# MOBILE PERSUASION AND URBAN COMPUTING

21w.789 CLASS 8

# Today's Class

- Persuasion
  - Captology
  - Background from Psychology
  - Trans-Theoretical Model of Behavior Change
  - Mobile Persuasive Applications
- Share results from Networking and Location Assignments
- Urban Computing
  - Familiar Stranger
  - Participatory Sensing
  - Community Feedback
  - Urban Games

# Captology

- BJ Fogg (Stanford) 1996
  - Computers as Persuasive Technologies
  - World peace in 30 years…



**Computers** | **Persuasion**

Kiosks
Virtual reality
Exercise equipment
Smart environments
Desktop software
Mobile phones
Video games
Web sites
PDAs

**CAPTOLOGY**

Compliance
Behavior change
Change in worldview
Attitude change
Motivation
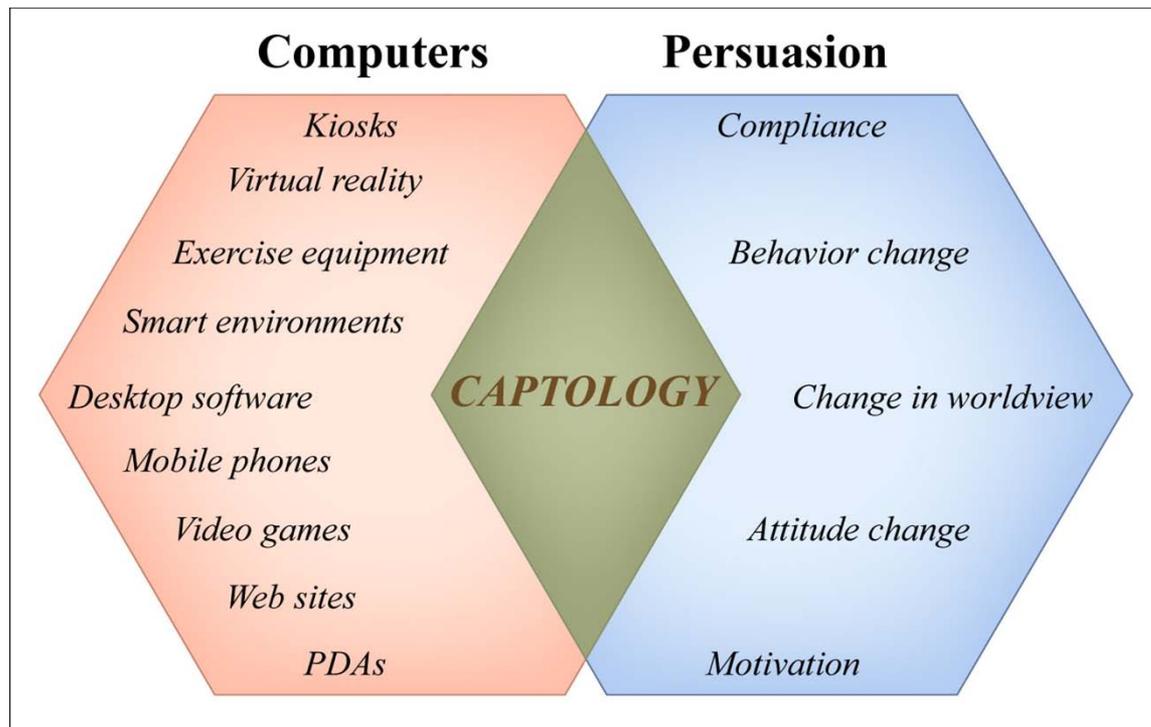
# Mobile Persuasion

- "Mobile phones will soon become the most important platform for changing human behavior."

  - BJ Fogg

- Applications that help people make changes in their lives
  - Healthcare
  - Wellness
  - Communication

# 8 step process for design

- BJ Fogg's 8 simple steps for creating apps for behavior change:
    - Choose a simple behavior to target
    - Choose a receptive audience
    - Find what prevents the target behavior
    - Choose a familiar technology channel
    - Find relevant examples of persuasive technology
    - Imitate successful examples
    - Test and iterate quickly
    - Expand on success

# Trans-Theoretical Model of Behavior Change

- Prochaska 1992
- Stages of Making a change in behavior:
  - Pre-contemplation - "people are not intending to take action in the foreseeable future, usually measured as the next 6 months"
  - Contemplation - "people are intending to change in the next 6 months"
  - Preparation - "people are intending to take action in the immediate future, usually measured as the next month"
  - Action - "people have made specific overt modifications in their life styles within the past 6 months"
  - Maintenance - "people are working to prevent relapse," a stage which is estimated to last "from 6 months to about 5 years"
  - Termination - "individuals have zero temptation and 100% self-efficacy... they are sure they will not return to their old unhealthy habit as a way of coping"

Prochaska, J., et al. "In Search of How People Change: Applications to Addictive Behaviors." *American Psychologist* 47, no. 9 (1992): 1102-1114.

# TTM

- Interventions should be stage-matched
- Earlier stages involve building awareness, desire
- Later stages involve goals and commitments

- Challenges:
  - Riemsma 2003 – Interventions that are stage-matched no better than common intervention for all
  - Clear boundaries between stages, not so clear in practice. More going back and forth than a real stage-matched intervention allows for.
- Still, a useful tool to think about where in a change-making process a person is.

# Goffman

- The Presentation of Self in Everyday Life (1959)
- Impression Management (front stage, backstage)
- The *performance encompasses "all the activity of an individual which occurs during a period marked by his continuous presence before a particular set of observers"*
- *Backstage is "a place, relative to a given performance, where the impression fostered by the performance is knowingly contradicted as a matter of course...Here the performer can relax; he can drop his front, forgo speaking his lines, and step out of character...[it is] where the performer can reliably expect that no member of the audience will intrude"*

# Examples in the market

- Nike+
- Many mobile food choice apps
  - Calorie lookup apps
- Logging apps (workout, food, weight, etc.)
  - FitBit, WiThings, etc.
- Persuade to give up info (GMail, Foursquare, etc.)

# Use

- Who in the class has used a mobile persuasive application?
- Web persuasive application?

# Health Applications

- When do we eat?
  - Kay Connelly
  - Low-literacy, kidney disease patients
  - Build awareness of what and when they eat
  - Vital to maintaining health
  - Awareness led to better eating behaviors
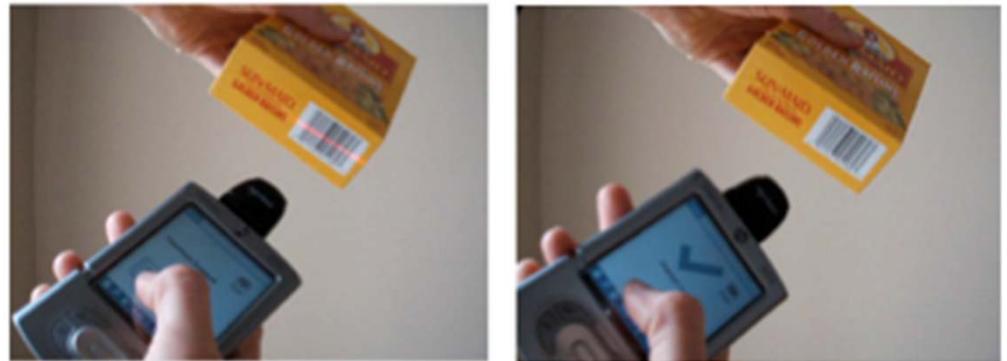
# Mobile Health Applications

- Zeer
  - Mobile ingredients lists – know what you're eating
- uBox
  - Medication reminder/dosing
- uPhone
  - Mobile tool for rural health professionals
  - Track disease/keep digital records

# MyFoodPhone

- Food blog of everything you eat
- Pictures taken from mobile phone
- Forces you to reflect on food choice and quantity

# BeWell - asthma

- Log episodes, upload to doctor

- Leads to better care

- Persuasion to keep more accurate logs for care

http://www.bewellmobile.com/

# Wellness

- Chick Clique
  http://www.cs.indiana.edu/surg/Projects/ChickClique/
  - Step count tracking
  - Share among group of girls
  - Motivation messages sent to others, see progress towards goals
  - Problems: Not everyone walks the same amount, discouraging when always losing to friends who walk a lot
  - Teens can be mean to each other

# Houston



□ Sunny Consolvo et al (Intel, UW)
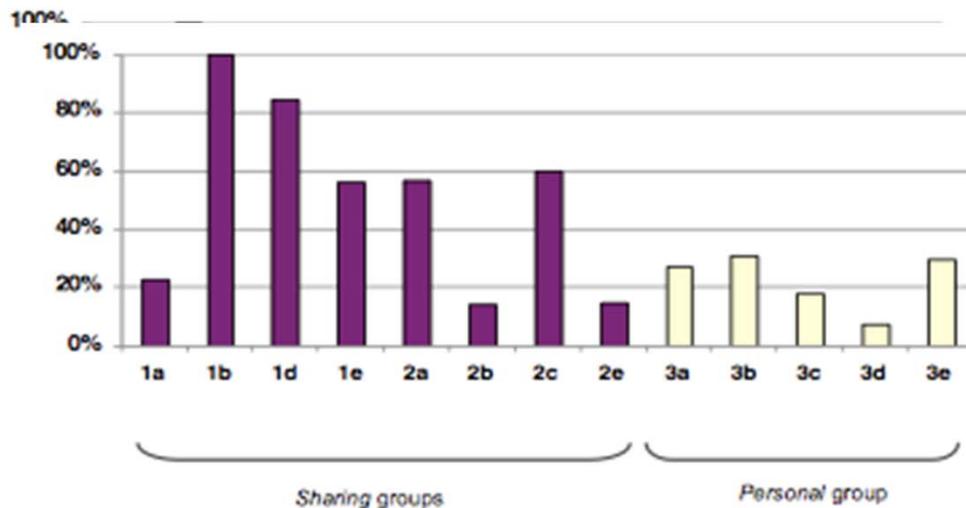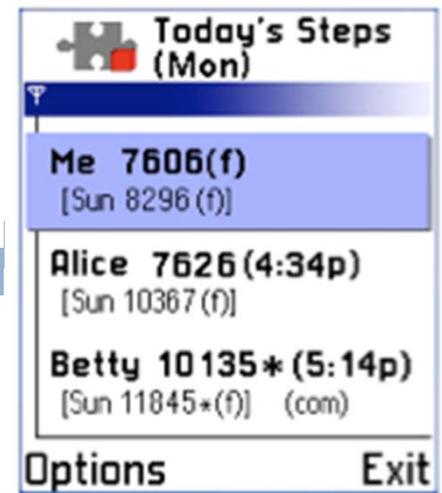


**Figure 3.** Percentage of days participants met their goals.



**Figure 1.** a) The Omron HJ-112 pedometer, b) the pedometer in use, and c) the Nokia 6600 mobile phone running Houston.

# Design Recommendations from Houston

- Give users proper credit for activities
- Provide personal awareness of activity level
- Support social influence
- Consider the practical constraints of users' lifestyles

# UbiFit Garden
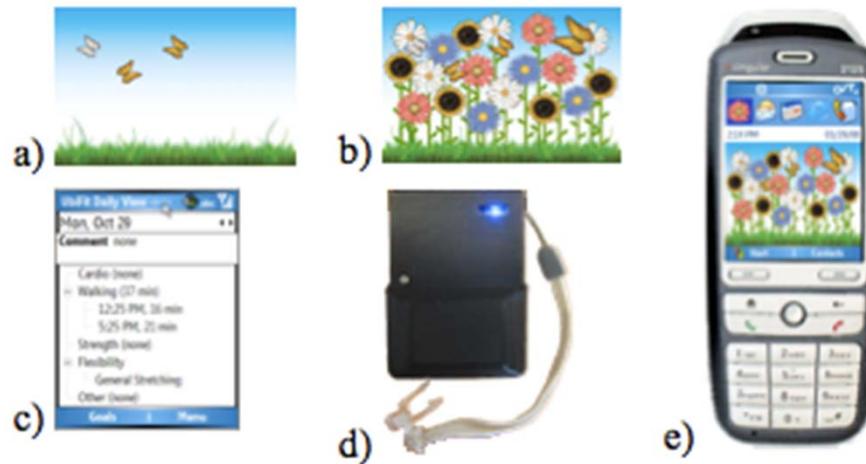


**Figure 1. The UbiFit Garden system.** a) The garden at the beginning of the week; b) an active week with variety; c) the interactive application; d) the MSP; and e) the garden on the background screen of a mobile phone.

# Glanceable displays and persuasion
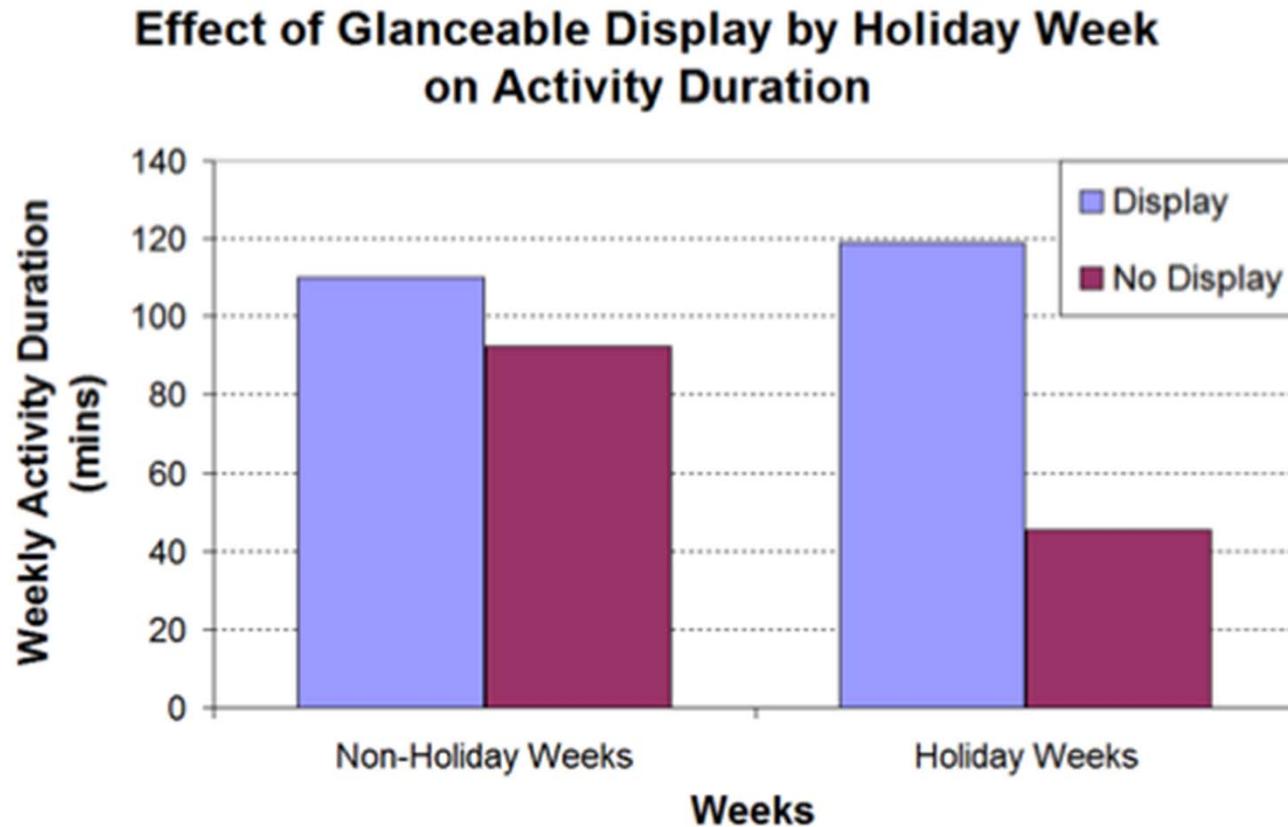


Effect of Glanceable Display by Holiday Week on Activity Duration

# UbiGreen



- Using same concept to encourage people to live greener lives

**Figure 1** (left) The UbiGreen Transportation Display shows transit behavior as "wallpaper" on a phone's screen. Here the tree is nearly full of leaves, indicating that the user has completed several green trips for the week. (top) The MSP sensor worn near the waist and the phone's GSM cell tower data are used to semi-automatically infer transportation mode.
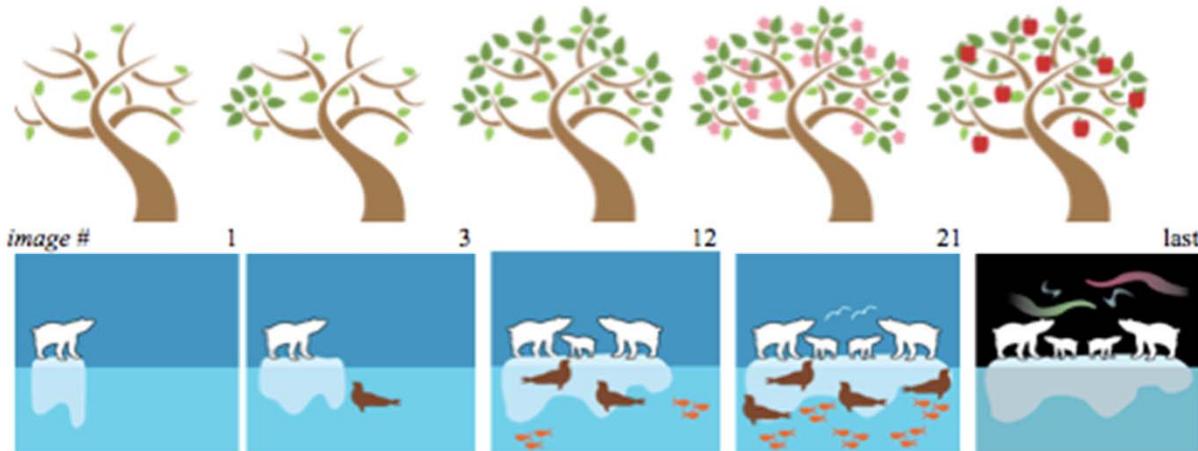


**Figure 3:** (top-left) A sample of images from the tree progression and (bottom-left) a sample of images from the polar bear progression. (right) Screenshots showing the graphics in context. In both examples, the user recently carpooled (as indicated by the car with the "2" in the windshield). Since carpooling saves money, the piggy bank is highlighted.

# EcoIsland – being more green

- Shiraishi et al
- Sense behaviors
- Persuade to make more green choices



Figure 1: The EcoIsland System

Table 2: Examples of Environmentally Friendly Behaviors

| Environmentally friendly behavior | $CO_2$ footprint reduction |
|---|---|
| Use a reusable shopping bag. | -16g |
| Avoid leaving leftovers from food. | -16g |
| Drive in an economic way. | -86g |
| Turn off the TV when not watching. | -13g |
| Instead of car, use bus, train or bicycle. | -180g |
| Shorten your car's idling time by 5 min. | -63g |

# Nike+

- Tracking + Motivation  (Immediate + long term)

http://nikerunning.nike.com/nikeos/p/nikeplus/en_US/plus/#//dashboard/

# Design Strategies for Behavior Change (Sunny Consolvo et al)

1. **Abstract & Reflective.** Use data abstraction, rather than raw or explicit data collected from the user and any technologies, to display information to encourage the user to reflect on his/her behaviors by showing the user what s/he has done and how those behaviors relate to his/her goal.

2. **Unobtrusive.** Present and collect data in an unobtrusive manner, and make it available when and where the user needs it, without unnecessarily interrupting his/her everyday life or calling attention to him/her.

3. **Public.** Present and collect the data, which is personal in nature, such that the user is comfortable in the event that others may intentionally or otherwise become aware of it. Because the data needs to be available whenever and wherever the user needs it, it is likely to be something that s/he wears/carries, resides in a shared/common space, or uses while in the presence of others. The technology should not make the user uncomfortable in those situations.

# Design Strategies for Behavior Change

4. **Aesthetic.** If the display and any accompanying devices function as a personal object(s) that may be used over time, they need to be inquisitive and sustain interest. The physical and virtual aspects of the technology must be comfortable and attractive to support the user's personal style.

5. **Positive.** Use positive reinforcement to encourage change. Reward the user for performing the desired behavior and attaining his/her goal. When the desired behavior is not performed, the user should not receive a reward nor a punishment, but his/her interest should be sustained.

6. **Controllable.** When appropriate, permit the user to add to, edit, delete, and otherwise manipulate data so that it reflects the behaviors that s/he deems suitable. The user should be in control of who has access to what aspects of his/her data.

# Design Strategies for Behavior Change

7. **Trending / Historical.** Provide reasonable and accessible information about the user's past behavior as it relates to his/her goals. Historical data should accommodate changes in lifestyle goals over time and provide for the portability of data across devices.

8. **Comprehensive.** Account for the range of behaviors that contribute to the user's desired lifestyle; do not artificially limit data collection and representation to the specific behaviors that the technology can sense or monitor.

# Social Games

- Foursquare – encouraging location sharing
  - Mayorships, checkin points



Courtesy of Foursquare Labs, Inc. Used with permission.

- Source:
  https://market.android.com/details?id=com.joelapenna.four squared

# Persuasive games based on rhetoric

- Airport Insecurity

http://www.persuasivegames.com/games/game.aspx?game=airportinsecurity

# Cruel 2 B Kind

- Not know who else in the city is playing

- Nice "weapon" to use on real people, guess when you come across someone in world, use weapon on them (be nice in some way)

- Persuasion to be nicer to people in a city

# Ethical Issues

- What data is being collected
- Persuasion = Manipulation?
- Voluntary disclosure (to whom?)

# Persuasion in your systems?

- Could your apps persuade people to…
  - Spend more time with friends
  - Walk a little out of your way
  - Reflect on your past
  - Use public transit more often
  - Be more artistic and share with others
  - Become smarter

# Sharing from Location Assignment

☐ What was interesting?

☐ What was unexpected?

☐ How does this change how you are approaching your project for the class (if at all)?

# Sharing from Networking Assignment

- In excel…

# Urban Computing

# Urban Computing

- Overview of Urban Computing
- Familiar Stranger Phenomenon
- Participatory Sensing
- Community Feedback
- Urban Games
- Physical Tagging

# What is urban computing?

- Computation in urban settings
- Usually mobile or installed in environments
- Seeks to engage residents to become engaged
- "Citizen Science" (Paulos et al)

# Domains of Urban Computing

- Participatory Sensing
  - Traffic
  - Pollution
  - Etc.
- Community Feedback
  - Broken Sidewalks
  - Harassment (hollabacknyc.com)
- Urban Games

# Why "urban" computing

- Cities provide:
  - Critical mass of people using a given technology
  - Many interactions with new people and places
  - Opportunity for people to contribute to society
    - Every phone is a data collection device

# Familiar Strangers

- Stanley Milgram (1972)
  - Someone you recognize but do not interact with
  - Share trains, buses, etc.
  - See coming out of work/apartment building
  - People you recognize at the grocery store
  - Usually mutual (e.g. not celebrity)

# Familiar Stranger Study

- Who do we know and why don't we talk to them?
- Train station in NJ
- Took photo of people waiting for the train
- Returned and asked those present who was familiar

# Findings

89% of people recognized at least one person

"We studied the familiar strangers. We spoke to them in station after station, and this is what they told us. As the years go by, familiar strangers become harder to talk to. The barrier hardens. And we know – if we were to meet one of these strangers far from the station, say, when we were abroad, we would stop, shake hands, and acknowledge for the first time that we know each other. But not here."

# Why Familiar Strangers?

- People more likely to help familiar strangers than total strangers when in need

- Familiar strangers who meet in non-familiar settings more likely to introduce themselves, talk

- Increase feelings of community

- Increase feelings of safety

# Intel + UC Berkeley

- Project to explore familiar strangers
- Replicated Milgram Study in Berkeley Plaza

http://www.paulos.net/research/intel/familiarstranger/index.htm

# Findings from Berkeley Study

- Milgram – 89% of people recognized one person
- Intel – 77% (less set times, BART station, not commuter rail)
- Those interviewed valued information about familiar people most when they felt unsafe and when they had a choice of options.
- Would "respect" a venue more if people they knew came there
- "What if my device showed that I didn't know anyone? I would feel worried about my safety in a crowd."
- "It depends whether I'm looking for people, for connections. When I'm on my own business I'd be more discrete."

# Jabberwocky

- Visual confirmation of when you are around people you regularly see

- Reassurance that you are around people who "know" you
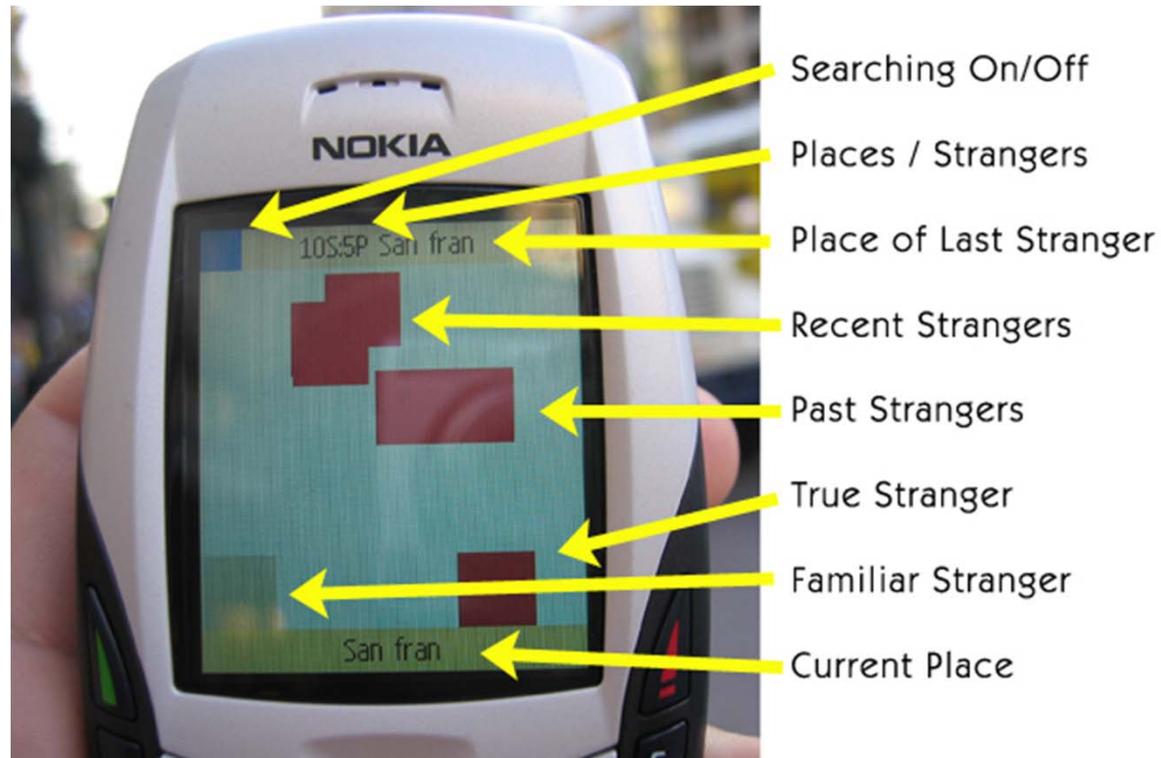


Searching On/Off

Places / Strangers

Place of Last Stranger

Recent Strangers

Past Strangers

True Stranger

Familiar Stranger

Current Place

# Other uses of Familiar Stranger…

☐ "See you on the Subway" Belloni et al (2009)
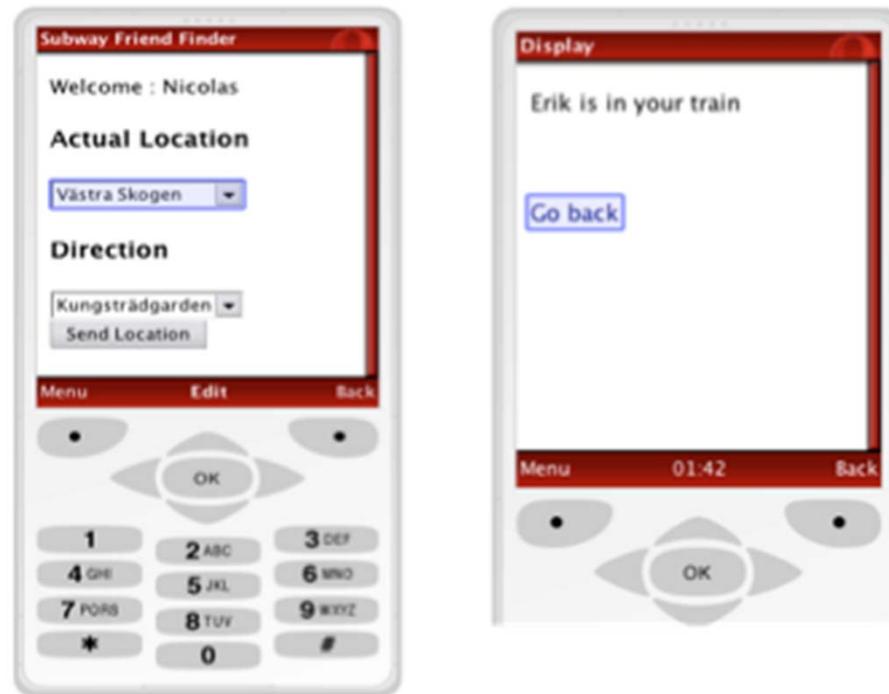
# Other uses of Familiar Stranger…

☐ Telelogs (Davis and Karahalios 2005)



a)

b)

c)

d)
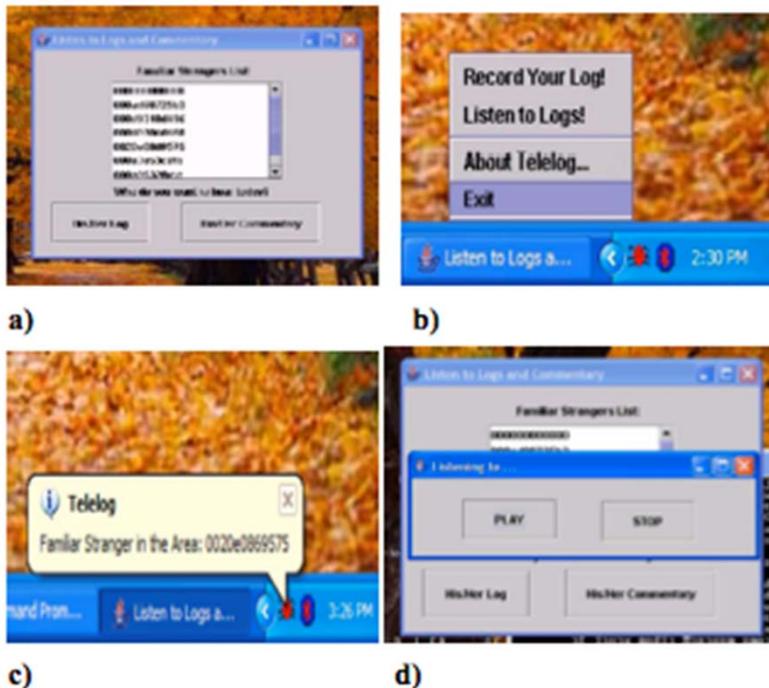
**Figure 2. a) A list of familiar stranger's identification numbers (IDs) within the main window. b) The menu displayed by right-mouse clicking on the Telelogs tray icon. c) A notification of a familiar stranger in the area by displaying a balloon icon through the tray icon. d) The window used to play a log of a familiar stranger.**

# Familiar Strangers

- Do you have familiar strangers in your life?
- Do you ever talk to them?  After how long?
- Have you ever run into them in a different place?
- Ever come to their aid?

# Smart Mobs

- **TXTmob:** a open source text messaging system used to coordinate protests during the United States Republican Presidential Convention in 2004 (Justo, 2004)

- **Orange Revolution:** a series of protests and political events coordinated using text messaging that took place in the Ukraine in 2004 that exposed massive corruption, voter intimidation, and direct electoral fraud between candidates Viktor Yushchenko and Viktor Yanukovych (Myers & Mydans, 2005).

- **People Power 2:** a four-day popular revolution that peacefully overthrew Philippine president Joseph Estrada in January 2001 where text messaging played a leading role (Mydans, 2001).

(from Paulos et al 2007)

# Participatory Sensing

- Systems that allow the public to systematically observe, study, reflect on, and share their unique world (participatorysensing.org)
- Turning citizens into scientists
  - Let billions of phones be the sensors to learn about the world and make it better
  - Hopefully carefully
  - Data needs to be easy to interpret/visualize

# Feral Robots (U of London)

- Robots with environmental sensors on.
- Drove around park measuring air quality.
- Web interface to view results.

# Snout (U of London)

- Extension to feral robots

- Display air quality on clothing in a street performance

# MIT – Inquiry with Imagery (1999)

☐ Seeing the city through different eyes … the past



Figure 1: The current retrieval interface. Thumbnails on the right are images taken by students. Choosing one of these displays its larger image and an array of historical thumbnails across the top. The left image is the historical photo chosen from the retrieved collection.
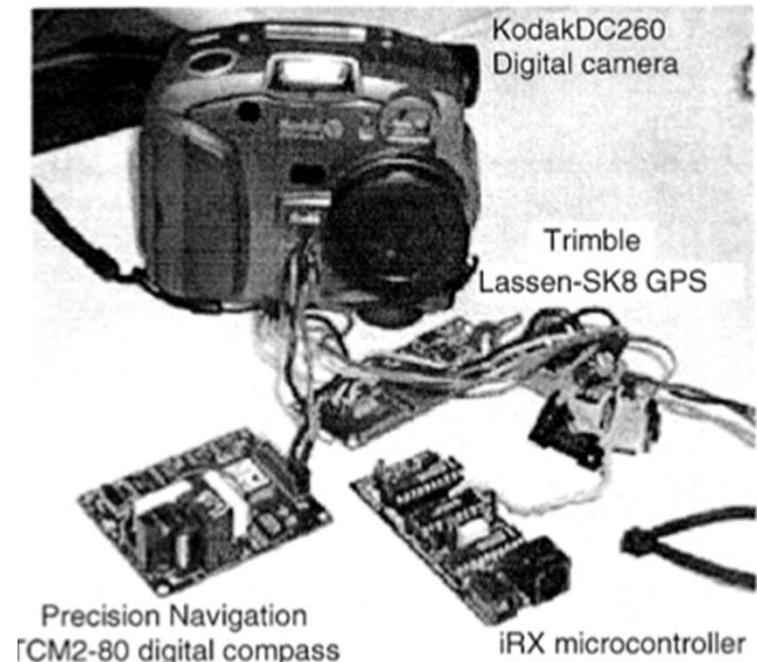


KodakDC260 Digital camera

Trimble Lassen-SK8 GPS

Precision Navigation TCM2-80 digital compass

iRX microcontroller

# Deb Estrin (UCLA)

- Leads Center for Embedded Networked Sensing at UCLA

- Many participatory sensing applications over the years

- Created platforms for upload of mobile geotagged images for various community application

# Garbage Watch (Estrin et al)

- Mobile upload of trash cans that are full

- Help to get them emptied

- Work with reduced staff cleaning cans

- Identify where recycling bins should be placed

- Most cleaning staff do not analyze garbage when emptying trash
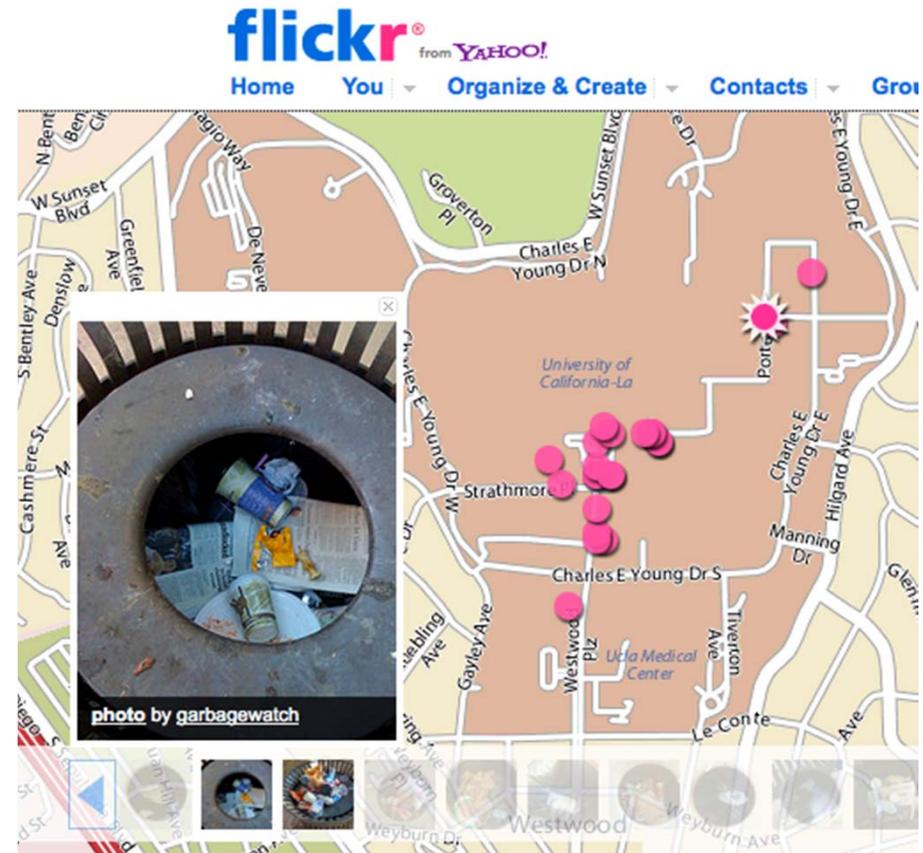
# Networked Naturalist (Estrin et al)

☐ Project Bud Burst (tracking flower bloomings)

# What's Invasive (Estrin et al)

- Android app
- Log sightings of invasive plants of animals in your community

Use your **Android** mobile phone to help us locate invasive species!

To participate:
Step 1. Sign up.
Step 2. Download the app.
Step 3. Start collecting!

12 People Contributing    979 Invas

**Top Invasive Plants!**

Anise, Fennel    Fountain grass    Giant Reed

Terracina spurge - East    Terracina spurge - West

# Noise Monitoring

- Maisonneuve et al 2009 (Sony CS Lab)
- Phones record noise, location
- Reported to and aggregated on central server
- Visualizations of aggregate data

# WeTap (Estrin et al)

- Android app that maps public drinking fountains
- Map to visualize them on phone and web

# Pollution Sensing (Paulos et al)

- Accra Ghana – pollution sensing devices to cab drivers for two weeks

- Micro-climates, pockets of bad air

- Drivers exchanged information with each other, drove different routes, took cars in for emissions testing
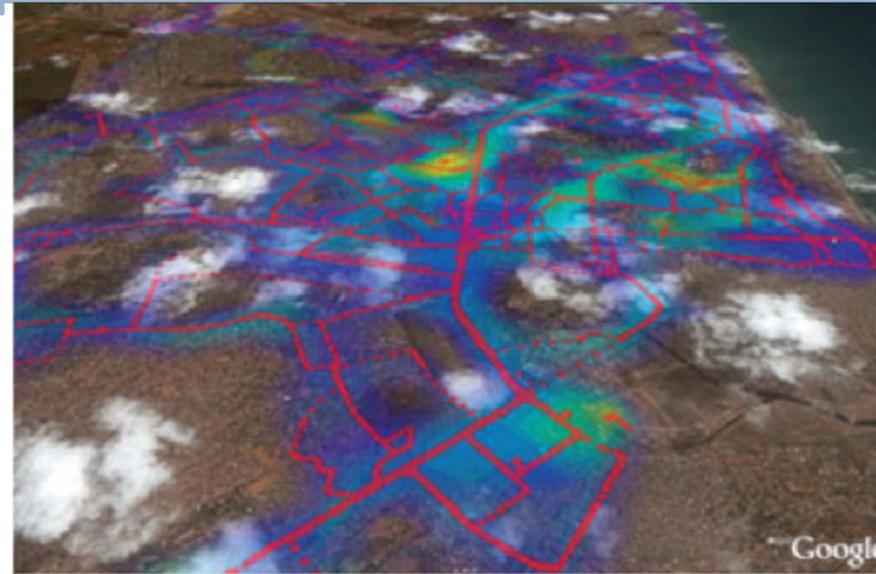


*A heat-map visualization of carbon monoxide readings across Accra, Ghana rendered atop Google Earth. Colors represent individual intensity reading of carbon monoxide during a single 24-hour period across the city. Red circles are locations where actual readings were taken.*

# Indoor Air Quality (Kim + Paulos 09)

- inAir system

- People became more aware of air quality

- Took steps to improve it:

  - Open window or turn on fan while cooking

- Issues understanding cause and effect

Figure 1. *inAir* located in a living room.

# Traffic Monitoring

- Berkeley and Nokia (2008)
- Use GPS traces from mobile phones to infer traffic on Bay Area Roads
- EVERY taxi driver in SF
- Augmented with traffic loop sensors in roads, radar, etc.

# Concept currently used by Google

- Areas with colors have had people using Google Maps with GPS on in the last few minutes
- Augmented with data from govt. sources
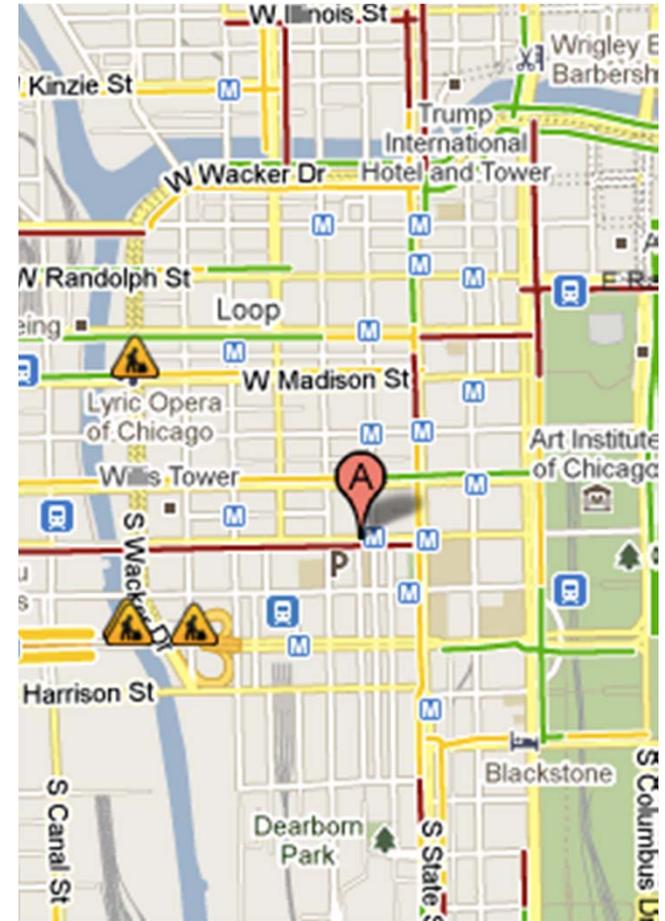
# Pulse of the City (Froehlich et al)

☐ Barcelona bike stations
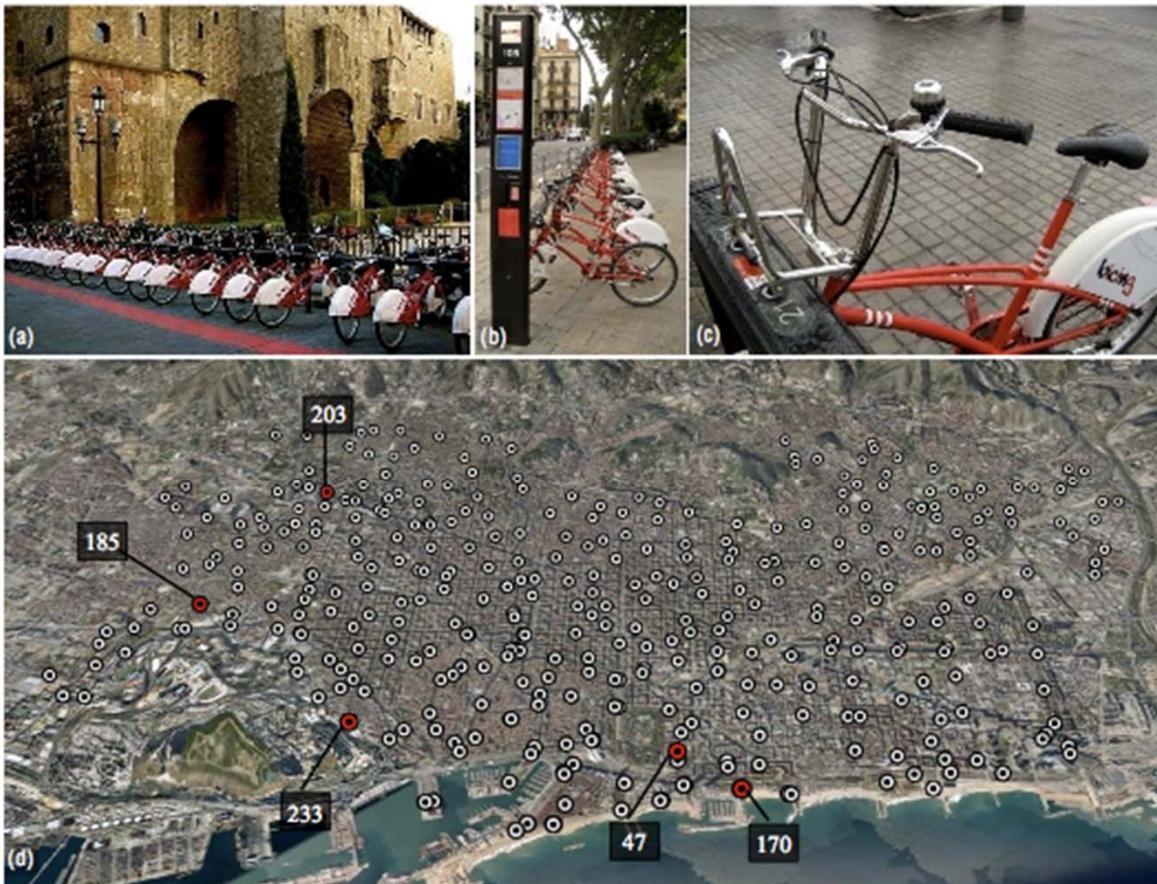


Figure 1. (a) A nearly full Bicing station; (b) A station kiosk; (c) A close-up of a locked bicycle; (d) A map of Barcelona showing the location of the 373 Bicing stations. The five highlighted stations are discussed below.

# Measuring the Pulse of the City

□ Patterns throughout the day…



Figure 2. (a) The total number of bicycles checked-out from all stations over a week, averaged across the observation period. (b) The average number of available bicycles at Station 47, Ramon Trias Fargas, averaged across all weekdays (Mon-Fri) in our dataset (c) Same as previous but over the weekend (Sat-Sun). The dashed line in (b) and (c) indicates the number of parking slots at Station 47.

III. ANALYZING THE "PULSE OF THE CITY"

# Measuring the Pulse of the City

- Getting a quick look at the city
- Show where people are going from/to at a given time
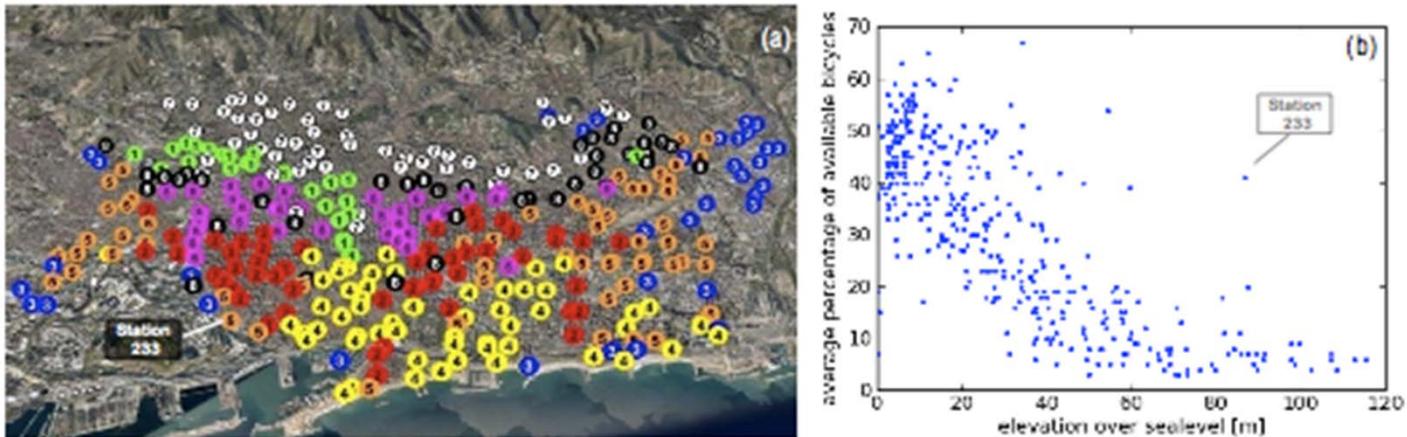


Figure 5. (a) The clustering results; (b) A scatter plot of station elevation vs. average number of available bicycles.

# Participatory Sensing - Issues

- How do you ensure data is valid?
  - Require multiple reports from different people
  - Assign trustworthiness to each participant based on past performance (trust data more over time when confirmed by others)
- Can everyday people (non-scientists) interpret data
  - Decision of moving to suburbs because of crime, but driving on the highway every day is more dangerous
- What if you get data but have no power to affect change? Miserable population?

# Participatory Sensing - Issues

- How do you end your experiment?
  - People in the community might now rely on it
  - Keep datasets available?
  - Keep something simple running?
  - What if getting really popular, meeting demand?

# Urban Games

- Games that take place in the world
- Use mobile devices
- Take advantage of proximity to others or urban infrastructure
- Take place on "human scale"

# Geocaching

- Year 2000 – selective availability turned off on GPS
- Now consumers could get accurate fix on a $100 device
- People would hide things in the world to be found by others.  Coordinates posted online.
- 1.2 million caches around the world
- Video at: http://www.geocaching.com/

# Picking Pockets on the Lawn (Glasgow)

- Takes place in a park setting
- Goal to collect (and steal) coins



**Opponent player**

**Coin**

**Team mate**

**Mine**

**Player**

# Picking Pockets Side Effects

- Used GPS – could hide under a big tree to be "invisible" and thus not get your coins stolen

- Got people active in the city!

# Disney's Kim Possible World Showcase

- Pick up phone from desk and pick a country for mission
- Phone guides you to country where you interact with environment in various ways
- Take pictures of objects to prove location
- Make gong ring, interact with objects

# REXplorer

- Mobile game to discover history of a city

- Played in groups

- Phone interacts with city as you travel around

- Users given quests as the travel around


- Video:
  http://www.youtube.com/watch?v=Mf7m97tF3Ls

# Meet Your Heartbeat Twin (XiLabs)

- Paris startup

- Participants wear heart rate monitors

- You are paired up with someone with same heartbeat in your city

- Need to keep heartbeats the same to stay matched and physically find each other

# Real World Go (XiLabs)

- Playing the game Go in the real world
- Need to surround opponent

- Video: http://xilabs.fr/category/games-english/page/4/

# Can You See Me Now

- Blast Theory and Mixed Reality Lab (UK)

- Mobile + Online Game

- Being chased through the city by real and virtual people.  Can hear their messages as you run.

- Creates real memories in particular parts of the city based on events that happened virtually

# Uncle Roy All Around You

- Another game by Blast Theory

- People show up on the street, given phone with 60 minute countdown

- Need to collaborate with other players (visible on map) to find Uncle Roy

- Each player gets specific clues, but need clues of others to complete puzzle

# PacManhattan

- Game of physical pacman around Manhattan
- Run around, collect "dots" in augmented-reality system
- Chased by other players who are ghosts



Courtesy of pacmanhattan.com. Used with permission.
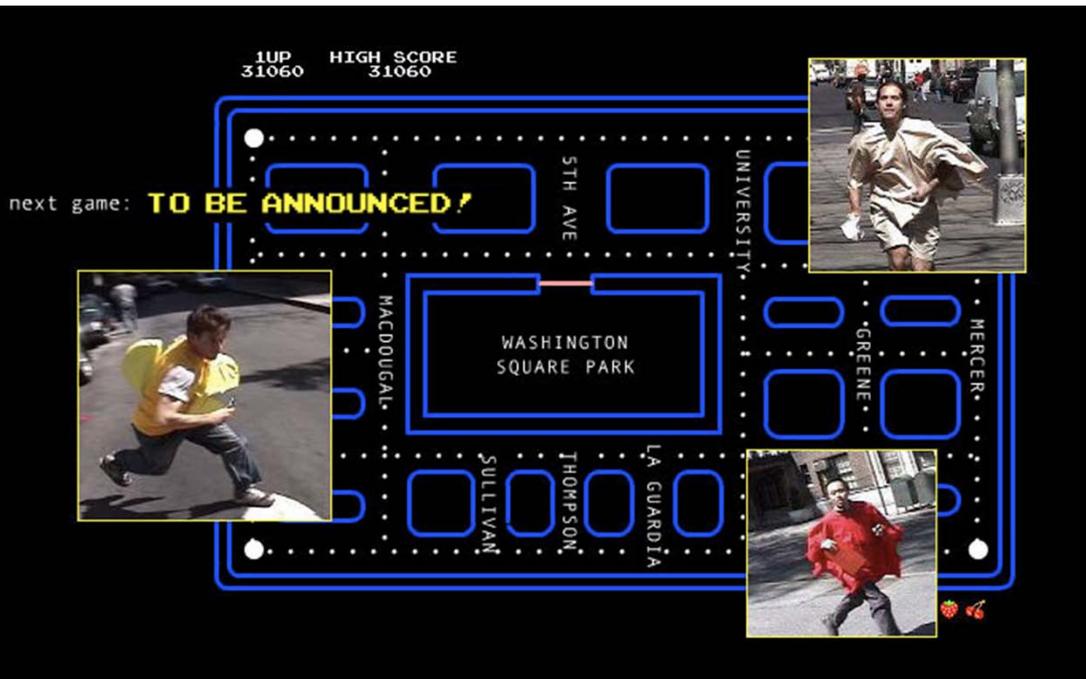
# Dodgeball

- Precursor to Foursquare
- Bought by Google
- Check into places, have your friends see you there
- SMS/MMS based

# Foursquare

- Urban: Going about city and checking into physical places
- Game: Earning points, competing with friends and strangers to be mayor

# Physical Tagging

- Putting physical objects in the world that can be scanned by mobile phones

- Tags link to online content

- QR Codes:

# QR Codes

- Started in 2004 in Japan

- Posted on movie posters, magazines

- Used for downloading apps to mobile phones

- Getting more information about bus stops, etc.

**QR Code data capacity**[1]

| | |
|---|---|
| Numeric only | Max. 7,089 characters |
| Alphanumeric | Max. 4,296 characters |
| Binary (8 bits) | Max. 2,953 bytes |
| Kanji/Kana | Max. 1,817 characters |

# Phi Square

- Physical tags for FourSquare
- Automatically check in if scanned from phone
- MIT Building 4:



- Video: http://phi2.mobilelifecentre.org/

# Je chante pour toi (XiLabs)

- Post audio samples in physical places with mobile phone
- Put sticker in that place to notify others than content is there
- They call a number to hear audio

# Urban Computing

- Changing the way people engage with the city
- In your projects can users…
  - Provide data (e.g. train arrivals, popular places to eat lunch, etc.)
  - Interact with features of the city (music in particular locations, places to meet up with friends, etc.)
  - Engage with familiar strangers

# For next class

- No specific assignment
- Continue to work on final projects (only 4 weeks to go!)


- Next class will be on Large Scale Deployments, Instrumentation, and Commercialization
  - + short guest lecture by Andy Aftelak, Director of Research for Motorola Mobility

21W.789 Communicating with Mobile Technology
Spring 2011