment**
  - Self-report
  - Repeated, intensive, longitudinal
  - Allows analysis of physiological/ psychological/behavioral processes over time

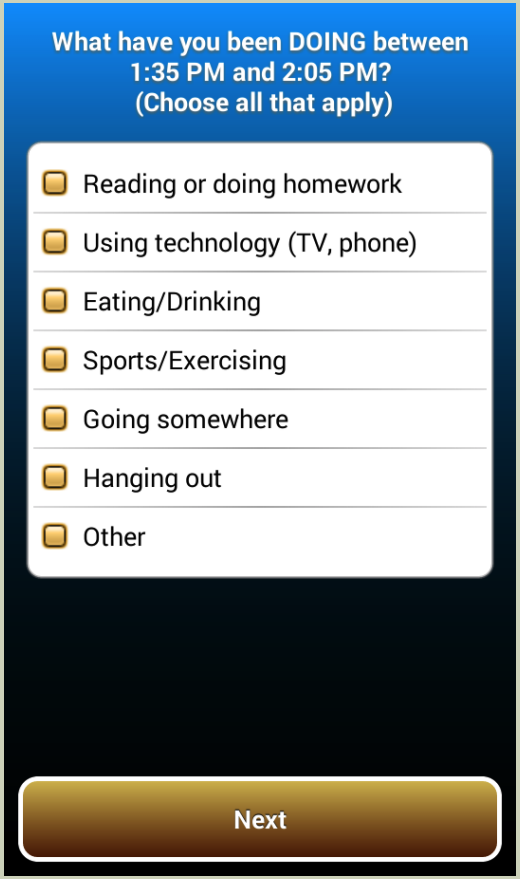
(Stone & Shiffman, 1994)

SPECIFICATIONS

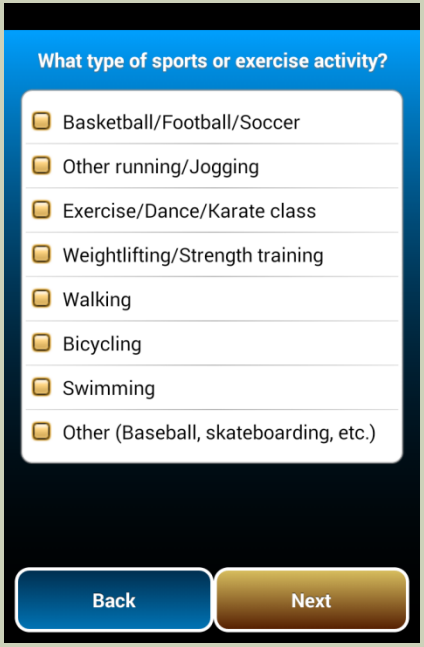
- Mobile Teen App for Android smartphones
- Downloaded from Google Playstore
- Programmed to trigger EMA surveys **after internal cues (smartphone accelerometer) and external cues (bluetooth).**
- Data sent to secure server daily
- Android Galaxy Y, Nexus 4, and MotoG smartphones loaned to participants

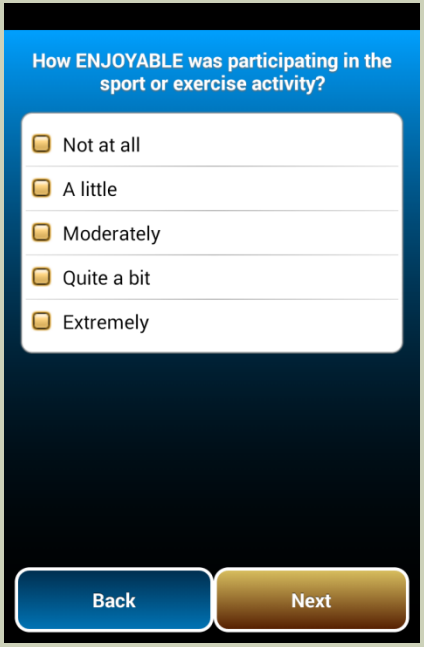
MAIN FUNCTIONS

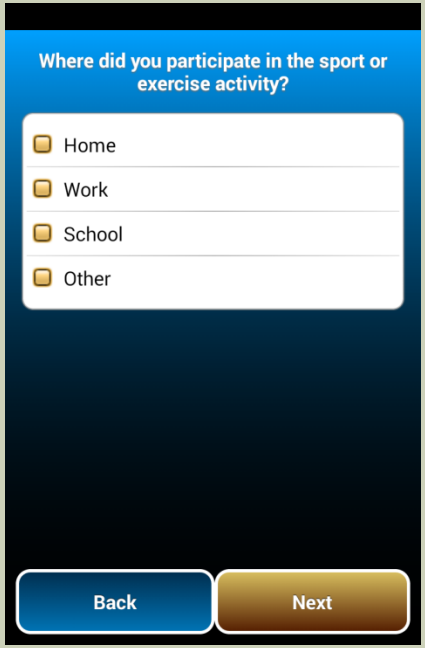
Type of Trigger	Triggering Rule
1.Physical Activity Bout	15+ min. of high intensity activity followed by 10+ min. of low intensity activity
2.Sedentary Behavior or Device Non-wear	60+ min. of low intensity activity followed by 1+ min. of moderate intensity activity or greater
3.Device Powered Off	10+ min. of no activity data followed by 1+ min. of some activity data

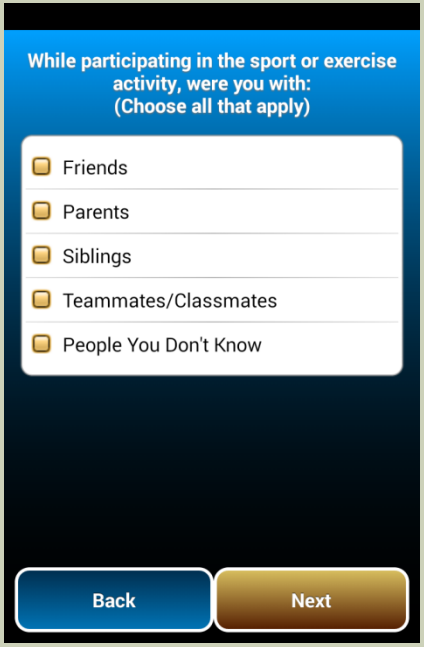


MAIN FUNCTIONS



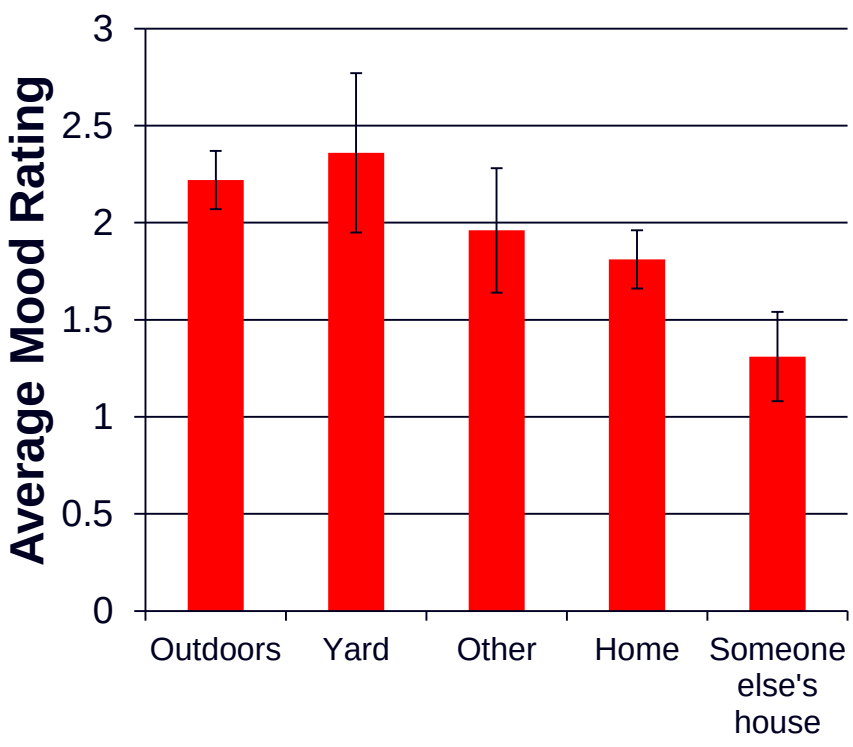


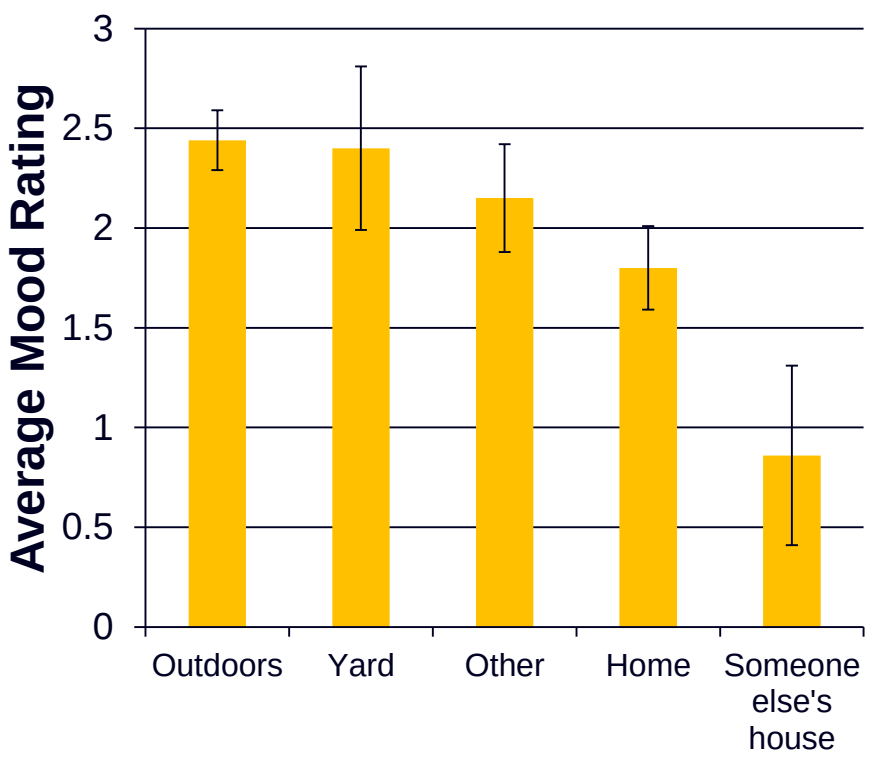




DATA TYPE AND EXAMPLE

Mood During Physical Activity by Physical Context

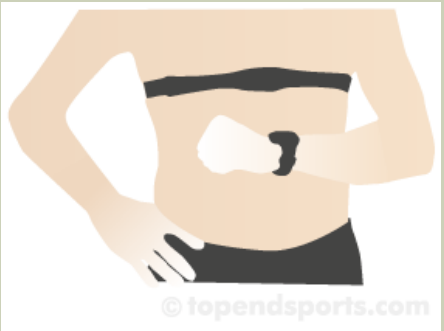




Dunton, G. F., Liao, Y., Intille, S., Wolch, J., & Pentz, M. (2011). Social and physical contextual influences on children's leisure-time physical activity: An Ecological Momentary Assessment study. Journal of Physical Activity and Health, 8(Suppl 1), S103-S108.

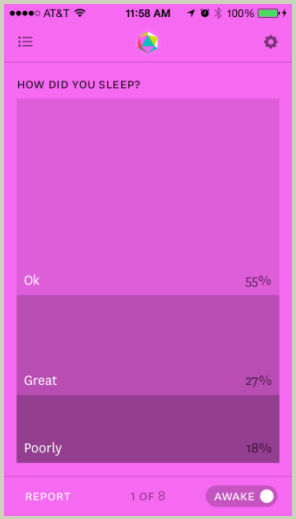
OTHER TYPES OF SENSOR-ASSISTED CS-EMA

- Location monitors (GPS, Cell towers)
- Heart-rate monitors
- Galvonic skin response
- UV dosimeters
- Portable alpha-amylase readers
- Other smartphones (= people)
- Others ideas??



OTHER AVAILABLE EMA APPS (FOR NON-PROGRAMMERS!)

Reporter

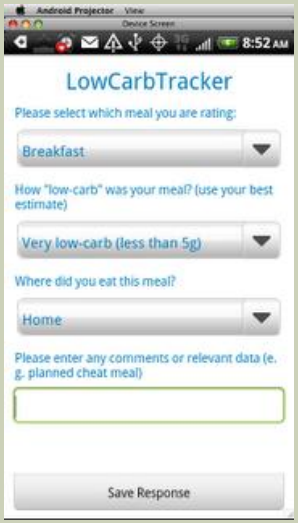


http://www.reporter-app.com/

Available on the App Store

PACO

The Personal Analytics COmpanion



http://www.pacoapp.com/

Google play

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Brenda Yanez (High School Student Intern)

- NHLBI (1R21HL108018) (Dunton, PI)
- NIEHS(5 P30 ES07048-16) (Dunton, PI on pilot)

MAPMYFITNESS

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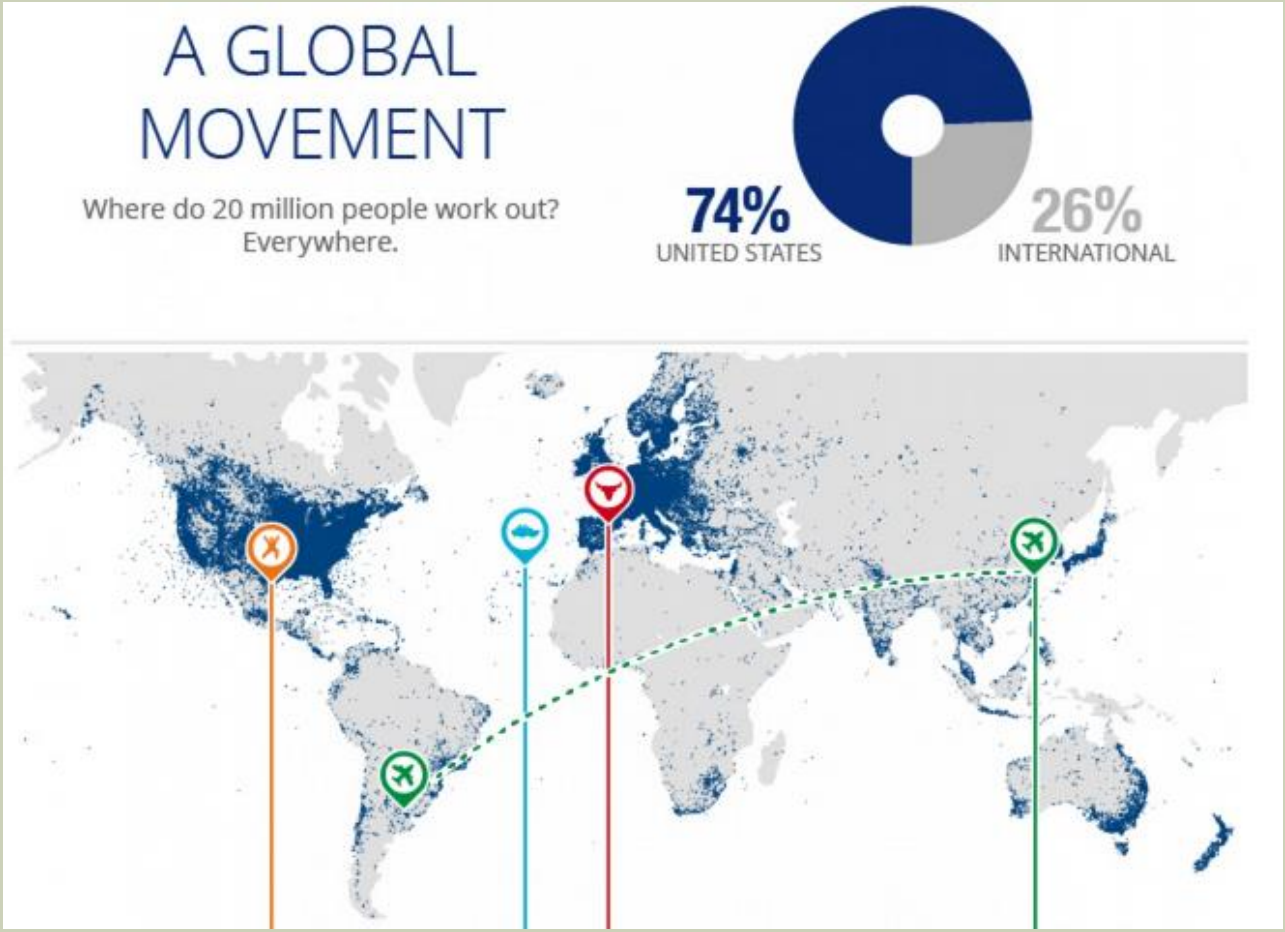
Jana Hirsch, University of Michigan

SPECIFICATIONS

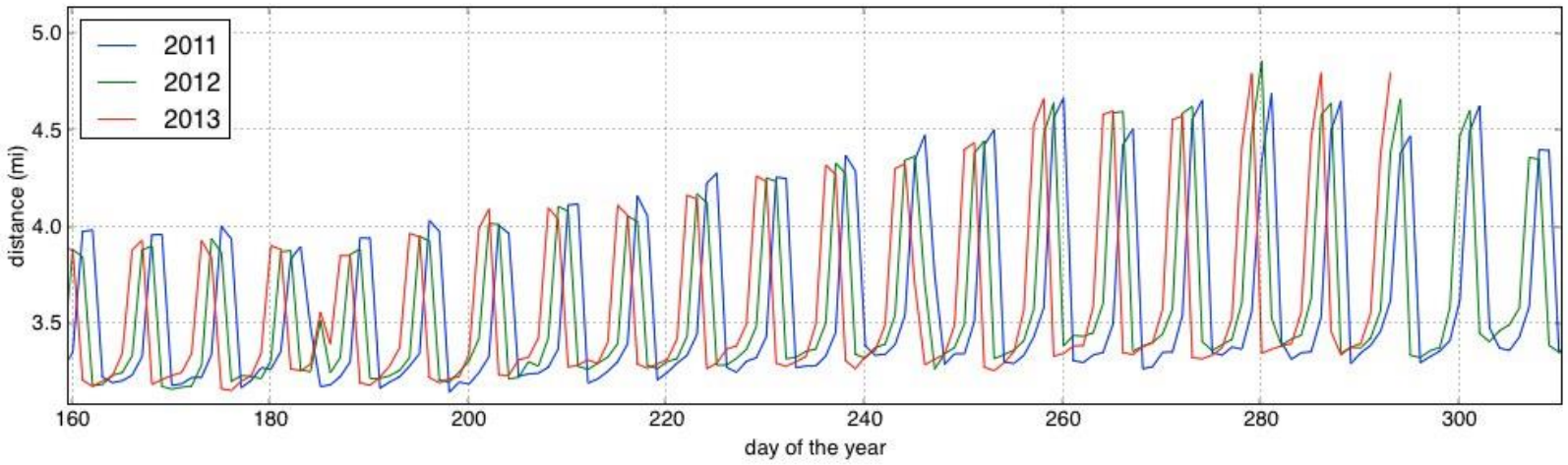
- Tracks workouts
- Plots routes of walks, runs, bicycle rides+
- Mobile app+GPS (~97%)
- Online interface
- Save and share routes
- Open platform integrating with over 400 fitness tracking devices

WORLD COVERAGE- 20 MILLION+ USERS



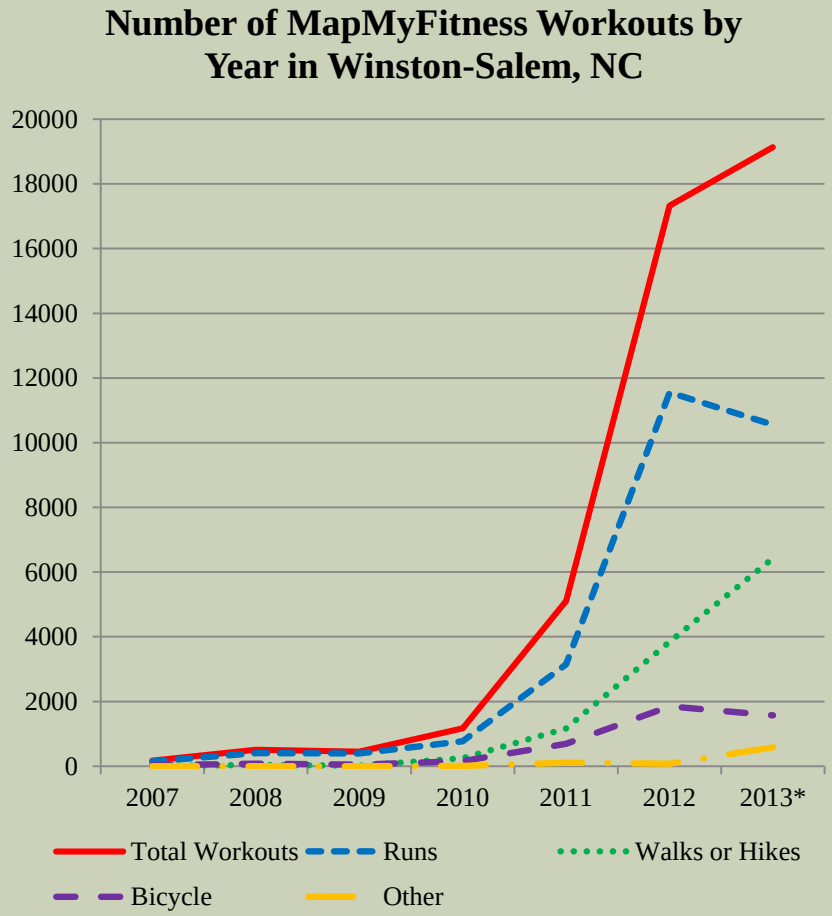
http://visual.ly/celebrating-20-million-strong

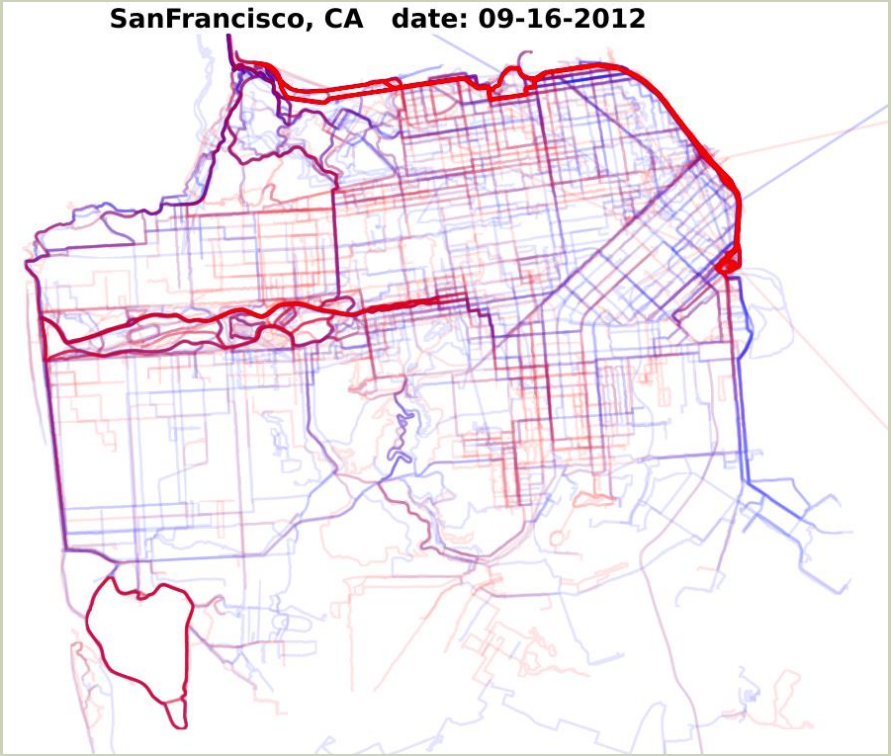
POTENTIAL FUNCTIONS



- Large-scale physical activity data
- Historic data back to ~2007
- Geographic patterns of physical activity
- User patterns
- Pre-post policy/intervention assessments

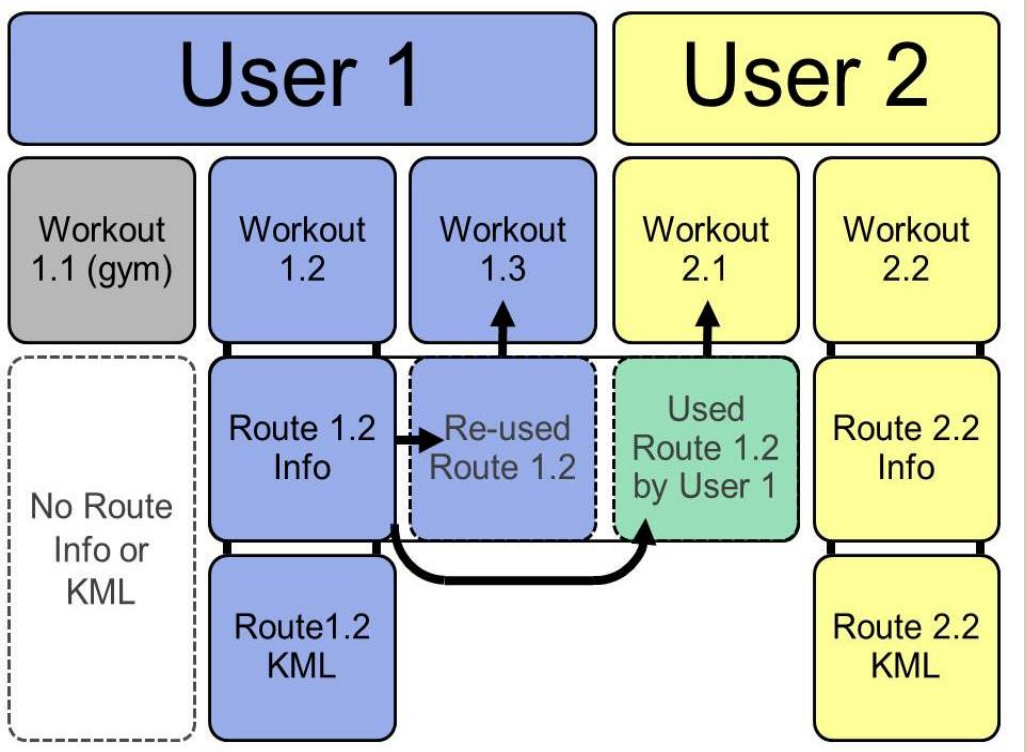
POTENTIAL FUNCTIONS





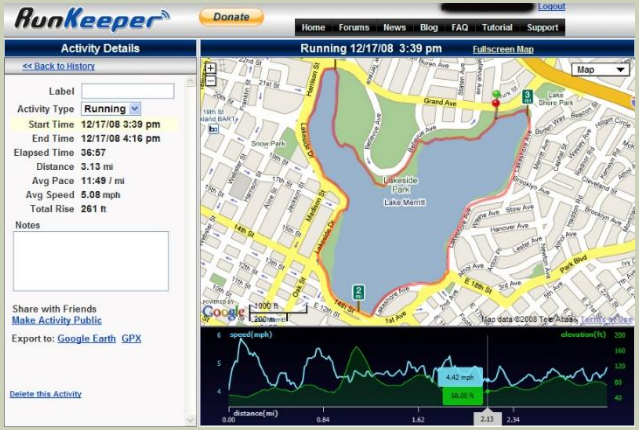
DATA TYPE AND EXAMPLE

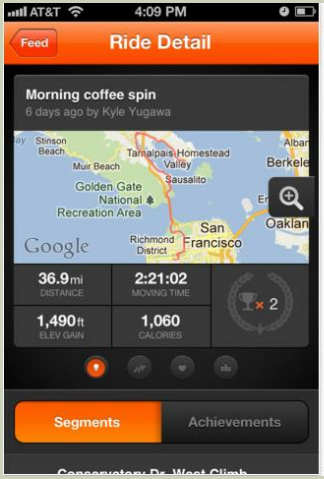
- Routes (KML)
- Workouts (CSV)
- Users (CSV)
- Total database VERY LARGE (over 197,000,000 workouts, +++TeraBytes)

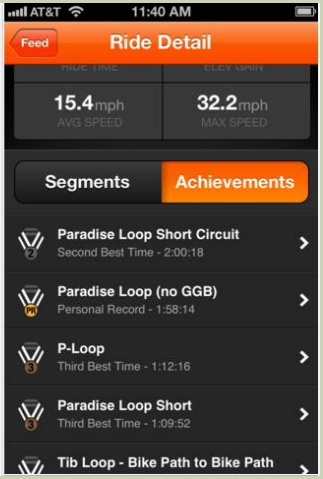


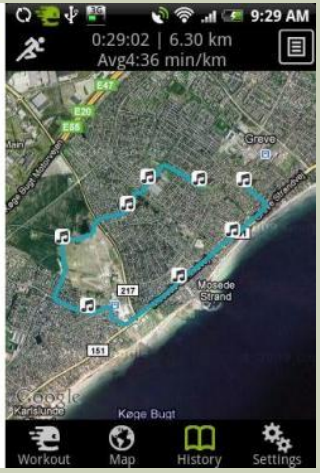
OTHER SIMILAR APPS

- Strava
- RunKeeper
- Endomondo









CURRENT PROJECTS USING THIS TECHNOLOGY

- MapMyFitness working on easy way to give researcher access to data

- Hirsch, James, Robinson, Eastman, Conley, Evenson, and Laden "Using MapMyFitness to place physical activity into neighborhood context" Frontiers in Public Health Education & Promotion doi: 10.3389/fpubh.2014.00019
- Adlakha, Hipp, Budd, Sequeira "Does outdoor physical activity in St. Louis, Missouri differ by neighborhood socio-economic status"

FITBIT

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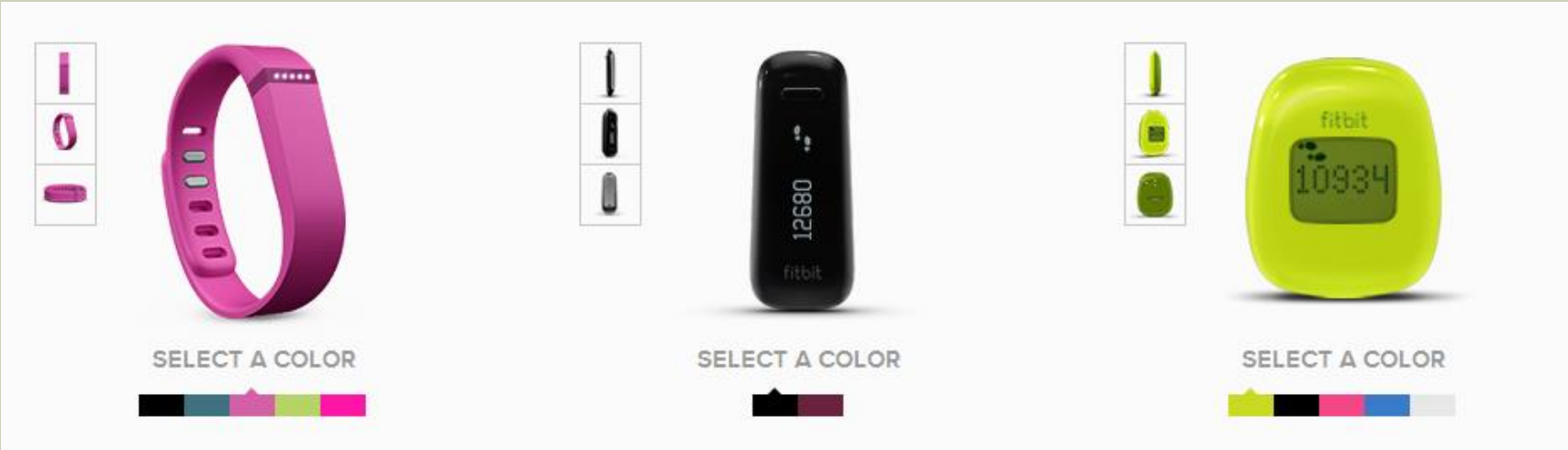
Jana Hirsch, University of Michigan

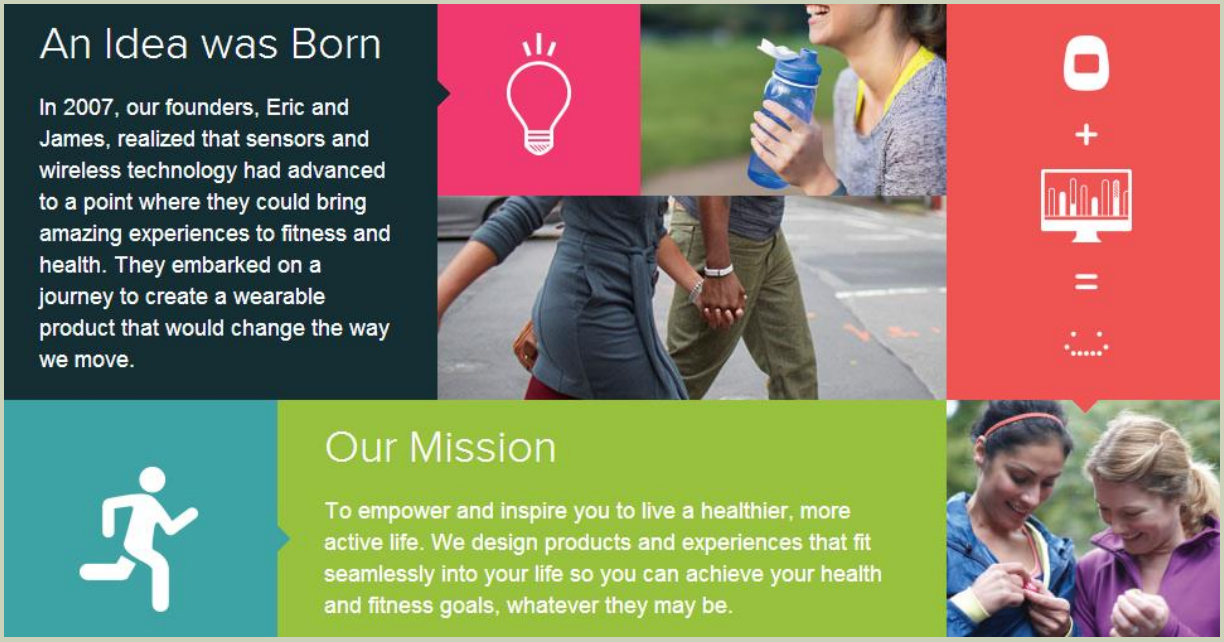
SPECIFICATIONS

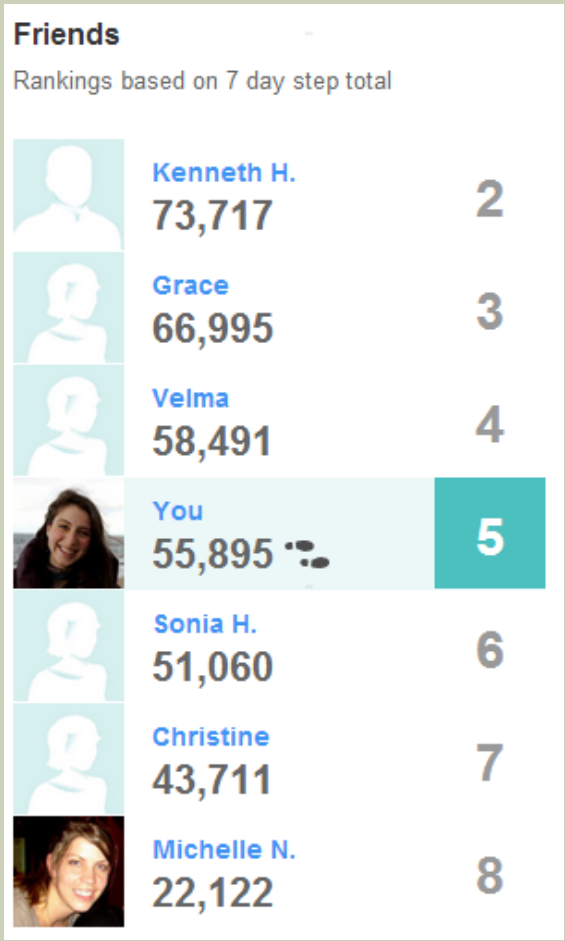


- Wearable fitness sensor
  - Steps, distance, estimated calories,
  - Active minutes, stairs climbed, sleep/wake
- Flex, One, Zip (Force recalled)
- Bluetooth sync to phone or computer dongle
- Rechargeable batteries (Flex, One; week); or replaceable (Zip; 4-6 months)

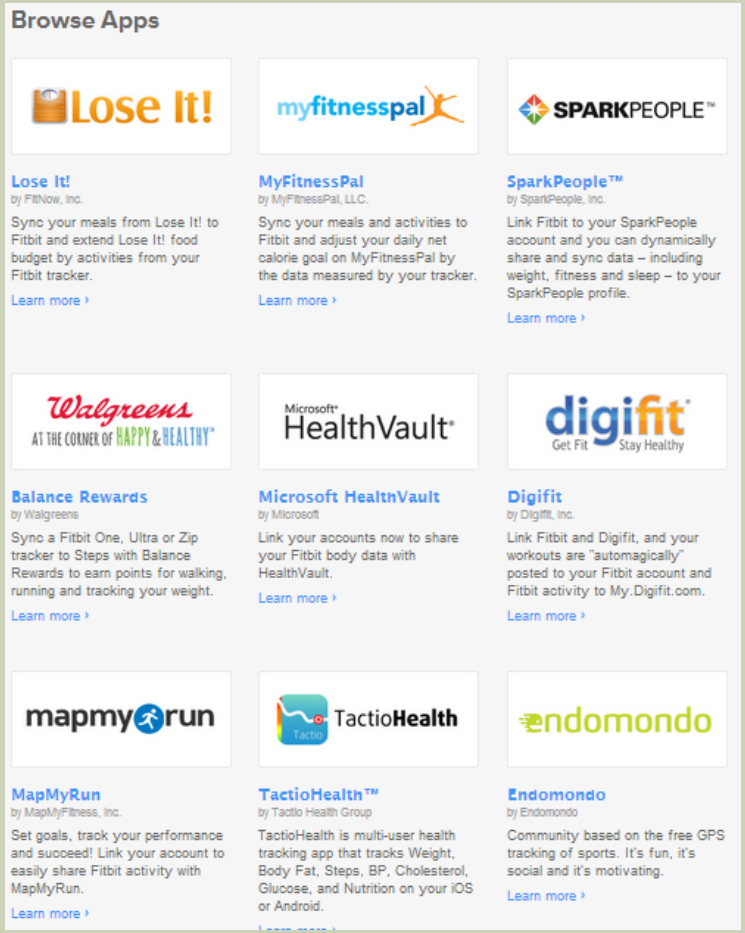
MAIN FUNCTIONS

- Tracking steps, distance, and stairs
- Tracking sleep duration, and interruptions
- Syncs to both online desktop and app
- Compete against friends, earn badges
- Corporate wellness programs

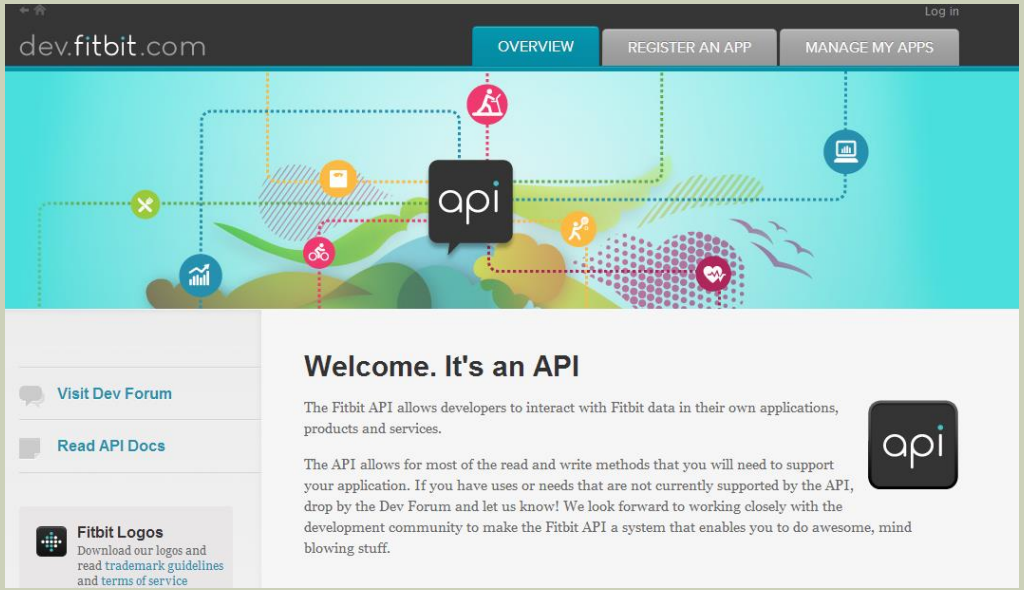




LINKING TO APPS/API



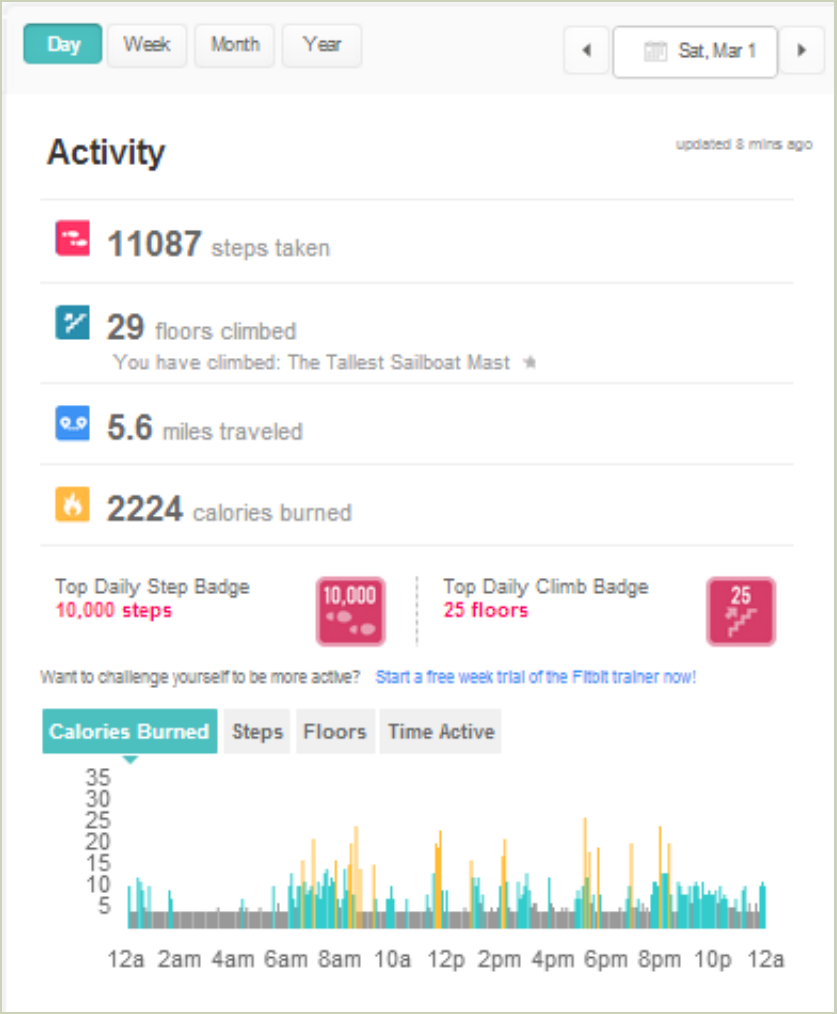
- Developer API
- Link to FitBit user's data
- Existing linked apps

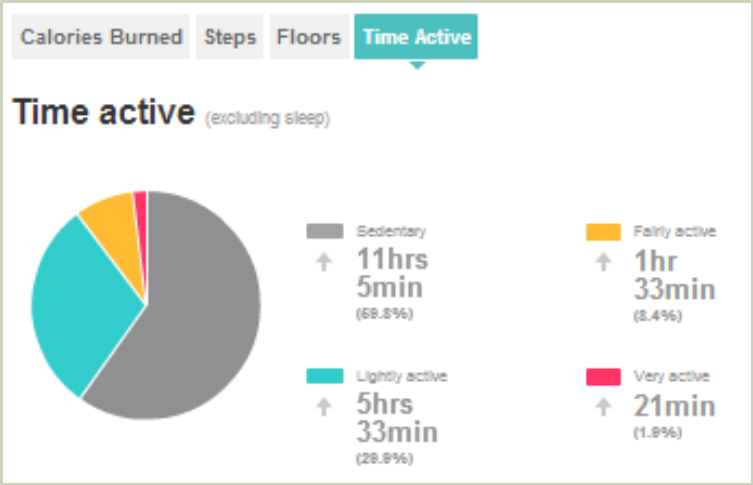


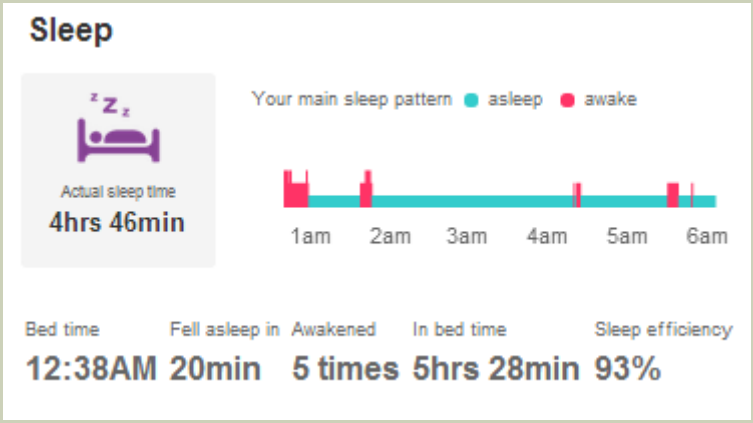
https://www.fitbit.com/apps

http://dev.fitbit.com/

DATA TYPE AND EXAMPLE







OTHER FITNESS TRACKERS

- Jawbone Up!
- Nike Fuelband
- Withings Pulse
- Garmin Vivofit
- Atlas
- Many more!

SOME CURRENT PROJECTS USING THIS TECHNOLOGY

- "Movement toward a novel activity monitoring device" http://link.springer.com/article/10.1007/s11325-011-0585-y
- "Is This Bit Fit? Measuring the quality of the FitBit Step-Counter" http://www.healthandfitnessjournalofcanada.com/index.php/html/article/view/144
- "Fitbit+: A behavior-based intervention system to reduce sedentary behavior" http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=6240381&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D6240381
- Health eHeart http://www.health-eheartstudy.org/
- Centre for Hip Health & Mobility (Active Streets Active People; Walk The Talk Team)
- "Functional Recovery in the Elderly After Major Surgery: Assessment of Mobility Recovery Using Wireless Technology" http://www.annalsthoracicsurgery.org/article/S0003-4975(13)01253-8/abstract

SENSECAM

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Jacqueline Kerr, UCSD

SPECIFICATIONS

- Person worn camera
- Automatically takes wide angle low resolution photo
  - With movement change
  - With light change
  - With temperature change
  - With another person
- About 3,000 time stamped images per day
- 18 hr battery

SENSECAM CODING – 5 IMAGES

Pass 1: Social Context /Interactions
Pass 2: Indoor/ Outdoor
Pass 3: Positions/Activities

Social Context/ Interactions
Social/ Interaction
Social/ No Interaction
Not Social

Indoor / Outdoor
Indoor
Outdoor
In Vehicle
Mixed

Position
Sedentary
Standing Still
Standing Moving
Walking/Running
Biking
Changing Position

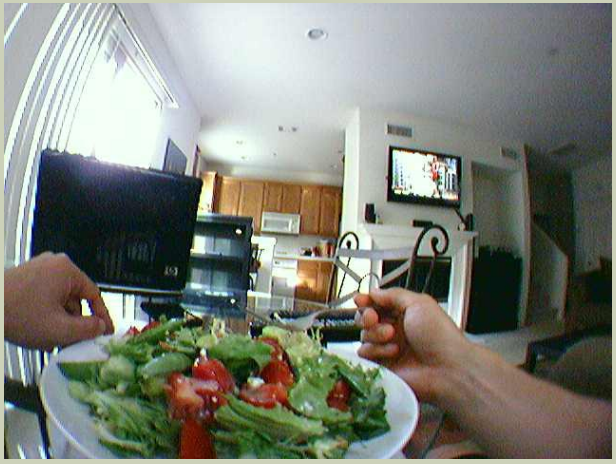
Activity
Household Activity
Self Care
Conditioning Exercise
Sports
Manual Labor
Leisure
Administrative Activity
Car
Other Vehicle
Television *
Other Screen *
Eating *

*Not exclusive and can be used in addition to other activity codes

SITTING IMAGES








STANDING IMAGES



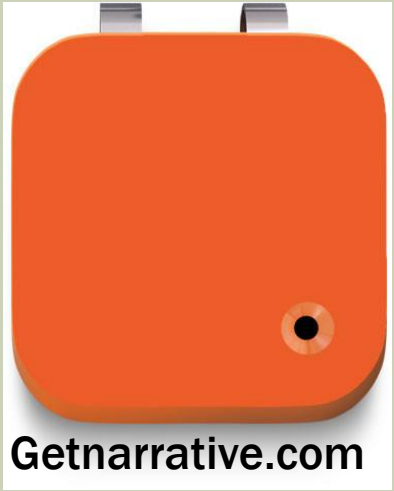



DATA TYPE AND EXAMPLE

- Data format: images and sensor readings
- Data size: 3000 images per day; potential to code multiple behaviors and environments
- Data issues: coding is time consuming; developing automatic image recognition algorithms
- Device issues: devices keep changing, coding software is no longer compatible, newer devices are NOT better… lots of devices on the market; test, test, test
- Data aggregation: minute level estimates

OTHER DEVICES

- Autographer
- Memoto
- SenseCam
- Vicon Revue 1.0
- Vicon Revue 3MP
- E-button
- Google glasses


Getnarrative.com

www.autographer.com/

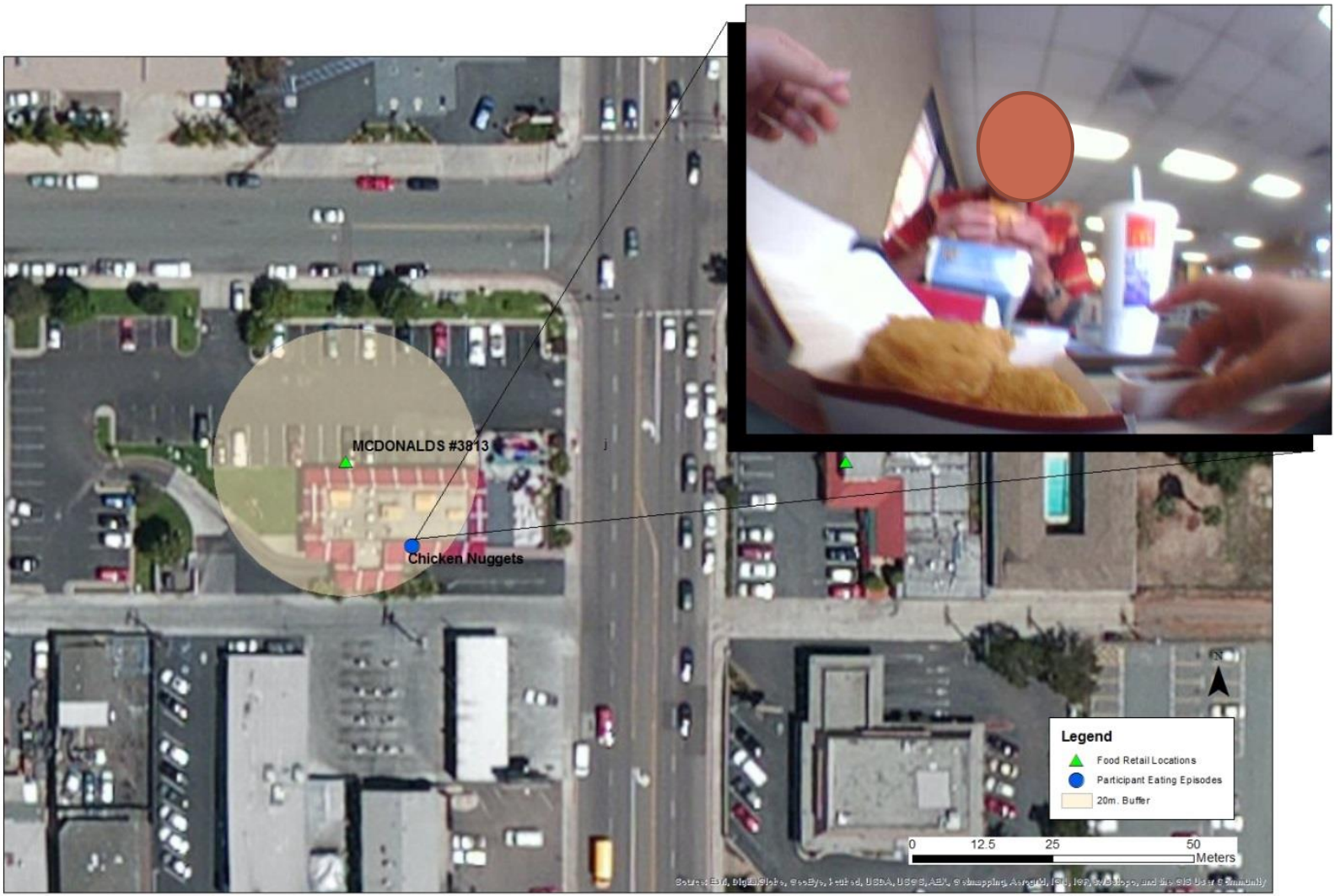

http://www.google.com/glass/start/

http://www.lcn.pitt.edu/ebutton/

CURRENT PROJECTS USING THIS TECHNOLOGY

- **An ethical framework for automated, wearable cameras in health behavior research** Paul Kelly et al., American Journal of Preventive Medicine (2013), 44: 3: 314
- **Using the SenseCam to improve classifications of sedentary behavior in free-living settings** Jacqueline Kerr, et al. American Journal of Preventive Medicine (2013), 44: 3: 290
- **Using the SenseCam as an objective tool for evaluating eating patterns** Jacqueline Chen, et al. Proceedings of the 4th International SenseCam & Pervasive Imaging Conference (2013), 34-41
- **Physical activity recognition in free-living from body-worn sensors** Katherine Ellis, et al. Proceedings of the 4th International SenseCam & Pervasive Imaging Conference (2013), 88-89
- **Using wearable cameras to categorise type and context of accelerometer-identified episodes of physical activity** Aiden R Doherty, et al. International Journal of Behavioral Nutrition and Physical Activity (2013), 10:1:22
- **Utility of passive photography to objectively audit built environment features of active transport journeys: an observational study** Melody Oliver, et al. International journal of health geographics (2013), 12:1:20
- **The feasibility of using SenseCams to measure the type and context of daily sedentary behaviors** Catherine Marinac, et al. Proceedings of the 4th International SenseCam & Pervasive Imaging Conference (2013), 42-49
- **Using SenseCam images to assess the environment** Suzanne Mavoa et al., Proceedings of the 4th International SenseCam & Pervasive Imaging Conference (2013), 84-85
- **Measuring time spent outdoors using a wearable camera and GPS** Michael S Lam, et al., Proceedings of the 4th International SenseCam & Pervasive Imaging Conference (2013), 1-7

VALIDATING EATING LOCATIONS



OPPORTUNITIES

- Multiple behaviors in one tool, concurrent behaviors
- Context: physical environment & social interactions
- Validation tool
- Assessment tool
- Intervention tool
- A PICTURE IS WORTH A 1000 WORDS

CROWDSOURCES

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Aaron Hipp, PhD

Washington University in St. Louis

SPECIFICATIONS

amazon mechanical turk
beta
Artificial Artificial Intelligence

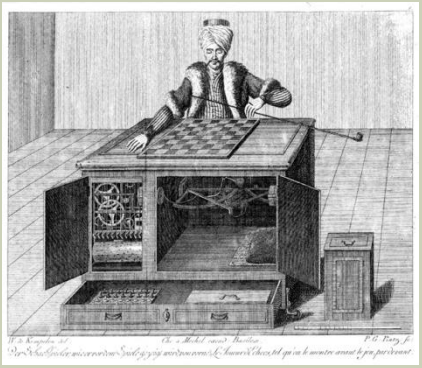
CrowdSource®

crowdsourcing.org
THE INDUSTRY WEBSITE™

CrowdFlower

crowdSPRING

- MTurk
- Online marketplace to complete tasks that a computer cannot yet complete
- Source of human subjects



MAIN FUNCTIONS

- Workers/Turkers

- Over 18 years of age
- Amazon.com account
- Can be listed as a 'Master'

- Requester

- Post Human Intelligence Tasks (HITs) or Tasks
- Photographs, video, audio, surveys
- Costs ≤10% of total dollar amount distributed to Workers

DATA TYPE AND EXAMPLE

Complete the following five steps to finish the HIT:

1. FIND PEOPLE
2. FIND BIKES
3. FIND CARS
4. MATCH SCENES
5. ANSWER QUESTIONS

Step 1: Find all the people in this scene

☐ There are no people in this scene.

I am done with this step | Start over from step 1

Instructions:

- Left-click to place a dot.
- Double-click on dot to remove it.
- Drag a dot to move it around.
- Place just one dot per person, at the approximate center of the person.
- Do NOT label people who are not entirely visible.
- If there is no person, select the check box below the image
- To return to a previous step, select the step from the navigation menu on the left.
- Please remember to accept the HIT before beginning work.

Outline Guidelines and Examples

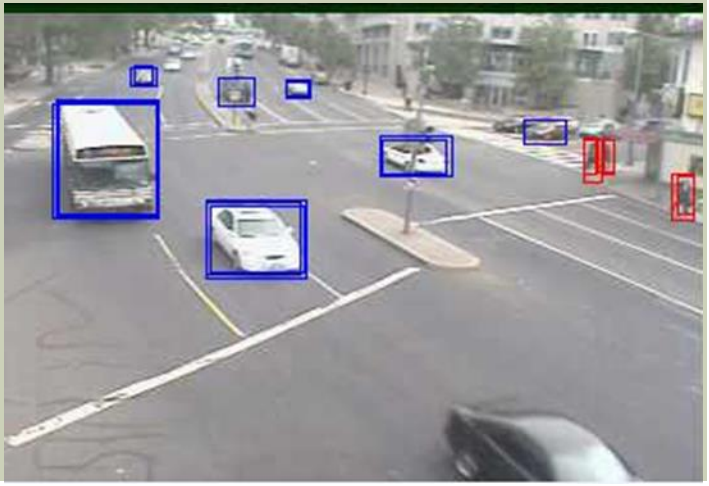
Your outlines at each step should follow the guidelines below to avoid being rejected. The same guides apply to bicycles and vehicles.

GOOD: This shows correctly outlined people.

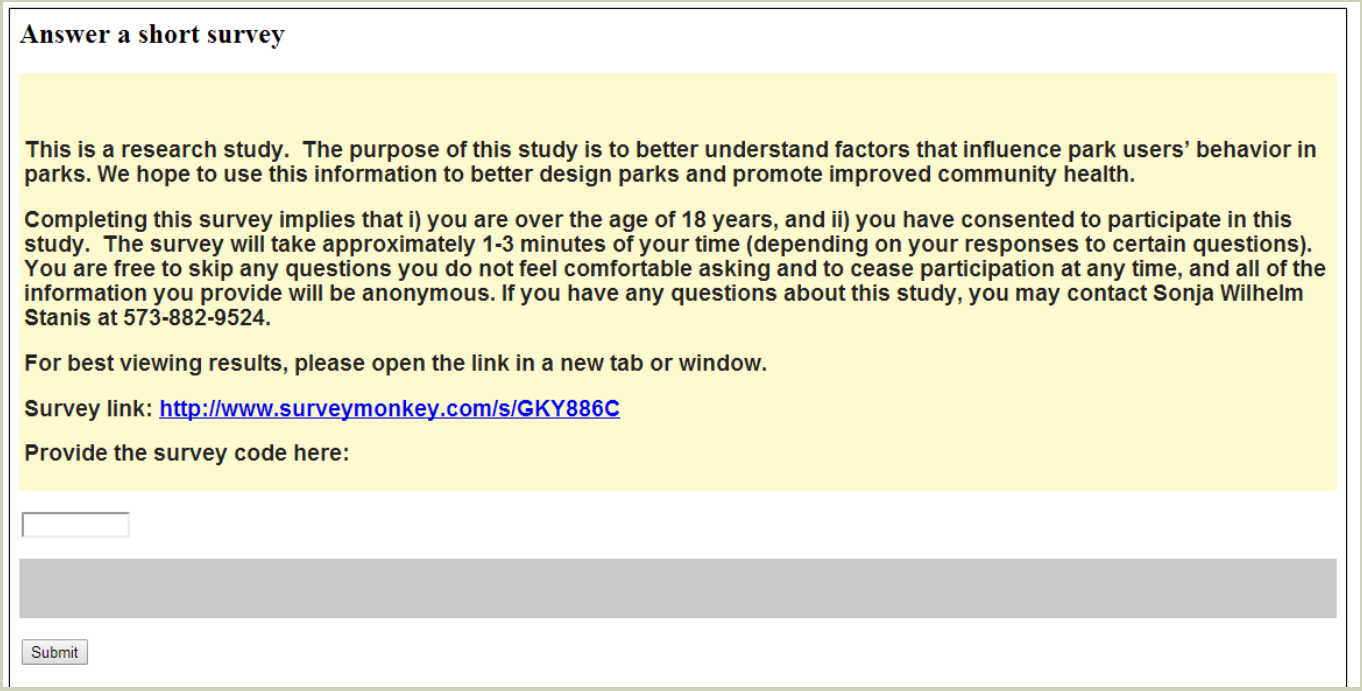
✓

BAD: Too many people per outline.

X



DATA TYPE AND EXAMPLE



Answer a short survey

This is a research study. The purpose of this study is to better understand factors that influence park users' behavior in parks. We hope to use this information to better design parks and promote improved community health.

Completing this survey implies that i) you are over the age of 18 years, and ii) you have consented to participate in this study. The survey will take approximately 1-3 minutes of your time (depending on your responses to certain questions). You are free to skip any questions you do not feel comfortable asking and to cease participation at any time, and all of the information you provide will be anonymous. If you have any questions about this study, you may contact Sonja Wilhelm Stanis at 573-882-9524.

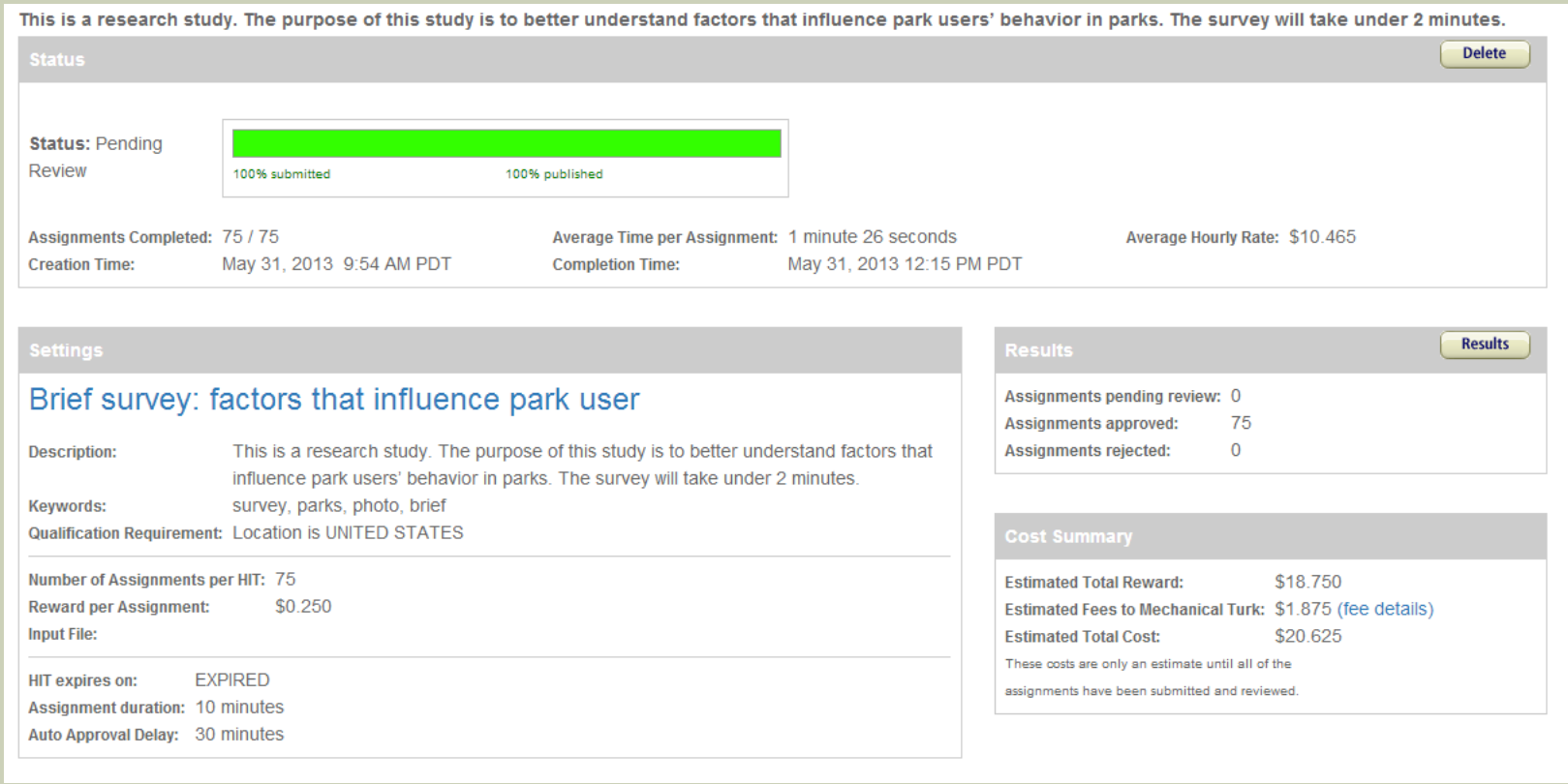
For best viewing results, please open the link in a new tab or window.

Survey link: http://www.surveymonkey.com/s/GKY886C

Provide the survey code here:

Submit

DATA TYPE AND EXAMPLE



THANKS!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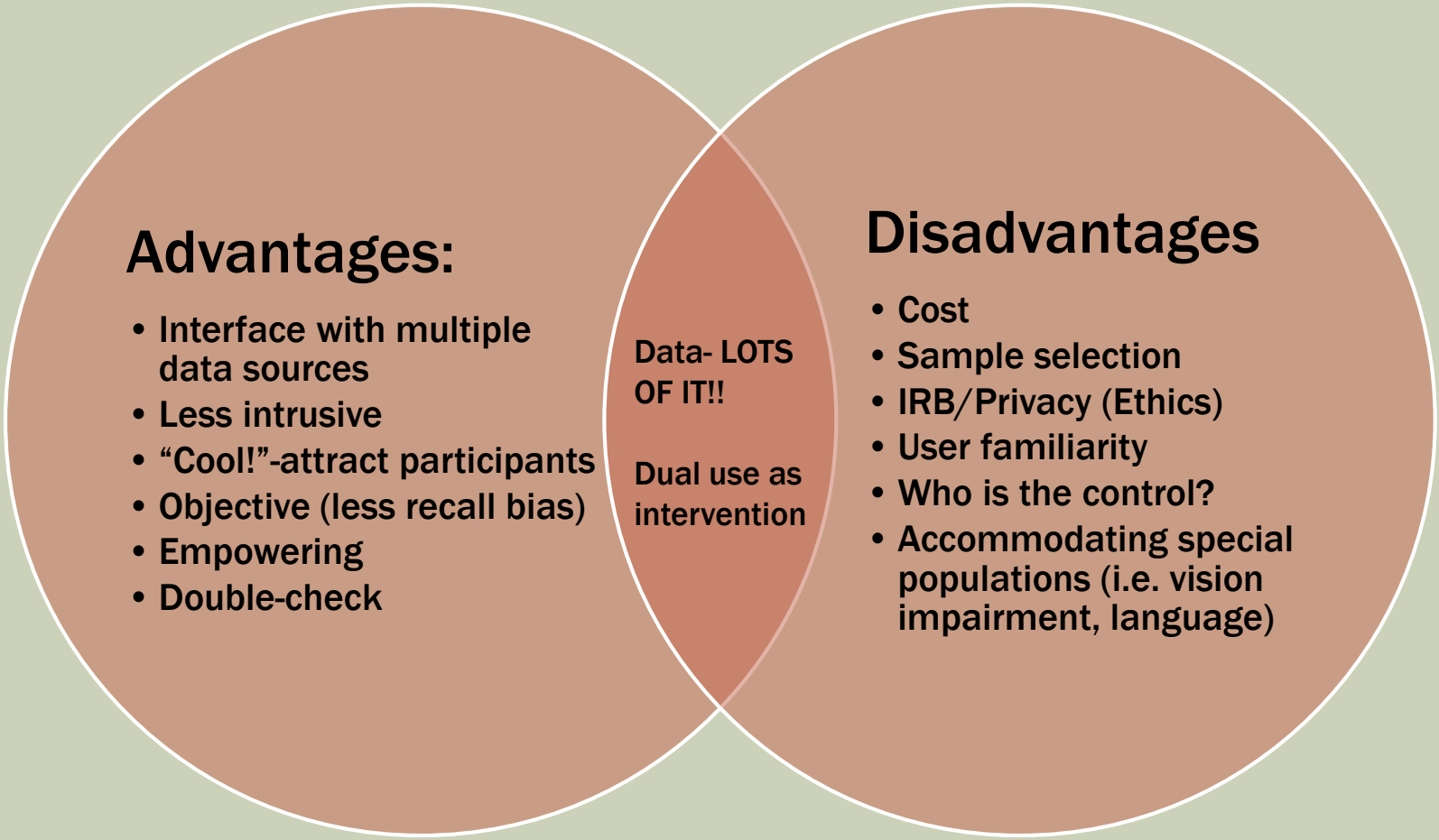
QUESTIONS?

GROUP BREAKOUT BRAINSTORM (3:40-4:10)

- 1. Community Transformation Grants
- 2. State-level Complete Streets
- 3. New Park Infrastructure
- 4. Physical Activity Education Intervention
- 5. Workshop Attendee's Choice!

- BRIEFLY introduce yourselves
- Brainstorm:
  - What questions are you trying to answer?
  - What is the scope of the potential project? Population? Time?
  - New technology to measure the environment?
  - New technology to measure behavior or health outcomes?
  - Three advantages; Three disadvantages
- Presentations
  - 4 min per groups

DISCUSSION NOTES FROM GROUP WORK



VIDEO EXAMPLE