FIELD EVALUATION AND DEPLOYMENT

21w.789 Class 7   Frank Bentley

Today's Class

- Principles for field evaluation of prototypes
- Methods for evaluating new concepts
- Instrumentation / Data analysis
- Examples of rapid prototyping and field evaluation
- Plan your own field studies

What the lab can tell you

- basic flow and interaction issues

- data integration issues (interfacing with contacts, web service accounts)

- understanding of prompts and icons

- etc.

What use in context can tell you

- How and when service will be used
- How interactions fit into daily life
- Tasks which system does not support
- Creative uses of service in the world

http://www.flickr.com/photos/yourdon/3030246123/

http://www.flickr.com/photos/nicaprio/4557139564/

Much more basic (and important!) questions!

New evaluation philosophy

- Get new concepts in the field as early as possible
    - Weeks after having idea!
    - Working functional prototype
- Field evaluations serve to:
    - Improve Concept
    - Mitigate Risk (kill unsuccessful concepts)
    - Build understanding of mobile interaction
- Make prototyping and field testing:
    - Cheap (incentives + your time)
    - Fast (~2 week implementation, ~3 week study)
    - Informative (interviews, home tours, diary logs, voicemails, photos, etc.)

Principles for building prototypes

1. build only what you need
2. build the experience, not the technology
3. build it sturdy (enough)

Build only what you need

- The first prototype is built to answer specific research or implementation questions
- Build the minimum that you need to answer these!
  - Minimal configuration
  - Minimal graphics / custom screens
- If purpose is to test new experience, goal is to minimally prototype that experience
- If purpose is to test tech, goal should be to implement that new technology component

Build the Experience, Not the Tech

- If testing how a new experience will fit into people's lives:
  - Build something that creates that experience as simply as possible
  - Limit the development of large tech pieces until you have proven your concept
  - Mashup, don't reinvent

Build it study (enough)

- Application has to work in real world settings
  - Sturdy network code (retry as necessary, fail gracefully)
  - Sturdy database code (accept all types of character inputs)
  - Stable and responsive interface that does not (often) crash or crashes gracefully

Principles for testing prototypes

1. social groups for social technologies
2. real contexts of use
3. primary device
4. field-based data collection

Social Groups for Social Tech

- If app/service requires communication among friends/family
  - Recruit social groups to participate in study
  - Find existing groups of friends and family
  - Can be difficult if they all need to have a certain phone type or carrier!

Real Contexts of Use

- Have participants use system in real settings
  - Throughout daily life for most apps/services
  - For apps tied to a place, can run small trials in a particular setting:
    - Restaurant
    - Stadium
    - Etc.
  - Directly observe users of have them keep detailed notes of their interactions combined with interviews with you

Primary Device

- For systems where people are using system over a period of time:
  - Use their own phones
  - Install app
  - Interacting with two devices creates new patterns of interaction that do not correlate with real use
  - Much easier now with Android and iPhone

Field-Based Data Collection

- Don't rely on self reports

- Instrument application/server to log interactions

- Have participants create voice notes or call a voicemail system to record details of their interactions

- Conduct interviews soon after participants use application and use prompts from logs/voicemails to elicit memories of particular interactions

Evaluating results of studies

- When should you keep going with an idea?
  - Participants choose to keep your application installed on their phones
  - Participants find rewarding ways to interact with your application/service that bring them real benefit/enjoyment
- When should you change course?
  - If users find little/no benefit to using service
  - If service does not fit into the way they live their lives

Methods

- Diary Logging

- Content Analysis

- Instrumentation

- Contextual Inquiry

- Experience Sampling

- Interviews

Diary Logging

- What it is:
  - Asking users to keep track of specific data tied to particular instances of use (usually over several weeks)
  - Diaries can be paper, photo, video, voicemail, etc.
- What you learn:
  - Details of specific interactions, close to the time of interaction (when details most salient)
  - More accurate representations of frequency of use and action taken (if asked weeks later, data not trustworthy)

Diary Logging

- How to:
  - Decide on specific actions that you want users to log (e.g. every phone call, instances of mobile search, TV watching, etc.)
  - Provide a means of logging (paper log, mobile logging app, voicemail number, photos, etc.)
  - Collect logs and find any log entries that you do not fully understand / would like more data about
  - Conduct interviews with participants focusing on items that need additional contextual information / items of specific interest

Diary Logging

- Examples:
  - Serendipitous Family Stories
    - Voice mail logs used after finding a story to record experience, any follow up actions
    - Helped us understand experience of finding location-based videos and what people do once they found them
  - Motion Presence Study
    - Voice mail logs used after viewing moving/not moving status in the phone book
    - Helped us understand how motion data was being interpreted and used

Diary Logging:

- You can report:
  - For example, Harold delayed communication: "[George], I knew he was going to work, but I wasn't sure if he got there already and I saw that he was not moving for 12 minutes. So judging by that I'm getting that he was already at work so I didn't bother calling him."
  - "I could tell when he was leaving work by when he went off of 'not moving.' ... It was like, ok, I saw that he was already on his way and we'd get there about the same time."
  - She called "to say that I made her cry that she was so touched by the stories. And she thought they were funny, the first ones I told her about."
  - "After that [watching the two new stories] I called both my mom and my brother and I laughed about the situation cause it was pretty funny what they said."
  - "My husband was watching it with me, we were in the car. So we were in the car and he was watching it with me and was laughing. I don't remember word for word what we were talking about and then my kids starting asking us questions about it, I know that. He wanted to see the video and they got all involved in it too."
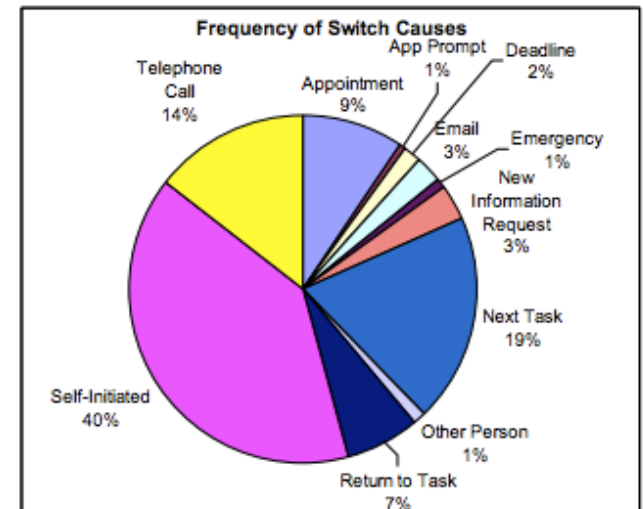

Figure 3. The frequency of diary entries for the kinds of events that instigated task switches. For our sample, users chose when to switch tasks or worked off a to-do list a majority of the time.

Further Reading

☐ Palen, L. and Salzman, M., "Voice-mail diary studies for naturalistic data capture under mobile conditions," *Proc. of CSCW '02, pp. 87-95.*

☐ Bentley, F. and Basapur, S. (2012) StoryPlace.me: The Path From Studying Elder Communication to a Public Location-Based Video Service. In Proc CHI 2012.

☐ Mary Czerwinski, Eric Horvitz, and Susan Wilhite. 2004. A diary study of task switching and interruptions. In Proceedings of the SIGCHI conference on Human factors in computing systems (CHI '04).

☐ Bentley, F. and Metcalf, C. (2007) Sharing Motion Information with Close Family and Friends. In Proc CHI 2007.

Content Analysis

- What it is:
  - Systematically analyzing aspects of the content in a particular collection

- What you learn:
  - An understanding of the qualities of a particular platform, the types of content it affords
  - Evolving use over time in terms of types of content created

Content Analysis

☐ How to:

- Get access to a relevant subset of content (random sample, all content that meets your criteria, etc.)
- Explore various aspects of that content:
  - Length, creator demographics, points of view expressed, day/time created, topic, comments/likes on media, narrative style, etc.
- Look for common themes in data
  - Affinity analysis
  - Statistical analysis

Content Analysis

- **Good Examples:**
 - Audubon Dougherty's CMS Thesis
    - Analyzing civic content in mobile live streaming systems
    - Content length, creator demographics, language, hosting style, location created, date created, etc.
  - StoryPlace.me (Motorola Research)
    - Analyzing aspects of inter-generational location-based media content
    - Content length, people mentioned in story, story location, timeframe of story, places mentioned in story, etc.

Content Analysis

☐ You can then report things like this:
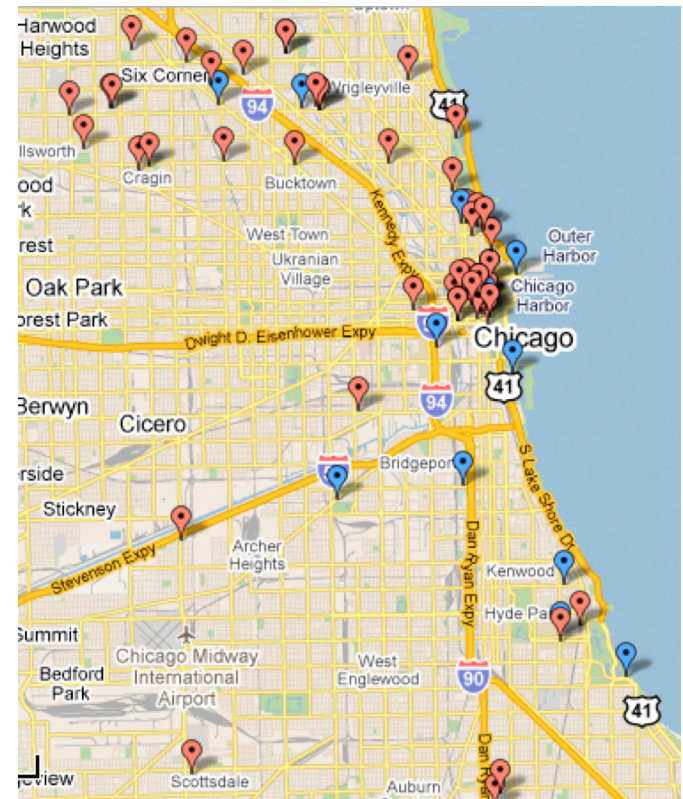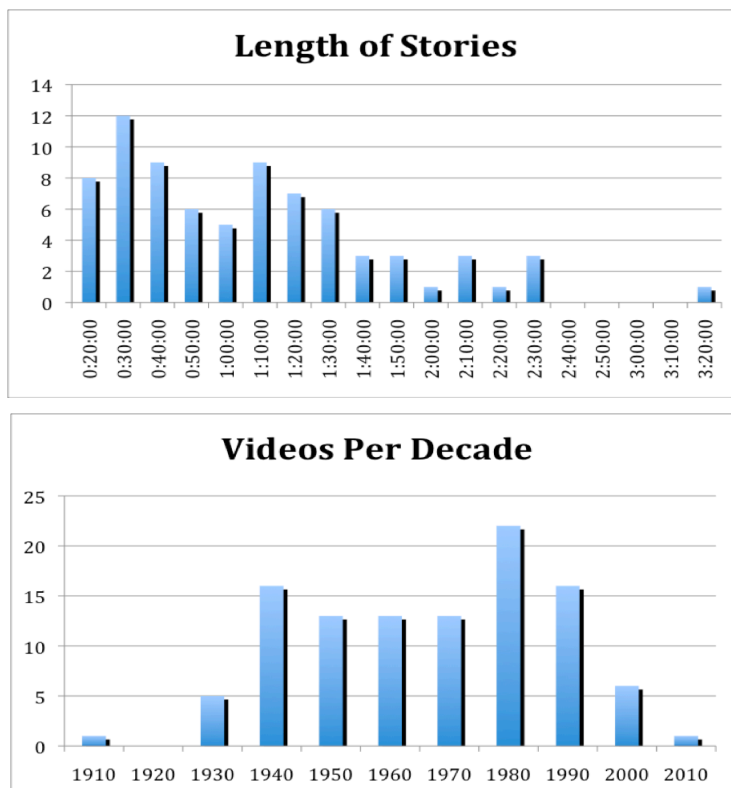
Frank R. Bentley, Santosh Basapur, and Sujoy Kumar Chowdhury. 2011. Promoting intergenerational communication through location-based asynchronous video communication. In Proc UbiComp '11. ACM, New York, NY, USA, 31-40. http://doi.acm.org/10.1145/2030112.2030117 Used With Permission.

Further Reading:

- Hansen, A., Cottle, S., Negrine, R., & Newbold, C. (1998). Content analysis. In *Mass communication research methods. New York: New York University Press.*

- Dougherty, A. New Medium, New Practice: Civic Production in Live-Streaming Mobile Video. CMS Masters Thesis. MIT. 2010.

- David A. Shamma; Lyndon Kennedy; Elizabeth F. Churchill. Tweet the Debates: Understanding Community Annotation of Uncollected Sources. ACM Multimedia, ACM, 2009

- Bentley, F., Basapur, S., Chowdhury, S. Promoting Intergenerational Communication Through Location-Based Asynchronous Communication. Proceedings of Ubicomp 2011.

Instrumentation / App Analytics

- What it is:
  - Getting detailed data about how people are using an application or system
  - Logs of use (per user or aggregated)
  - Finding patterns / trends / descriptive statistics in usage data
- What you learn:
  - How systems are being used by different users and in different contexts
  - Which features get the most use when and by whom
  - Differences in use across time and day

Instrumentation / App Analytics

- How to:
  - Decide on the factors that you want to log
    - User ID, Timestamp, Every screen or click, Specific interactions like creating or viewing content, commenting, etc.
  - Add logging to system for these factors (or ask application provider for data)
  - Find patterns in data (usually with Hadoop and R)
    - Usually GB and GB of data!

Instrumentation / Analytics

- Examples:
  - Facebook Data Team
    - Predicting presidential elections based on Facebook updates
  - Shamma's work on Zync
    - Understanding use over time, session length, repeat visitors, etc.
  - Bentley and Basapur's work on Serendipitous Family Stories
    - Understanding use of the application, how many times videos were replayed, how many notifications preceded actually opening the story
  - Bentley and Groble: TuVista sports media system.
    - Showed how content access was strongly correlated with breaks in the game on the field.

Instrumentation / App Analytics

☐ What you can report:

- ☐ By the end of the four weeks, our participants had discovered 83% of the stories that were created for them. (Bentley et al)

Videos Found Per Day of Study

Frank R. Bentley, Santosh Basapur, and Sujoy Kumar Chowdhury. 2011. Promoting intergenerational communication through location-based asynchronous video communication. In Proc UbiComp '11. ACM, New York, NY, USA, 31-40. http://doi.acm.org/10.1145/2030112.2030117 Used With Permission.

- ☐ A total of 895 users (32%) returned for more than one Messenger Zync IM session. (Shamma et al)
- ☐ Overall, the top 20 most watched videos average 197.7 seconds in length. However, we observed a general trend that videos with heavy chat activity were, on average, longer in length (304.9s). (Shamma et al)

Further Reading:

- David A. Shamma. 2011. Defensive research within the mobile marketplace. In Proceedings of the 2nd international workshop on Research in the large (LARGE '11). ACM, New York, NY, USA, 5-8.

- David A. Shamma. 2012. People and the Data They Make. Dean's Lecture. UC Berkeley. (audio available online: http://www.ischool.berkeley.edu/audio/download/ 21533/2012-02-29-david-ayman-shamma.mp3)

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Contextual Inquiry

- What it is:
  - Directly observing users perform tasks in real contexts of use

- What you learn:
  - How environment affects task performance
  - Other resources that are available while people are performing a tasks
  - Social and physical interactions involved in a task

Contextual Inquiry

- How to do it:
  - Decide on tasks that are of interest to you
  - Find people who do these tasks
  - Go to the places where people actually perform these tasks
  - Have them perform the task while video/audio recording
  - Ask follow up questions on parts that remain unclear
  - Create flow models
  - Perform grounded theory-based affinity on qualitative data

Contextual Inquiry

- Examples:
  - Bentley, Metcalf, and Harboe study of music use in context
    - Had users find music to play for specific situations in the home/car (situations that they actually reported doing in the recent past)
  - H&R Block
    - Visited people's homes to see everything that goes into tax preparation off the screen (finding documents, calling banks, etc.)
  - General Motors
   - Design of the CUE system based on 32 contextual observations of users driving their cars

Contextual Inquiry

Music Information Flow Diagram

Physical Flow Model

- What you can report:
  - They would play a mix or random shuffle of their music, and skip songs they didn't like. MU2: "I don't like this song, I don't like this song. I'll just flip through it."
  - MU10 referred to her music by number. She'd pick up a CD and mention that "number 7" is her favorite song. Because she doesn't know the names of her songs and uses numbers to identify them, she must turn on the TV in order to see the numbers for songs she likes (displayed from the DVD player where she plays her CDs). She ends up memorizing track numbers and uses this knowledge to help her play the songs she likes in her car. She only plays particular tracks from a CD when she inserts it.

Frank Bentley, Crysta Metcalf, and Gunnar Harboe. 2006. Personal vs. commercial content: the similarities between consumer use of photos and music. In Proceedings CHI '06,, 667-676.
http://doi.acm.org/10.1145/1124772.1124871 Used with Permission.
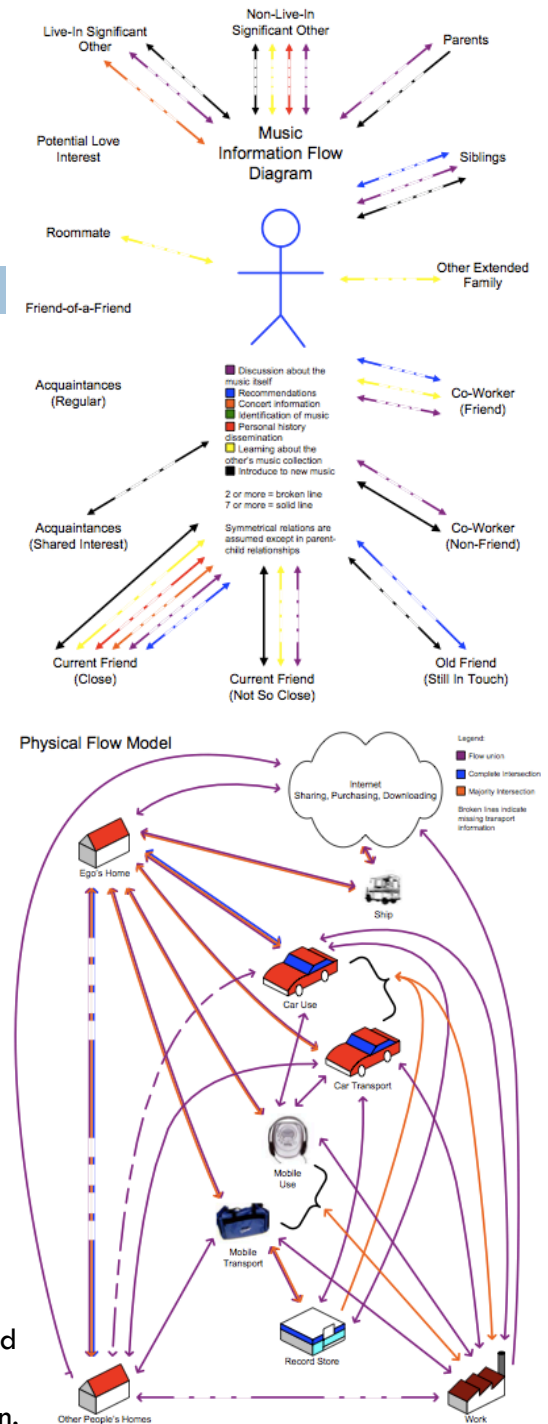
Further Reading

- Beyer, H. and Holtzblatt, K. (1998): Contextual Design: Defining Customer-Centered Systems. San Francisco: Morgan Kaufmann.

- Holtzblatt, K. and Beyer, H. (1993) Making Customer-Centered Design Work for Teams. In Communications of the ACM. October 1993. Vol 36, No 10. pp93-103.

- Andrew W. Gellatly, Cody Hansen, Matthew Highstrom, and John P. Weiss. Journey: General Motors' Move to IncorporateContextual Design Into Its Next Generation of Automotive HMI Designs Proceedings of the Second International Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI 2010), November 11-12, 2010, Pittsburgh, Pennsylvania, USA.

- Bentley, F., Metcalf, C., and Harboe, G. Personal vs. Commercial Content: The Similarities Between Consumer Use of Photos and Music. In Proc CHI 2006.

Experience Sampling Method (ESM)

- What it is:
  - Interrupting users and asking questions (usually on a mobile device, but could also be over the phone)

- What you learn:
  - Time use (% of responses doing a particular activity)
  - How users would respond to a request at a particular time (e.g. location sharing)

Experience Sampling Method (ESM)

☐ How to:
- ☐ Use an existing ESM toolkit
- ☐ Define prompts
- ☐ Define trigger times (e.g. 5 times/day random between 8am-10pm or after every phone call)
- ☐ Collect data
- ☐ Look for patterns within and among users

Experience Sampling Method (ESM)

- You can report:
  - Turning our attention to the 23% of the time participants were *not willing to disclose their location to the requester, they responded with "I am busy," "Request denied," "System busy," or a lie (in order of overall popularity). (consolvo et al)*

Further Reading:

- Barrett, L.F., Barrett, D.J., "An Introduction to Computerized Experience Sampling in Psychology," *Social Science Computer Review, Vol. 19, No. 2, (Summer 2001), pp.175-85.*

- iESP software website: http://seattleweb.intel- research.net/ projects/esm/iESP.html (verified Jan 6, 2005).

- Consolvo, S., Smith, I., Matthews, T., LaMarca, A., Tabert, J., Powledge, P. Location Disclosure to Social Relations: Why, When, & What People Want to Share. In Proc CHI 2005.

- Larson, R. and Csikszentmihalyi, M. (1983): The Experience Sampling Method. New Directions for Methodology of Social & Behavioral Science, vol. 15, Mar 1983, 41-56.

- Hektner, J.M., Schmidt, J.A., Csikszentmihalyi, M. (Eds.). (2006). Experience Sampling Method: Measuring the Quality of Everyday Life. Sage Publications, Inc. ISBN 978-1-4129-2557-0

Semi-Structured Interviews

- What they are:
  - A series of topic areas to explore with participants, following up with additional questions based on their responses
- What you learn:
  - Details of use in particular domains, preferences, recent behaviors/actions in domain of interest
  - Qualitative explanatory details behind observations attained through experience sampling, diary logging, home tour, etc.

Semi-Structured Interviews

- Examples:
  - Elder Communication Study
    - Asked participants details about recent communications across generation and distance, places these communications took place, etc.
  - Music Context Study
    - Asked participants details about music playback in a variety of settings, music acquisition, sharing, etc.

Semi-Structured Interviews

- What you can report:
  - Details of use, experience, preferences
  - Specific past instances of interaction with a system/content/social group/etc.
  - Examples:
    - C2 displayed a large photo of her mother in her room. "I'm very close to my family. So they're up there and so sometimes if I glance up at that picture I'm like, 'ah, calm.'"
    - C4 goes to a megachurch outside of Chicago that puts its sermons online. "If it's a hot subject she'll call up [P4]. 'Yeah, did you watch it?' ... So they compare notes on this guy."
    - P2: "When I'm driving long distances I will make calls to all three of my kids just to touch base or to leave a voicemail even if they're not picking up."
    - "I hadn't listened to [Laura Love] for a while because sometimes you get lazy and just keep going for the same thing, [...] so I listened again in the last couple of days."

Further Reading

- Beebe, James (2001) Rapid Assessment Process. Walnut Creek, California. Altamira Press publishers.

- Bernard, H. Russell (1988) Research Methods in Cultural Anthropology. Newbury Park, CA. Sage publications.

- LeCompte, Margaret D. and Jean J. Schensul (1999) Designing and Conducting Ethnographic Research. Ethnographer's Toolkit 1. Walnut Creek, California. Altamira Press, Sage publications.

- StoryPlace.me: The path from studying elder communication to a public location-based video service. Frank Bentley and Santosh Basapur. CHI 2012 Case Study. May 2012.

Small Scale Recap

- Many methods to pick and choose from…choose the best combination that answers your research questions!

- Now onto some methods to deploy your app and understand usage in the large!

Distributing your apps

- App Stores
- Ad Hoc
  - Compiled application delivered as a download or file transfer to phone
  - Android .apk file, Apple .app file + MobileProvisioning file
  - Phones need to enable the download of non-market apps
- Debug Builds
  - Loaded directly from developer computer
  - Phones must have a debug mode turned on (Android) or special certificate installed (Apple)

App Stores today

- One per Mobile OS
- Controller by OS maker (+ Amazon Android market)
- Large (100s of thousands of apps, millions of users)
- Variable submission process/oversight by OS maker
- Free or 30% cut to OS maker

Apple App Store

- Largest
  - >1M apps
  - >60B downloads
- Apps must be reviewed and approved by Apple
- Must enter NDA with Apple
- All communication with them is under NDA including terms of rejection
- One week to 9 month process each time app is updated
- $99/year fee and 70/30 revenue split

Google Play

- □ > 1M apps
- □ >50B downloads
- □ Any app that's submitted gets instantly published to store
- □ Google can remove malicious apps
- □ $25 one time fee to publish apps
- □ 70/30 revenue split

Ad Hoc deployments

- On Android, just post an APK file on the web and send out a link
  - Will not work with some older phones on AT&T (block non-market apps)
  - No limit on install base
- On iPhone
  - Need to get UDIDs from each device ahead of time
  - Generate certificate with those UDIDs on the web
  - Build app with that certificate
  - Distribute cert and app to participants, must load with iTunes
  - Limited to 100 users per year

Scalability

□ Reducing hits to the server

□ On-Device Cacheing
  ▫ Keep data local
    ■ Download large data/videos/etc. on wifi
  ▫ Conditional GETs to server

□ Leverage 3rd-party APIs directly from phone
  ▫ Phone interfaces to FB, Twitter, Yelp, etc. directly

Public Betas

- Why do a public beta?
  - Learn more about adoption
  - Systems that require large network effects
  - Scale gracefully
  - Get feedback from lots of users on feature sets
- Examples:
  - Phi^2
  - Spotisquare
  - ZoneTag

Issues with public betas

- Security
  - System needs to be tightly locked down
  - Fix vulnerabilities to hackers
    - Good programming practice anyway
    - Rarely done with quick and dirty prototypes
- Scalability
  - Paying for additional server resources
  - Designing system for scalability
    - Memcache, etc.
- Finding users…

Getting initial users

- Social Media
  - Facebook ads targeted towards target market segments
  - Twitter – getting retweeted by major blog, tech pundit
- Other
  - Google Ad Words
  - Pay for placement in app stores
  - Update app – Android Market, show up under "latest" apps each time there is an update

Ethics and Recruiting

- What is a research study if it's released like a product to thousands of users in an app store?

- How can we ensure that the many decades of work on ethical research practices is applied to this new kind of research? (or should we?)

- How can we trust the data that we get from a large deployment and how does this data compare to what is traditionally gathered in an small-n study?

Topics

- Research Validity
  - Recruiting
  - Quality of data
- Ethics
  - Informed Consent
  - Data Collection
  - Ending the "study"

Research Validity: Recruiting

- In the small:
  - Recruit a diverse set of 10-12 users from different backgrounds/ages/genders
  - Likely all from one city
  - Usually meet in person
- In the large:
  - Anyone can download
  - Demographics (if collected) are self-reported and unverified (Facebook login??)
  - Likely from all over the world

Recruiting: Benefits and Issues

- Benefits
  - Larger N
  - More diverse geographically
  - Potentially more like "real" users
- Issues
  - Possibly less diverse than if you had handpicked participants (aggregate results shown not to be trustworthy for use in general population)
  - Less trustworthy demographic data
 - Less understanding of use by very different user populations

Recruiting: What is the app?

- Present as a research study
  - Probably get fewer users (perception that it will go away, in progress)
  - Probably different demographic (younger, geekier, male)
- Present as a "real" app
  - Provide some benefit to user
  - Need to be more "polished" – high expectations!
  - How is this different from Facebook?
    - Facebook Data has all sorts of "research" trends pulled from usage

Example from Facebook Data Team

From: https://www.facebook.com/notes/ facebook-data-science/how-voters-turned-out-on-facebook/451788333858
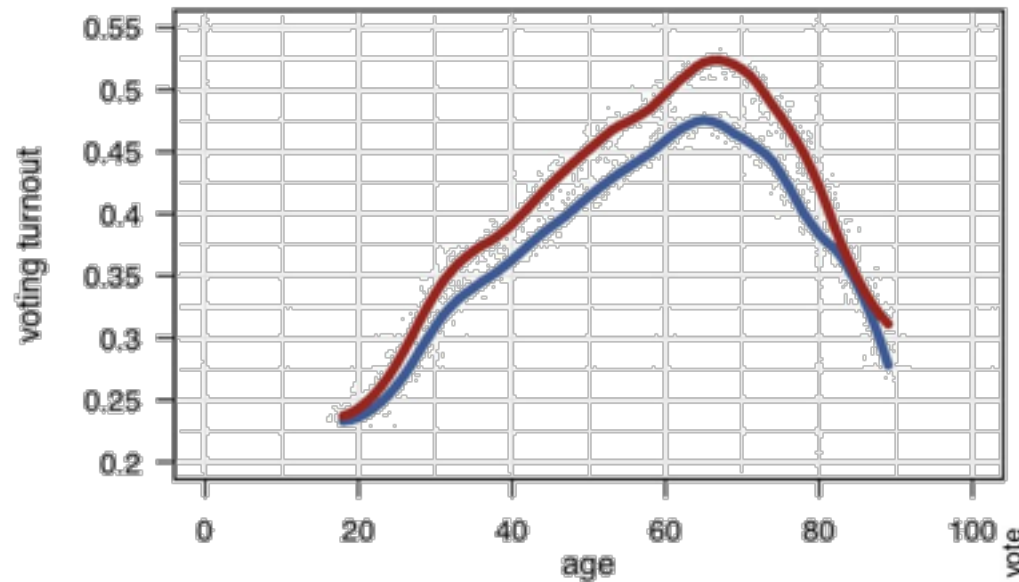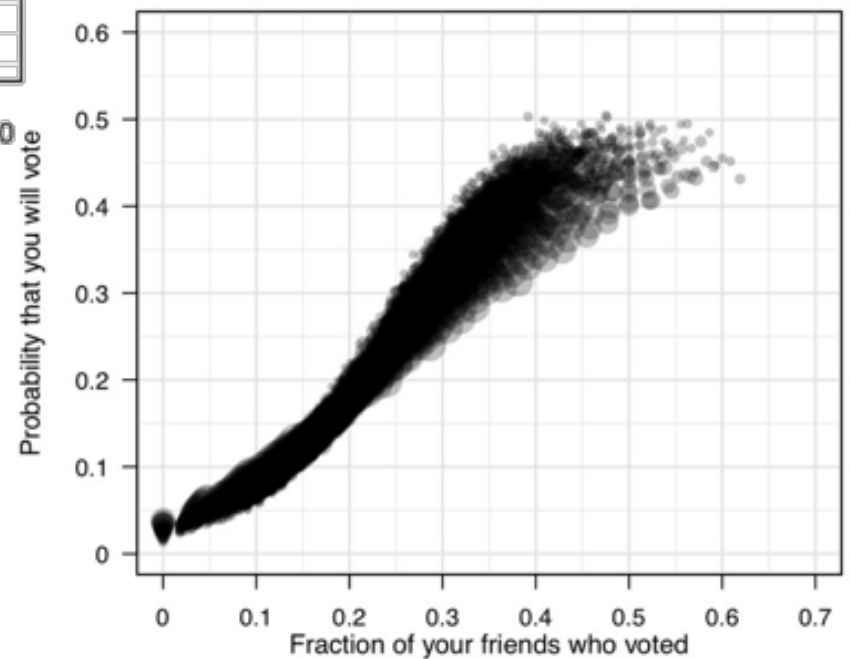
Quality of Data

- In the small:
  - Voicemail diaries
  - Interviews with participants throughout study
  - Ability to check logs with diaries for all participants
- In the large:
  - Lots of server logs
  - User comments/tweets/surveys
 - Maybe a few interviews over email/Skype with some users

Quality of Data: Benefits and Issues

- Benefits
  - Lots of usage data from real use in the world
  - Ability to create more realistic usage models
- Issues
  - Less contextual data about use
  - Lack of an understanding of why usage is the way it is
  - Hard to get random users interested in in-depth interviews or diary logging

Informed Consent: The "Other" Milgram Study

- Talked about "familiar strangers" last class
- More infamous experiment: "Experiment on obedience to authority figures"
- Learner answers questions asked by the Teacher (participant)
- When Learner gets an answer wrong, Experimenter tells Teacher to shock them
- Increasing levels of electric shock (simulated, but T doesn't know this)

http://en.wikipedia.org/wiki/File:Milgram_Experiment_v2.png
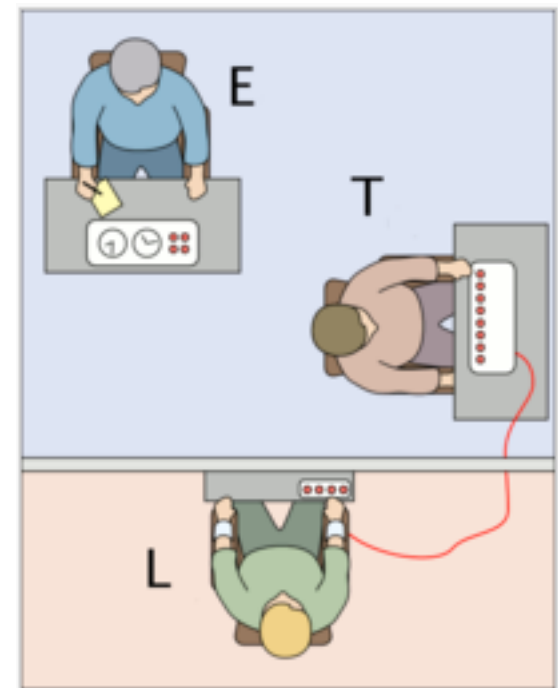
Milgram's effects on research ethics

- Large amount of stress put on participants
- They had no idea what they were getting into, possible risks

- Led to the creation of consent forms and Institutional Review Boards nationwide

Ethics: Informed Consent

- In the small:
  - IRB approval
  - Informed Consent form explaining purpose of research, benefits and risks, explicit consent for data collection and reuse
- In the large:
  - A EULA that no one reads
  - No ability to sit down and explain to users what they are getting into, answer questions, address concerns, etc.

EULAs

- Best to consult with a lawyer
- Important to make sure users understand what data you are collecting
- Protect yourself by making terms of the service clear
- Some 10+ pages of text

- Does anyone read them?
- Would knowing what they are doing prohibit installs? Good et al – YES!
  - Our study of 222 users showed that providing a short summary notice, in addition to the End User License Agreement (EULA), before the installation reduced the number of software installations significantly. We also found that providing the short summary notice after installation led to a significant number of uninstalls.

Example EULA - TuVista

PLEASE READ THESE TERMS OF USE CAREFULLY BEFORE USING THIS APPLICATION. IF YOU DO NOT AGREE TO THESE TERMS, PLEASE DO NOT USE THE APPLICATION.

INTENDED AUDIENCE/USE:
Motorola, Inc. ("Motorola") provides this Application to you, subject to these Terms of Use. This Application is intended for the lawful use of Motorola's customers, employees and members of the general public who are over the age of 13, and citizens of the United States or Canada.

ACCEPTANCE OF TERMS:
You acknowledge you have read, and agree to be bound by these Terms of Use and to comply with all applicable laws and regulations, including without limitation U.S. export and re-export control laws and regulations regarding the transmission of technical data exported from the United States or the country in which you reside. You further agree to comply with all local laws, regulations and rules regarding online conduct and acceptable Content. You represent you have the legal authority to accept these Terms of Use on behalf of yourself or any party you represent. IF YOU DO NOT AGREE TO THESE TERMS, PLEASE DO NOT USE THE APPLICATION.

RESTRICTIONS ON USE OF APPLICATION:
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Graphical EULAs:

- How to represent text in a way everyday people will understand, might actually look at

Figure 4. A diagram in the "interaction data collection" set, depicting the fact that keyboard activity is recorded. By using a single bar in the graph, most viewers correctly assume that individual keystrokes are not recorded.

Figure 5. Previously established conventions for data collection (the arrow and graph) are broken to display an example of data not collected (specific keys/text typed).

Matthew Kay and Michael Terry. 2010. Communicating software agreement content using narrative pictograms. In CHI '10 Extended Abstracts on Human Factors in Computing Systems (CHI EA '10). ACM, New York, NY, USA, 2715-2724. 6 http://doi.acm.org/10.1145/1753846.1753856

Ethics: Data collection

- In the small:
  - Data collection spelled out in Informed Consent
  - Anonymity of data / use in publications explained
- In the large:
  - Usage/content logged for all users
  - Different from Google/Facebook/other analytics companies?
  - No face-to-face opportunity to explain data collection procedures and ensure understanding

Ethics: Ending the "study"

- In the small:
  - Participants are recruited for an n-week study after which the system is taken away
  - Participants know what they are doing is evaluating a research prototype that is still in development
  - Participants are usually paid for their participation
- In the large:
  - System can be taken down at any time / often unexpectedly for users
  - Users may not understand the concept of a research application or know that they are using one
  - User data can disappear
  - Participants unpaid

Understanding use with large deployments

- Telefonica Research study
  - Surveys given to users in app or through email
    - High amount of random answers, need to filter them out
    - Even when filtered, averages not telling of general population
    - Need to scale respondent categories based on % of population
  - Same applies for usage data of apps
    - The mean is not the mean if different groups of people start adopting it!

Mixed Methods

- Large Deployments with Small Ethnographic Research
  - ZoneTag (Ames et al)
    - System deployed publicly on web (500+ users)
      - Self-selected early adopters
    - Small-scale ethnographic study
      - 13 users
- Large deployments get more statistically meaningful data about use
- Small qualitative studies help to understand use

Mixed Methods - Benefits

- Example:
  - Quantitative data showing that no one is using feature x
    - Why is this so? Not a useful feature? Hidden in the interface? Function not explained well? Benefits not explained well?
  - Ethnographic data can help to interpret this finding and understand the problem
- Opposite works as well, find data in small-scale study, use data from large deployment to confirm severity of problem

Your project

- Think about these methods as you design your study
- If possible, combine quantitative and qualitative methods to understand both the what and the why of use!

An example…

- Health Mashups
  - A service that finds significant patterns in your wellbeing over time
  - Deployed for 90 days with 60 participants
  - Large use of instrumentation and diaries/interviews

Health Mashups
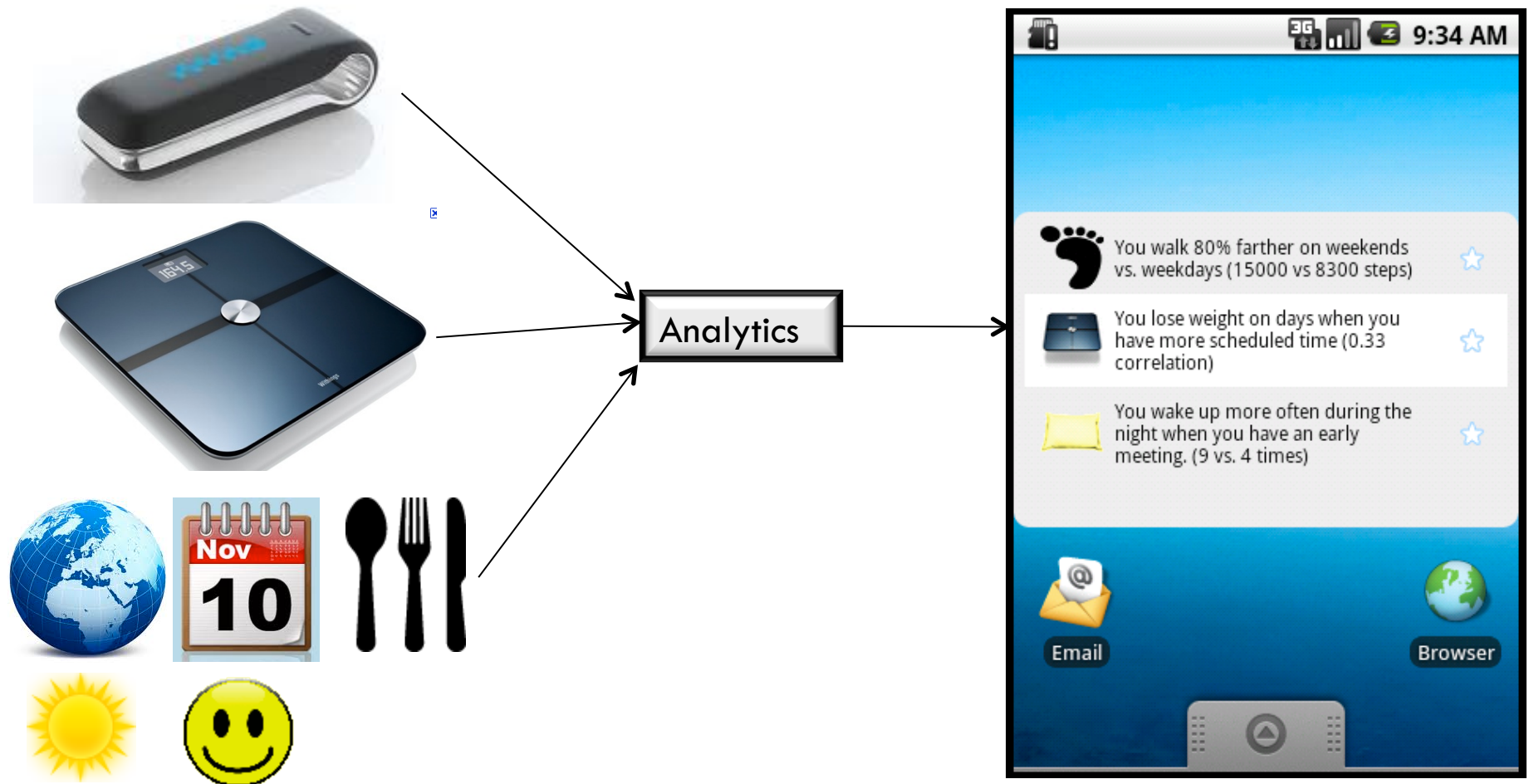
Frank Bentley, Konrad Tollmar, Peter Stephenson, Laura Levy, Brian Jones, Scott Robertson, Ed Price, Richard Catrambone, and Jeff Wilson. 2013. Health Mashups: Presenting Statistical Patterns between Wellbeing Data and Context in Natural Language to Promote Behavior Change. ACM Trans. Comput.-Hum. Interact. 20, 5, Article 30 (November 2013), 27 pages. http://doi.acm.org/10.1145/2503823 Used with Permission.

Analysis / Observations

- □ Deviations:
  - Specific Days of the Week (e.g. "You walk less on Wednesdays")
  - Weekend/Weekday (e.g. "You gain weight on the weekends")
  - Specific Days (e.g. "Yesterday you ate significantly more than normal")
  - Weeks or Months (e.g. "Last week you walked significantly less than normal")
- □ Correlations:
  - Daily between sensors (e.g. "You are happier when you sleep longer")
  - Weekly between sensors (e.g. "On weeks when you sleep more, you lose more weight.)

Mobile Interface

☐ Mobile Interface for self-logging and viewing

Frank Bentley, Konrad Tollmar, Peter Stephenson, Laura Levy, Brian Jones, Scott Robertson, Ed Price, Richard Catrambone, and Jeff Wilson. 2013. Health Mashups: Presenting Statistical Patterns between Wellbeing Data and Context in Natural Language to Promote Behavior Change. ACM Trans. Comput.-Hum. Interact. 20, 5, Article 30 (November 2013), 27 pages. http://doi.acm.org/10.1145/2503823 Used with Permission.

Research Questions

- Do the reminders provide enough increased engagement to collect enough data to make significant observations?

- Do observations stay significant over time with this increased data?

- How do people use the observations in their daily life? Positive behavior changes? Weight, Mood, Step Count, etc.?

- Will people continually engage with the service over time?

Humana Study

- 60 participants using the system for 90 days
  - 40 in Atlanta
  - 20 in Chicago

- Diversity of ages, occupations, education levels, health conditions

- Participants given fitbit and wifi scale for participating, no incentives to use application, told to use it as if they just downloaded it from the market.

- Pre-study interview and device set-up in home
- Online questionnaire during 3rd week (with open ended questions about use and usefulness of specific observations)
- Final online questionnaire and phone interview after 90 days

Instrumentation

The data we logged…

- Usage data logged
  - Every click in the mobile application
  - Logged userid, timestamp, additional details (e.g. sensor being viewed)

- Server database
  - Every value logged by every user over the 90 days
  - Every observation calculated for each user, statistical details, and the dates for which it was valid

Quantitative findings

- There is a very high level of user engagement with the app:
  - Average of 6.5 interactions/day (view a graph, latest observations, manual logging, etc.)
  - Users have browsed 791 graphs (13 times per user)
  - Users are logging food about 60% of the time (much higher than in similar systems and for quite a long duration - 3 months)
  - Users are logging mood 63% of the time
  - Highest user engagement Humana has seen with a general wellbeing app

- Changes in Wellbeing:
  - 36/60 users lost weight, averaging 5.3 pounds
  - WHO-5 wellbeing scores significantly increased over study ($t(55) = 3.29$, $p < 0.003$)

Overall Engagement
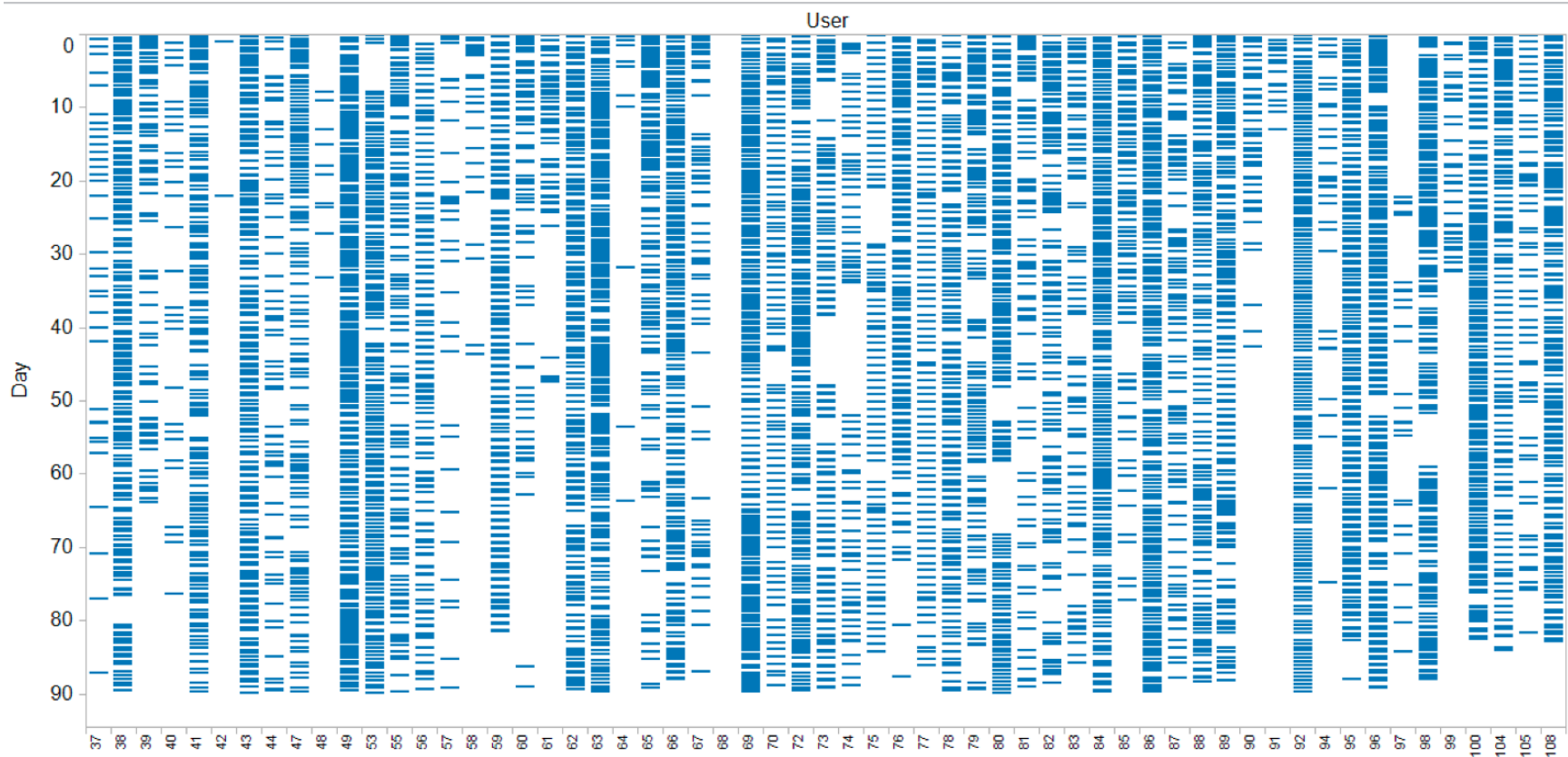
Frank Bentley, Konrad Tollmar, Peter Stephenson, Laura Levy, Brian Jones, Scott Robertson, Ed Price, Richard Catrambone, and Jeff Wilson. 2013. Health Mashups: Presenting Statistical Patterns between Wellbeing Data and Context in Natural Language to Promote Behavior Change. ACM Trans. Comput.-Hum. Interact. 20, 5, Article 30 (November 2013), 27 pages. http://doi.acm.org/10.1145/2503823 Used with Permission.
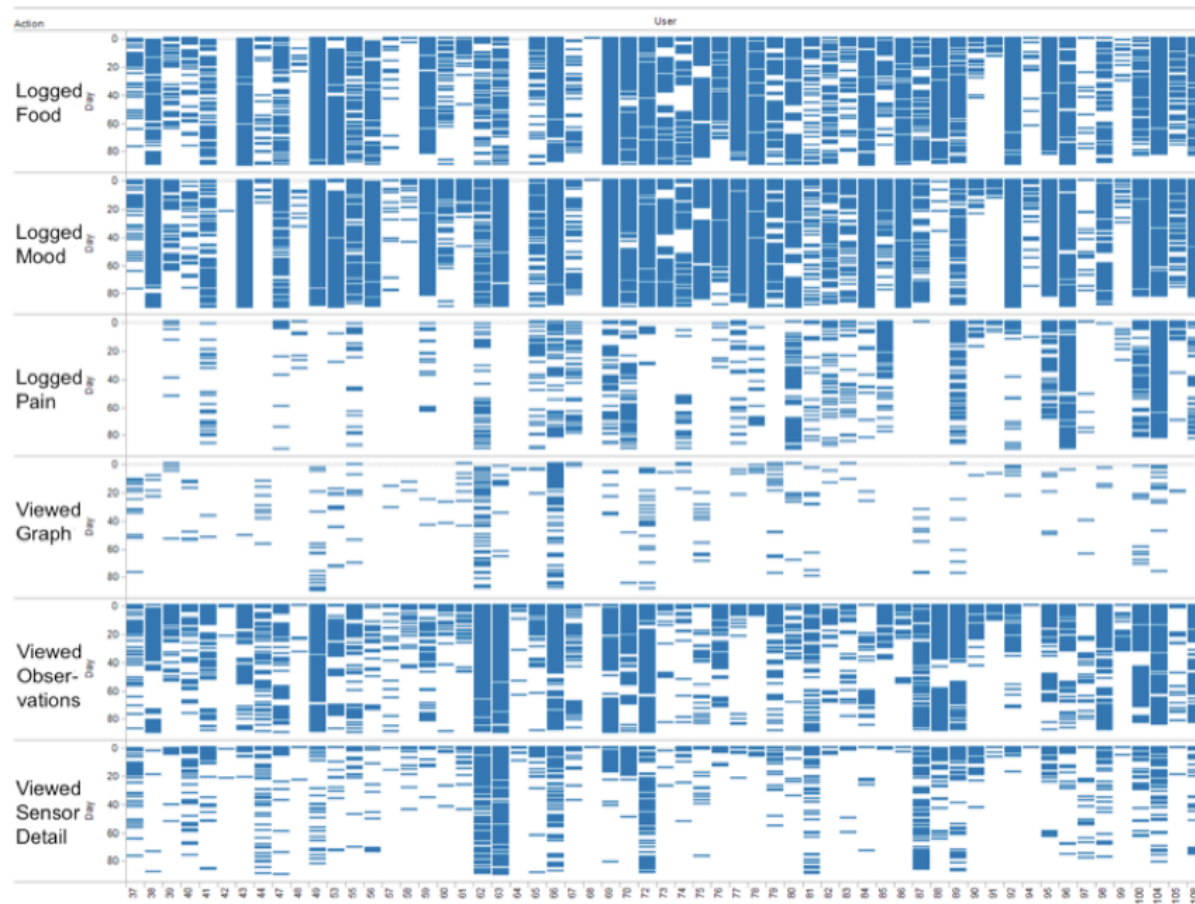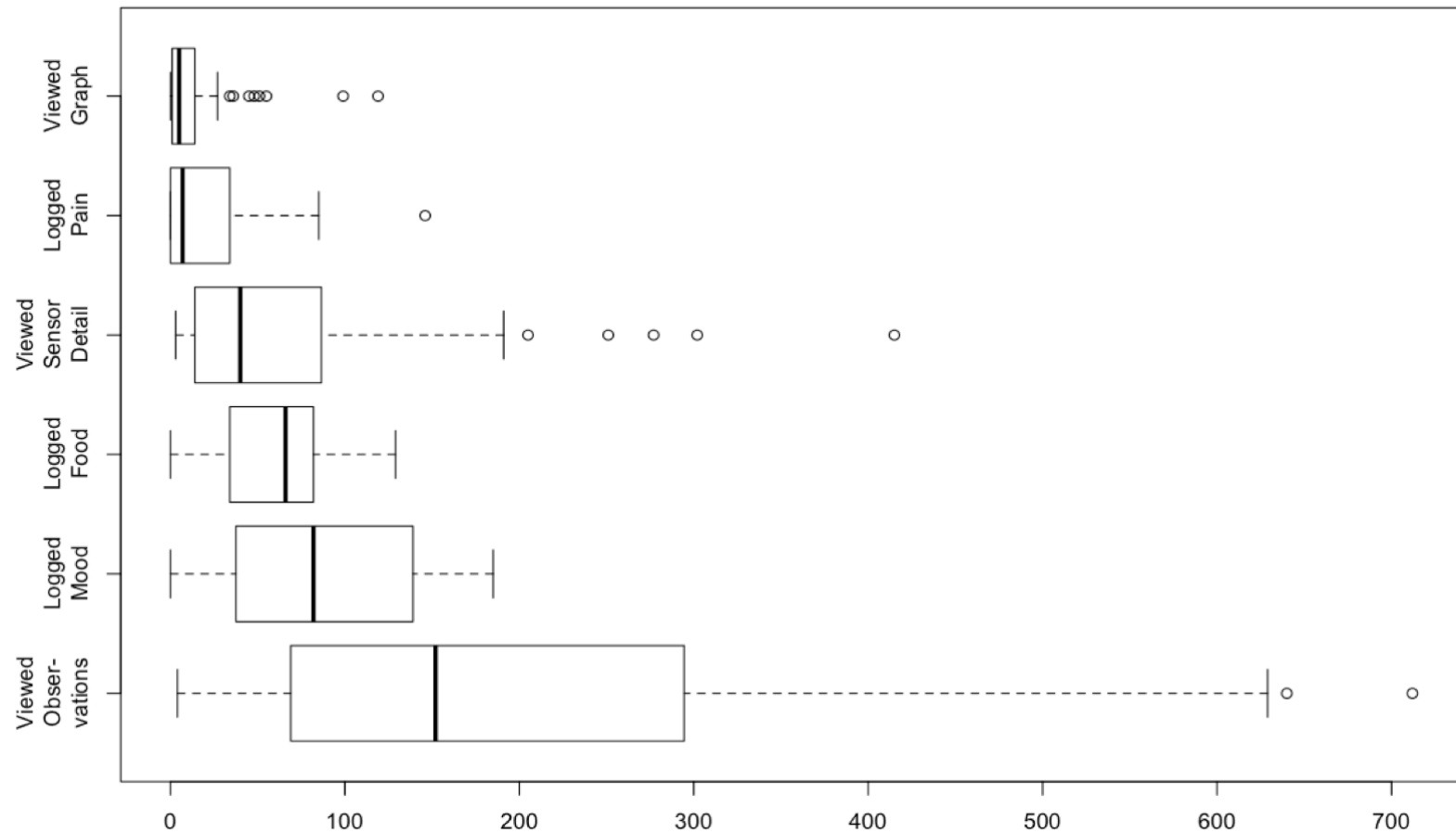
Another Look at Overall Engagement
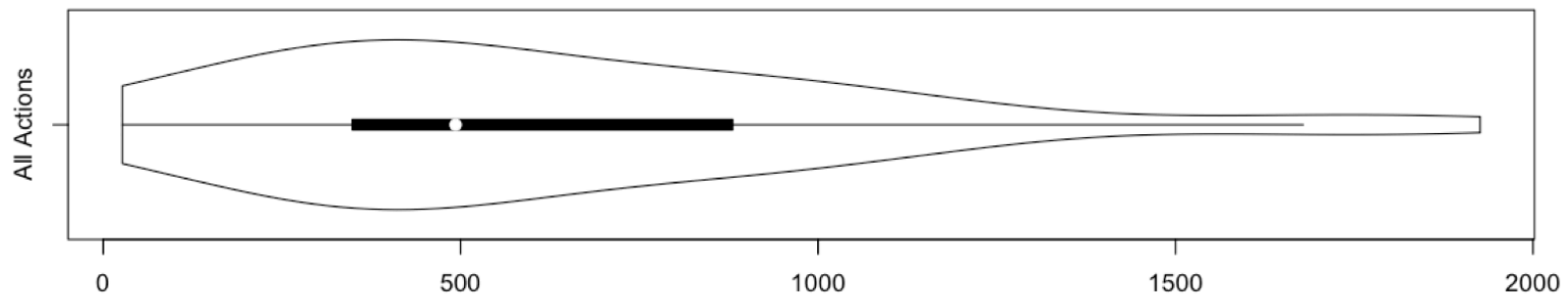
Feature Usage

Figure 6: Usage of each feature of the mobile application
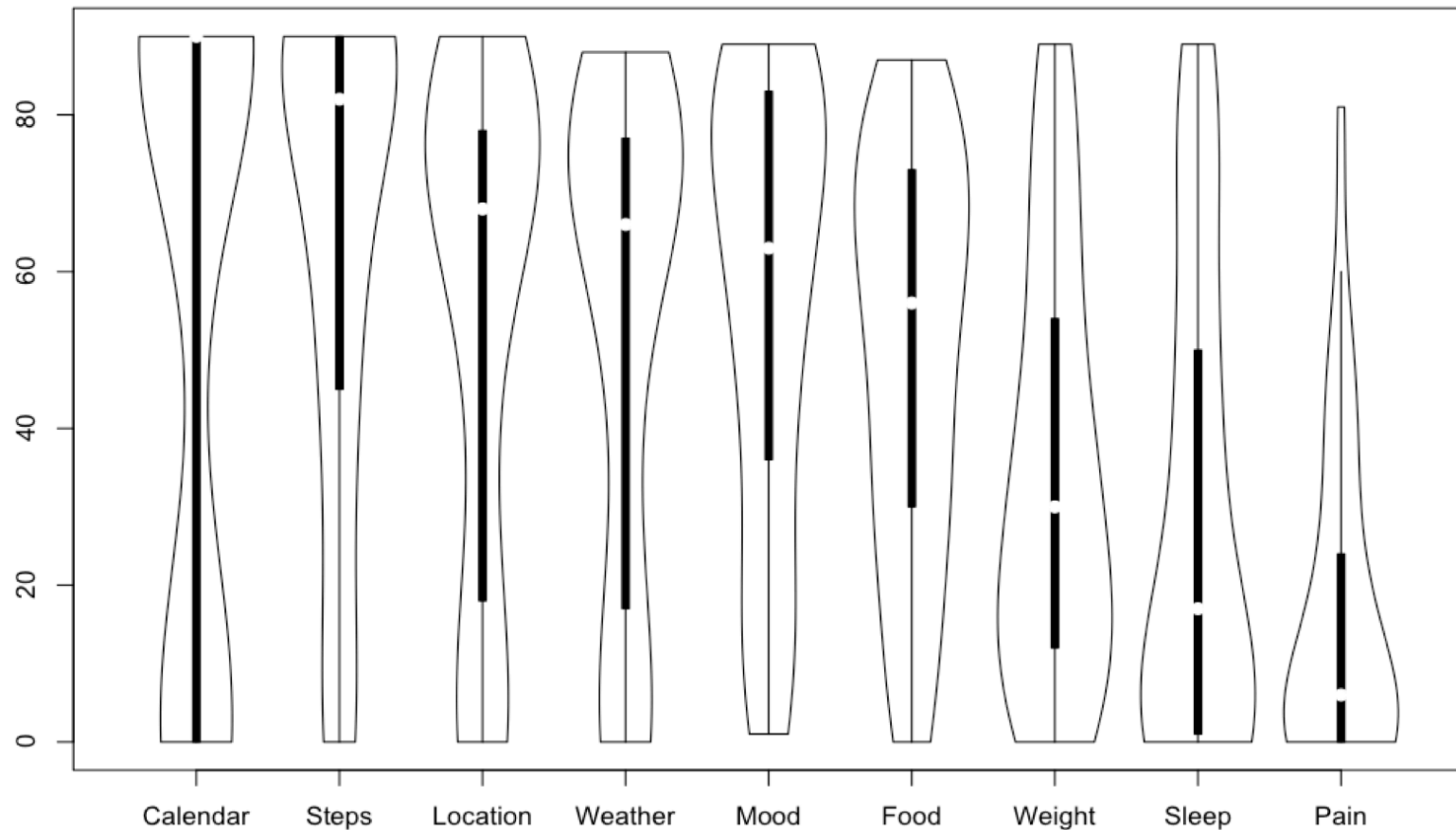
Another look at use by feature:

Frank Bentley, Konrad Tollmar, Peter Stephenson, Laura Levy, Brian Jones, Scott Robertson, Ed Price, Richard Catrambone, and Jeff Wilson. 2013. Health Mashups: Presenting Statistical Patterns between Wellbeing Data and Context in Natural Language to Promote Behavior Change. ACM Trans. Comput.-Hum. Interact. 20, 5, Article 30 (November 2013), 27 pages. http://doi.acm.org/10.1145/2503823 Used with Permission.

Usage High Across All Days of Week
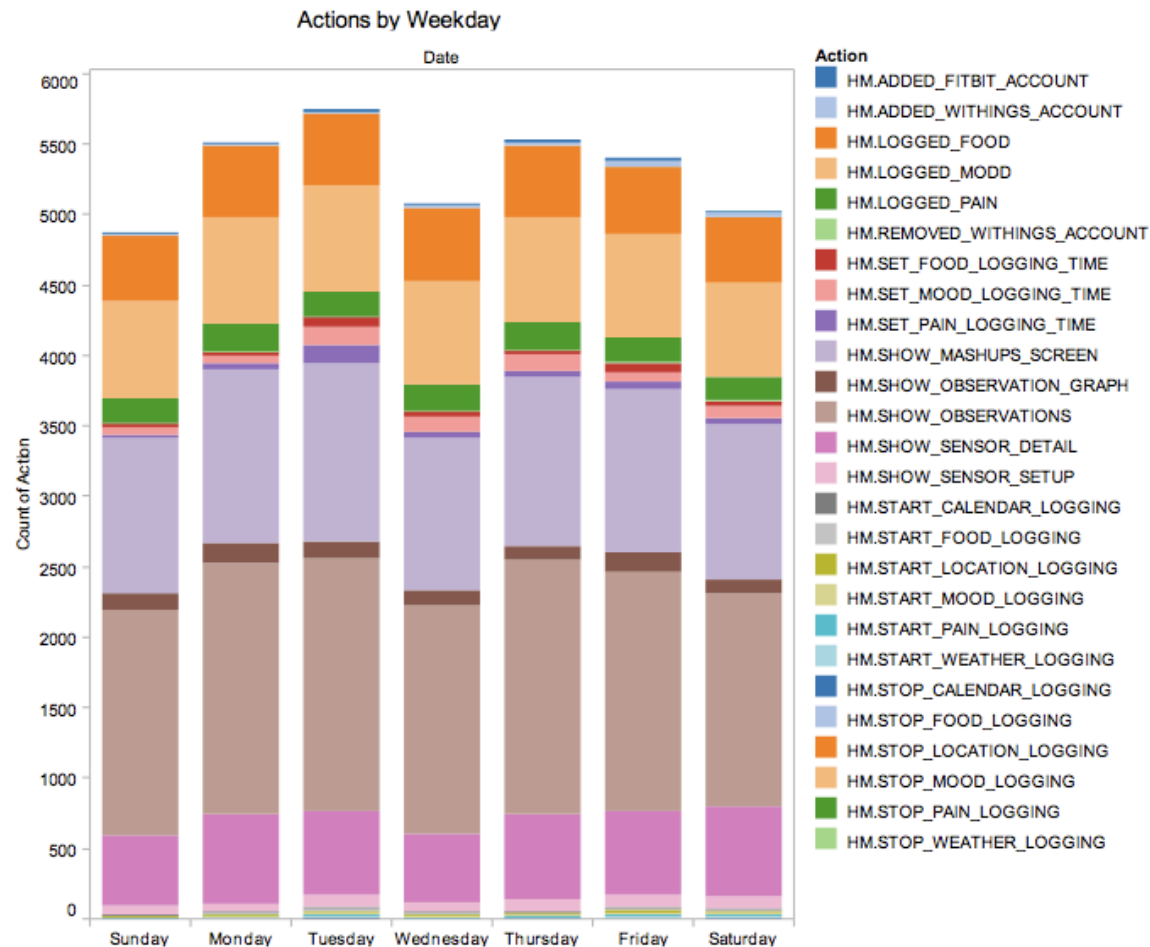
Actions by Weekday

Data Provided to System

Data Type	Average Days Logged	Stdev.
Calendar	78	25
Steps	67	29
Location	66	21
Weather	64	21
Mood	55	29
Food	50	25
Weight	35	27
Sleep	34	30
Pain	25	21

Frank Bentley, Konrad Tollmar, Peter Stephenson, Laura Levy, Brian Jones, Scott Robertson, Ed Price, Richard Catrambone, and Jeff Wilson. 2013. Health Mashups: Presenting Statistical Patterns between Wellbeing Data and Context in Natural Language to Promote Behavior Change. ACM Trans. Comput.-Hum. Interact. 20, 5, Article 30 (November 2013), 27 pages. http://doi.acm.org/10.1145/2503823 Used with Permission.

Deeper look at data provided to the system:

Data for Correlations

	Food	Mood	Pain	Steps	Weight	Sleep	Calendar	Location
Mood	45.5							
Pain	14.1	15.7						
Steps	37.9	41.2	13.8					
Weight	21.3	24.3	7.7	27.4				
Sleep	19.3	20.7	9.5	29.4	15.0			
Calendar	27.6	30.6	9.9	34.3	15.6	17.3		
Location	50.4	36.6	10.3	35.1	19.9	16.9	34.1	
Weather	32.2	35.7	9.9	33.8	19.3	16.2	32.9	64.5

Table 3: Average number of data points per user between sensors. These numbers represent the average number of days when a user logged both the sensor from the row and column of each entry on the same day, thus creating a data point for the correlation.
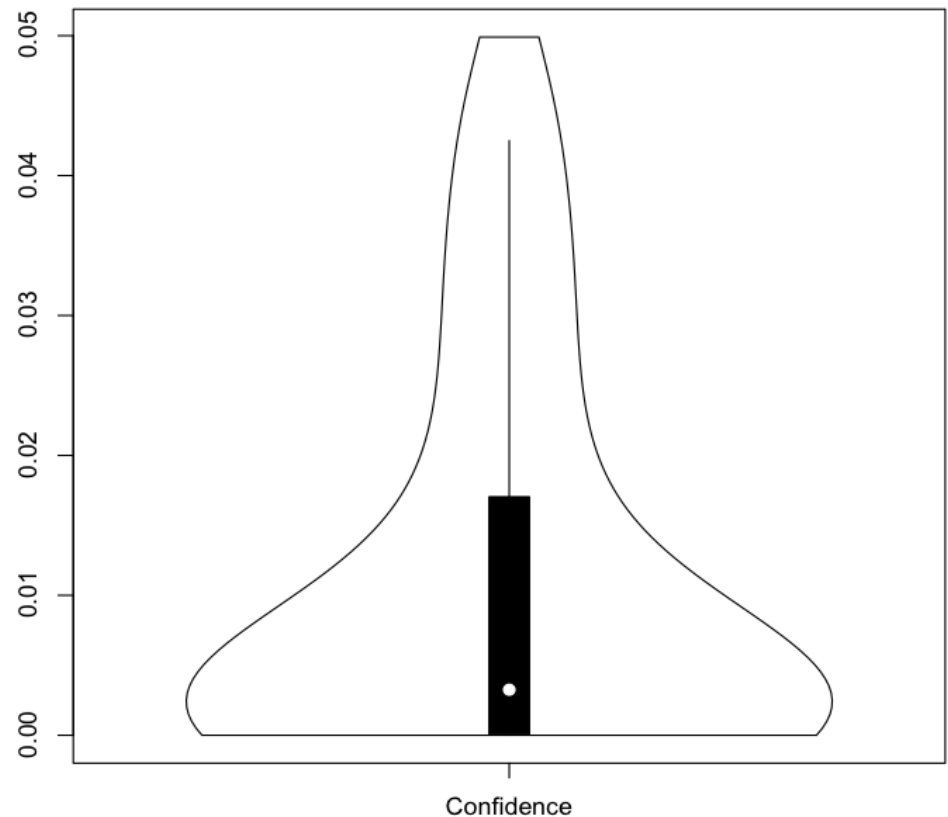
Individually Unique Correlations

☐ Strong individual differences demonstrate need for personal solution:
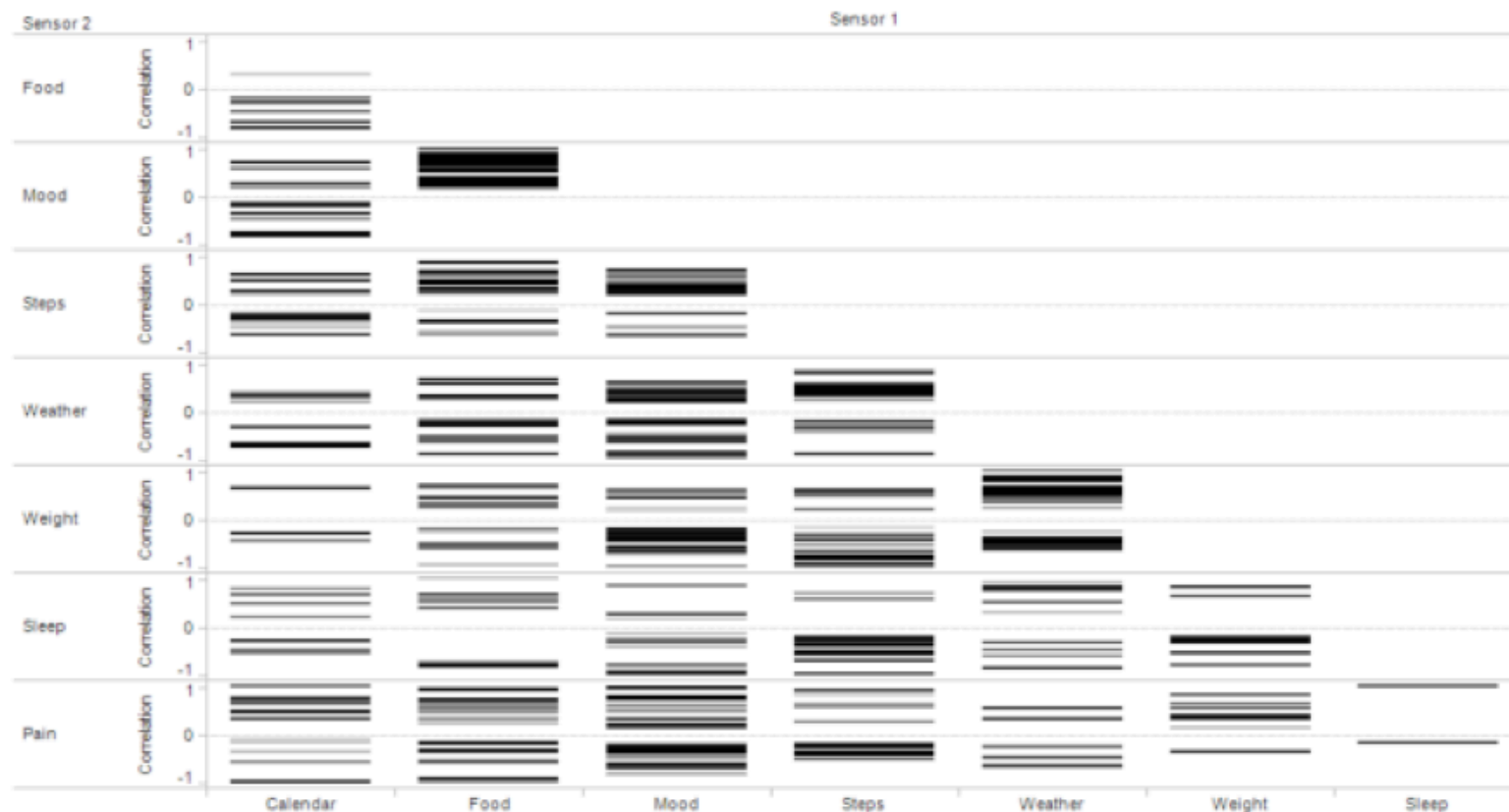
Frank Bentley, Konrad Tollmar, Peter Stephenson, Laura Levy, Brian Jones, Scott Robertson, Ed Price, Richard Catrambone, and Jeff Wilson. 2013. Health Mashups: Presenting Statistical Patterns between Wellbeing Data and Context in Natural Language to Promote Behavior Change. ACM Trans. Comput.-Hum. Interact. 20, 5, Article 30 (November 2013), 27 pages. http://doi.acm.org/10.1145/2503823 Used with Permission.

Significance of observations…

- Average observation stayed significant for 21 days!

- Confidence was quite strong for most correlation-based observations!

Frank Bentley, Konrad Tollmar, Peter Stephenson, Laura Levy, Brian Jones, Scott Robertson, Ed Price, Richard Catrambone, and Jeff Wilson. 2013. Health Mashups: Presenting Statistical Patterns between Wellbeing Data and Context in Natural Language to Promote Behavior Change. ACM Trans. Comput.-Hum. Interact. 20, 5, Article 30 (November 2013), 27 pages. http://doi.acm.org/10.1145/2503823. Used with Permission.

Qualitative Data Analysis

- 60 users, pre-study interview, 3 week open ended questionnaire, final interviews

- LOTS of qualitative data: 1850 notes

- Used standard affinity methods to analyze data at

Frank Bentley. Used With Permission

Building Awareness of Self

- A2: "I was able to see that on the days I slept less I was less happy and less motivated. I need sleep in order to function and live a healthier life."

- A37: "The info on when I walk more I'm in less pain really helped with my back. Made me realize I should exercise more and it dramatically helps with my pain levels."

- A8 saw that she was happier on days when she ate more. She described that to us as "one of the most *mind blowing* things" because she "had never really associated both so closely or paid attention to them before."

- A2: "I was able to see that on the days I slept less I was less happy and less motivated." This made her realize that "I need sleep in order to function and live a healthier life."

- A20: "I do find [the observations] useful because it reminds me what my workout habits and eating habits really are like instead of me guessing. Takes a lot of guesswork out and actually makes me reflect on my day."

Making Targeted Behavior Change

- C20: "looking at the summary showed me that I am happier, but eating more on the weekends and therefore weighing more come Monday morning. This showed me that if I really want to lose weight, I need to be focusing on my eating habits on the weekends."

- A30: "I learned that I should walk more and eat lighter meals to avoid sleeping longer."

- A24 saw the observation that "I am happier when I walk more and I am less tired." To her, "this was a great reminder that sacrificing sleep and exercise will not help anything I am trying to do or accomplish."

- C19: "I am a grad student who is overwhelmed and [the observations] helped to reflect on my life. They allowed me to take inventory and think about what I should change."

Main Findings

- Presenting significant long-term trends in wellbeing data via natural language allows for easy comprehension across educational background

- Seeing feed items leads to increased introspection which then can drive FOCUSED behavior change

- Our context affects our wellbeing in very individually dependent ways

- Simple, silent notifications can encourage people to manually log data at their convenience, while not feeling interrupted

stop and learn from the world

- Field studies are the best way to learn about use in context
- You don't have to wait for a final system to take something in the field
- The earlier you get data, the easier it is to change course

Where can you go from here?

- Research Topics
  - Mobile Human Computer Interaction
  - Wearables
  - Location-Based Services
  - Mobile Social Media
  - Persuasive Computing
  - Mobile Health

Where can you go from here?

- HCI @ MIT
  - 21w.785: Ed's Communicating with Web-Based Media
  - 6.813/6.831: User Interface Design and Implementation
  - 6.089 Interactive Technology Design (IAP seminar)
  - Various Media Lab Grad-level Seminar Classes (Social TV, Tangible Interfaces, New Textiles, etc.)
- Masters/PhD Programs
  - CMU HCII
  - Stanford's d.school
  - Berkeley's School of Information
  - Georgia Tech GVU
  - UW "dub"
  - UC Irvine
  - Royal College of Art
  - University of Zurich ZPAC

Where can you publish?

- CHI (Largest HCI Conference) (H-index 69)

- ACM Multimedia (H-index 42)

- Ubicomp (H-index 33)

- CSCW (Computer Supported Cooperative Work) (H-index 30)

- Mobile HCI (H-index 24)

- DIS (Designing Interactive Systems) (H-index 16)

Where can you go from here?

- Careers
  - User Experience Design
    - Corporate environments designing interactions and screens for new applications/services
  - Corporate Research
    - Defining new service opportunities for companies, continuing academic focus on publishing, rigorous studies
  - Startups
    - Always in need of developers who can also design and appreciate the entire user experience
    - Start your own based on ideas from this class
 - Academic Research
    - PhD, post-doc, faculty

Next steps…

- Get your applications to a point where they can be tested (by Poster Session)

- Speak to target population and get them the app / study instructions by Friday April 11

- Or post app in Google Play / Apple App Store!

- Gather data until final presentations / improve app

- For final paper, include analysis of use (preferably both quantitatively and qualitatively!)

Poster and Demo Session

□ Similar to how you would present "work in progress" at a major conference

□ Working demo of your app (make sure you think about how to reset it between demos!)

□ Poster describing your research and how you got to where you are today
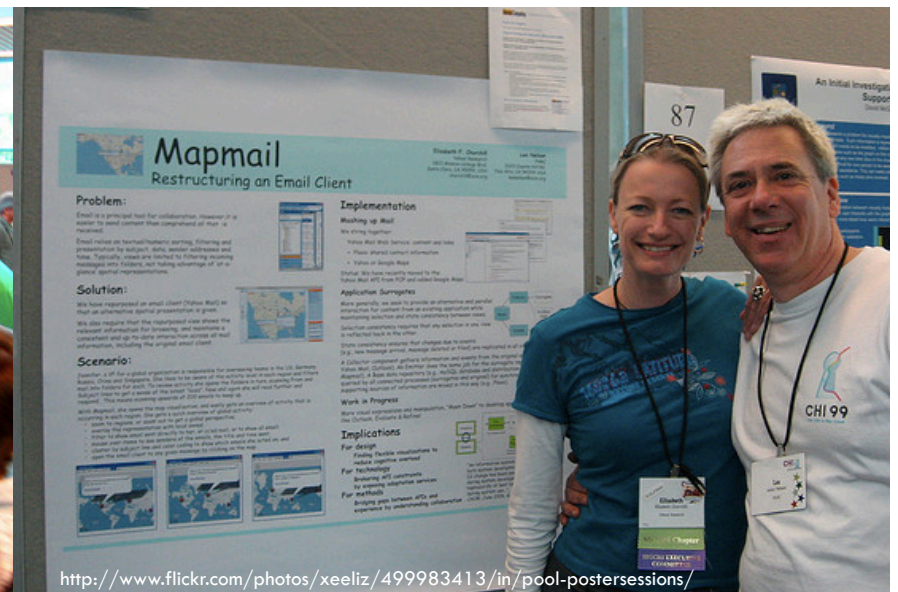
Poster Example

Serendipitous Family Stories:
Using findings from a study on family communication to share family history

Frank Bentley and Sujoy Kumar Chowdhury - Motorola Mobility Applied Research

THE CONCEPT

This project aims to increase the sharing of family history about places and open up new opportunities to communicate with family members who live at a distance. Stories can be recorded on the web and artifacts can be placed in front of the camera to tell the story, much like telling a story in person. Family members receive notifications of nearby stories as they live their lives and travel near these locations. Light-weight communication is enabled back to the story creator from the mobile device.

THE INSPIRATION

A study on communication between generations across distance demonstrated the importance of storytelling when family gets together. These stories of past history were less common over a distance. One participant in our study happened to be walking past a theater where her grandfather used to dance and commented on this to her mom creating a connection across three generations. We aim to create these types of experiences serendipitously as people go about their lives and highlight places with family importance in daily life.

UBICOMP "FAMILY" STORIES

For this conference, we are collecting stories from past conferences which can be shared with others using this system.

* Please visit http://stories.motlabs.com/s/ from a Windows computer (sorry, we are still having issues with Mac video capture) and leave a story of a past conference for others in the community to explore.
* Add +18475551234 as a friend to share with others
* Download the mobile phone software or try one of our phones to see the stories that others have shared. Clicking on "Set Location" in the options menu will let you virtually travel to locations of past conferences.

CREATE
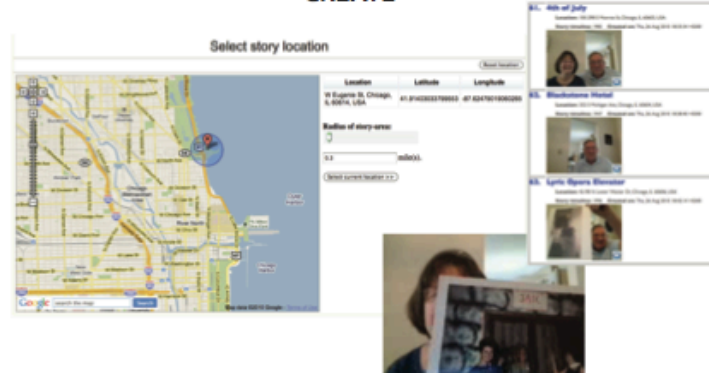
VIEW

1) Create a story in a location and share with family members.

2) Record video for the story. Show artifacts as if you were telling it in person.

3) Family members come near the location of a story and are notified that there is a story nearby

4) Family members can unlock stories and watch the videos telling the story of that place. They can call you or "like" the story.

In Sections

- How will you test your apps?
  - Who would you want to use it?
  - For how long? Where?
  - What methods would you use to collect data?
    - Diary Logging
    - Instrumentation
    - Contextual Inquiry
    - Experience Sampling
    - Interviews
- Briefly present results of location/networking assignments and overall plan for fielding your app