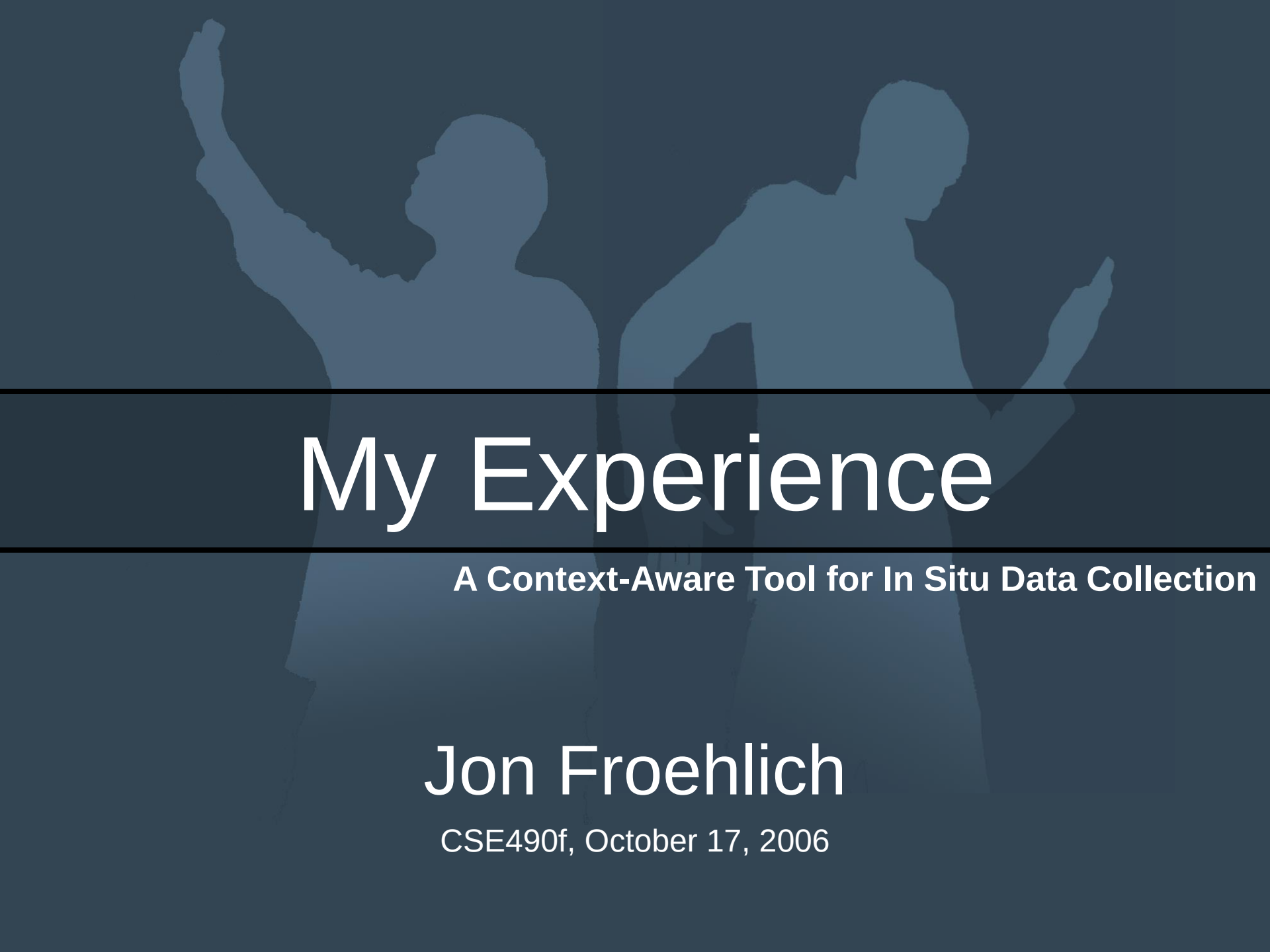


My Experience

A Context-Aware Tool for In Situ Data Collection

Jon Froehlich

CSE490f, October 17, 2006

Challenge

- Naturalistic data collection is
  - time-consuming,
  - costly,
  - resource intensive
- Desktop-based studies often in controlled usability labs
  - Context/environment not typically an issue

Goal Today

- Introduce *In Situ* Self-Report Methods
  - Convince you that they are useful!
    - Studying human behavior
    - Validating, assessing, building UbiComp apps
- Introduce our new tool
  - The *My Experience (Me)* Tool
  - Context-aware self-report app for mobile devices
- Go over some XML
- Questions/Answers

In Situ (“in place”)

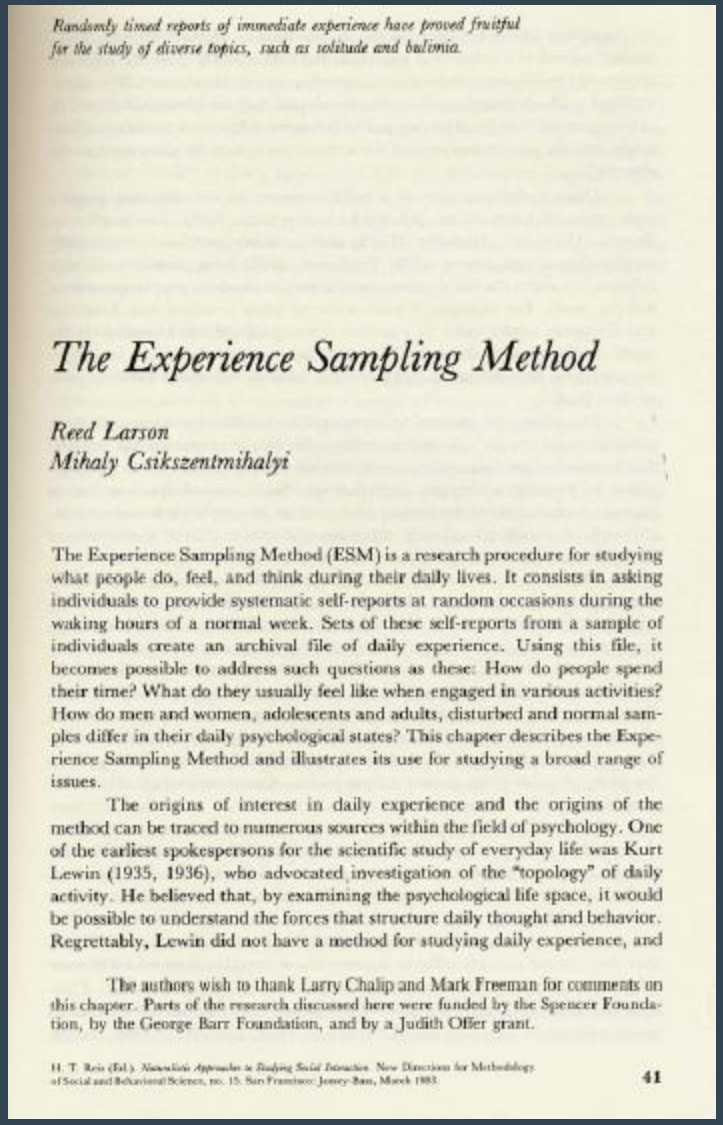
- Studying people in naturalistic settings:
  - Direct observation
  - Indirect observation
  - Diary method
  - Experience Sampling Method (ESM)

ESM

The Experience Sampling Method

History

- Larson / Csikszentmihalyi [1983]
  - Procedure for studying what people
    - Do
    - Think
    - Feel
  - Asking individuals to provide systematic self-reports
    - Random occasions
    - During waking hours



Randomly timed reports of immediate experience have proved fruitful for the study of diverse topics, such as solitude and bulimia.

The Experience Sampling Method

Reed Larson
Mihaly Csikszentmihalyi

The Experience Sampling Method (ESM) is a research procedure for studying what people do, feel, and think during their daily lives. It consists in asking individuals to provide systematic self-reports at random occasions during the waking hours of a normal week. Sets of these self-reports from a sample of individuals create an archival file of daily experience. Using this file, it becomes possible to address such questions as these: How do people spend their time? What do they usually feel like when engaged in various activities? How do men and women, adolescents and adults, disturbed and normal samples differ in their daily psychological states? This chapter describes the Experience Sampling Method and illustrates its use for studying a broad range of issues.

The origins of interest in daily experience and the origins of the method can be traced to numerous sources within the field of psychology. One of the earliest spokespersons for the scientific study of everyday life was Kurt Lewin (1935, 1936), who advocated investigation of the "topology" of daily activity. He believed that, by examining the psychological life space, it would be possible to understand the forces that structure daily thought and behavior. Regrettably, Lewin did not have a method for studying daily experience, and

The authors wish to thank Larry Chalip and Mark Freeman for comments on this chapter. Parts of the research discussed here were funded by the Spencer Foundation, by the George Barr Foundation, and by a Judith Offer grant.

H. T. Reis (Ed.). *Naturalistic Approaches to Studying Social Interaction*. New Directions for Methodology of Social and Behavioral Science, no. 15. San Francisco: Jossey-Bass, March 1983.

Primary Sampling Technique

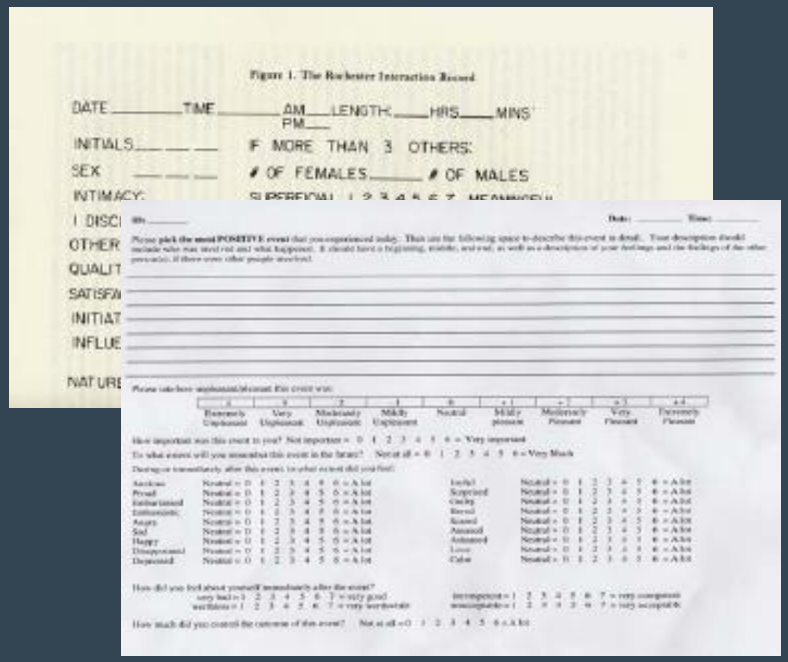


Figure 1. The Rochester Interaction Record

DATE _____ TIME _____ AM ___ PM ___ LENGTH: ___ HRS ___ MINS

INITIALS ___ ___ ___ IF MORE THAN 3 OTHERS:

SEX ___ ___ ___ # OF FEMALES _____ # OF MALES

INTIMACY:

I DISC

OTHER

QUALIT

SATISFA

INITIAT

INFLUE

NATURE

Please pick the most POSITIVE event that you experienced today. Then use the following space to describe this event in detail. Your description should include what was involved and what happened. It should have a beginning, middle, and end, as well as a description of your feelings and the feelings of the other person(s). If there were other people involved.

Please rate how unpleasant/pleasant this event was:

-3	-2	-1	0	+1	+2	+3
Extremely Unpleasant	Very Unpleasant	Moderately Unpleasant	Mildly Unpleasant	Neutral	Mildly pleasant	Moderately Pleasant	Very Pleasant	Extremely Pleasant

How important was this event to you? Not important = 0 1 2 3 4 5 6 = Very important

To what extent will you remember this event in the future? Not at all = 0 1 2 3 4 5 6 = Very Much

During or immediately after this event, to what extent did you feel:

Anxious	Neutral = 0 1 2 3 4 5 6 = A lot	Joyful	Neutral = 0 1 2 3 4 5 6 = A lot
Proud	Neutral = 0 1 2 3 4 5 6 = A lot	Surprised	Neutral = 0 1 2 3 4 5 6 = A lot
Embarrassed	Neutral = 0 1 2 3 4 5 6 = A lot	Guilty	Neutral = 0 1 2 3 4 5 6 = A lot
Enthusiastic	Neutral = 0 1 2 3 4 5 6 = A lot	Bored	Neutral = 0 1 2 3 4 5 6 = A lot
Angry	Neutral = 0 1 2 3 4 5 6 = A lot	Scared	Neutral = 0 1 2 3 4 5 6 = A lot
Sad	Neutral = 0 1 2 3 4 5 6 = A lot	Amused	Neutral = 0 1 2 3 4 5 6 = A lot
Happy	Neutral = 0 1 2 3 4 5 6 = A lot	Ashamed	Neutral = 0 1 2 3 4 5 6 = A lot
Disappointed	Neutral = 0 1 2 3 4 5 6 = A lot	Love	Neutral = 0 1 2 3 4 5 6 = A lot
Depressed	Neutral = 0 1 2 3 4 5 6 = A lot	Calm	Neutral = 0 1 2 3 4 5 6 = A lot

How did you feel about yourself immediately after the event?

very bad = 1 2 3 4 5 6 7 = very good incompetent = 1 2 3 4 5 6 7 = very competent

worthless = 1 2 3 4 5 6 7 = very worthwhile unacceptable = 1 2 3 4 5 6 7 = very acceptable

How much did you control the outcome of this event? Not at all = 0 1 2 3 4 5 6 = A lot

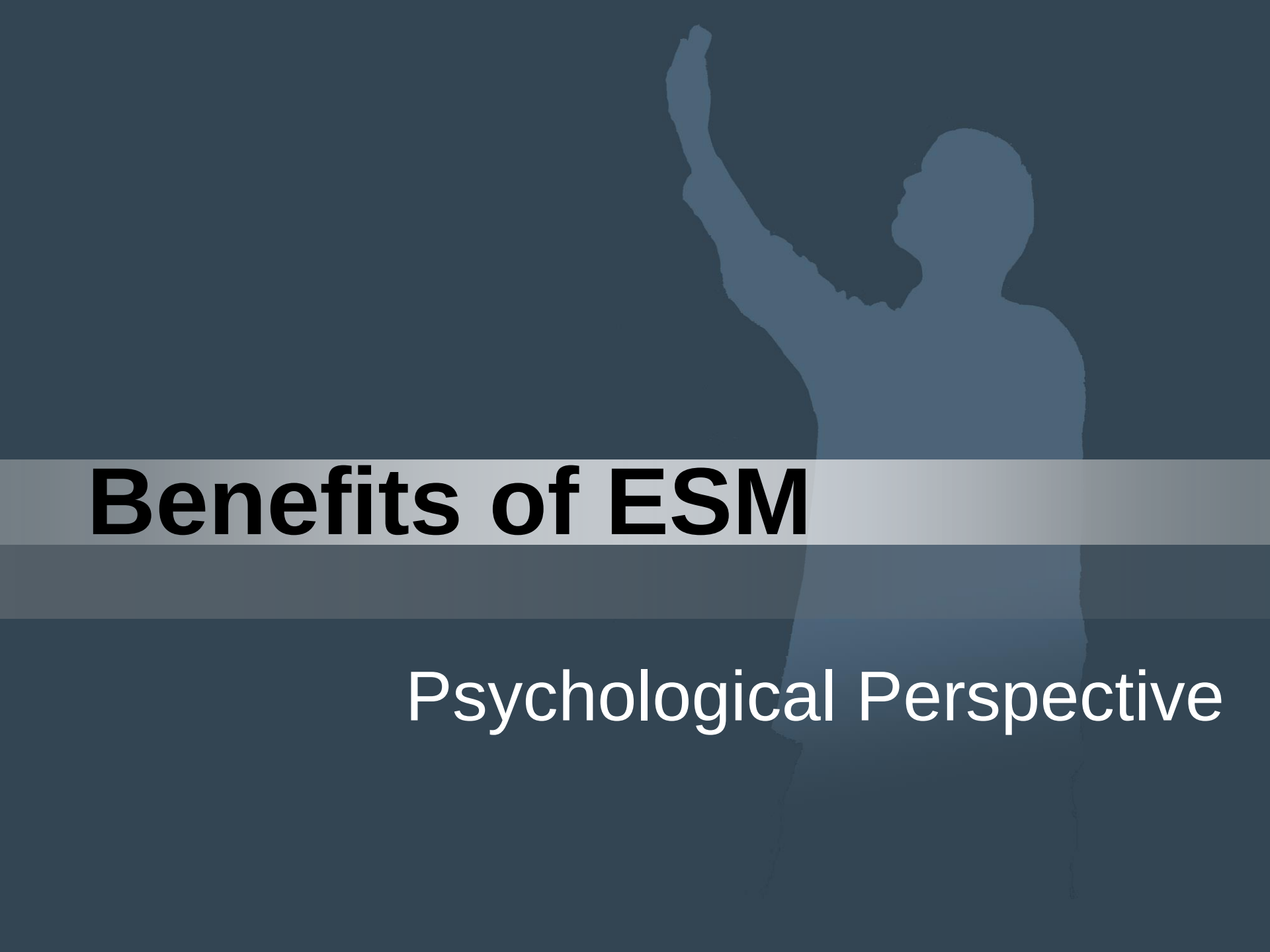
+

(Random Beeps)

Called “signal-contingent” sampling...

Other Sampling

- Interval-contingent sampling
  - Sample on experiences at fixed times
  - Good for time series data
  - Typically less burdensome to subjects
    - They begin to expect prompts
- Event-Contingent sampling
  - Report on experiences based on event of interest
  - Subject must be “cognitively-engaged” into own actions

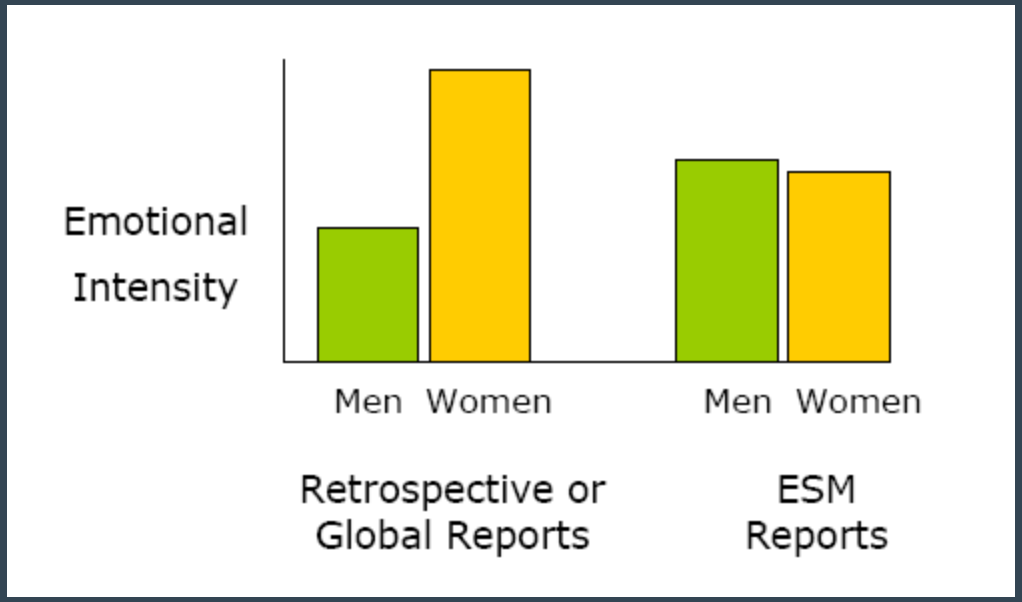


Benefits of ESM

Psychological Perspective

Immediacy

- Reduce recall memory bias
  - Important for qualitative data [Barrett 1998]
    - Difficult to remember mood, feeling, thoughts of particular events retrospectively



Multiple Assessments

- Multiple assessments over time allows for studying within-person processes [Conner 2004]
  - Time-series data
  - Observe patterns
  - Look for correlations between elements
    - Medication taken
    - Perceived pain
  - Calibrate responses per subject

Natural Setting

- Naturalistic data collection method
  - Outside the lab
    - "Ecologically valid"
  - Studying behaviors in real-life situations…

Studies

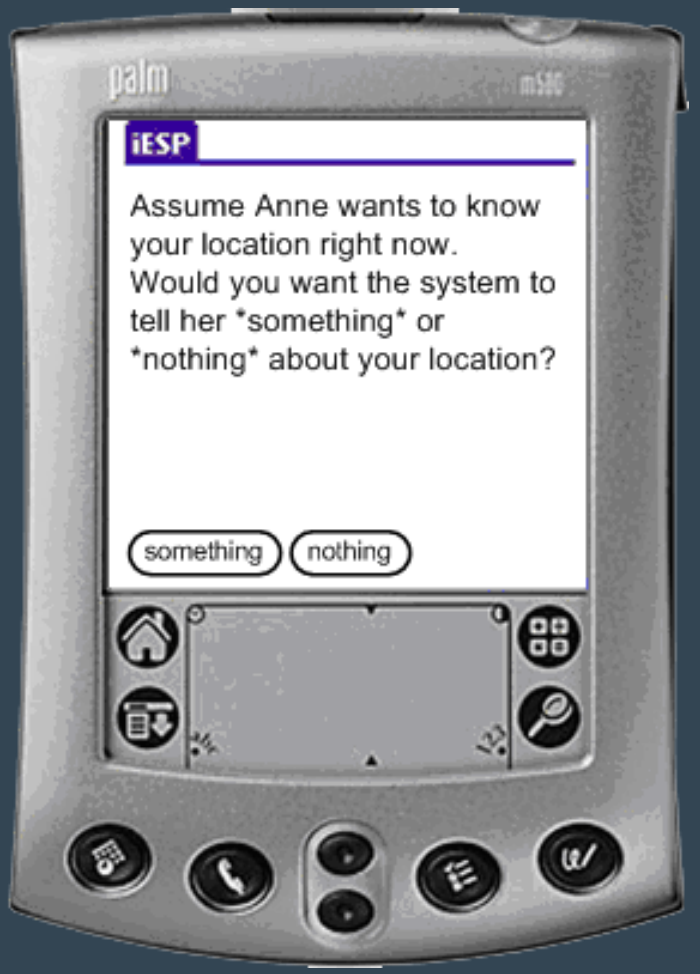
- Psychology/Medical Sciences*
  - Smoking, Asthma, Pain
  - Alcoholism/binge drinking; migraine headaches, eating disorders
  - Self-esteem, depression coping, flow
  - Many more…

* List lifted from Conner 2004


ESM Modernized

Computerized ESM

- Advantages
  - Ensures compliance
  - Sophisticated presentation
    - Conditionals
    - Probabilities
    - “Question pools”
  - Record reaction times
  - Data already in computer
    - reduces data entry error



Computerized ESM

- Disadvantages
  - Input constraints (limited free response)
  - Human factors
    - Small screen, buttons, etc.
    - Requires some prior experience with technology
  - Costs
    - Particularly for large-n subject studies

Context-Triggered Sampling

- New sampling technique
  - First introduced by Intille et al [2003] with Context-Aware Experience Sampling (CAES) Tool
- Use sensor data to achieve more targeted triggers

Immediacy

- Allows us to validate/assess context-aware algorithms
  - "Did you just finish jogging?" Yes/No
  - "Are you at work right now?" Yes/No
  - "Did you just finish your conversation?" Yes/No

Multiple Assessments

- Provide training data for machine learning
  - Models tailored per subject
- Look for contextual features where algorithm performed well and not-so-well

Natural Setting

- Validate user interfaces, sensors, algorithms, etc.
  - Within the environment of actual deployment

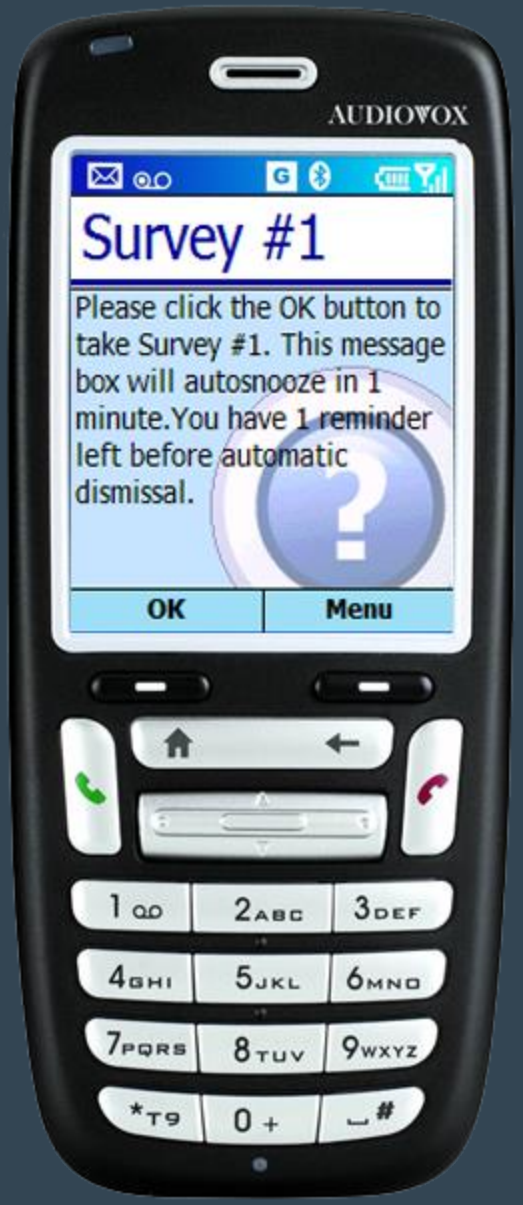
HCI/UbiComp Studies

- Computerized ESM
  - Personal Server [Consolvo et al 2003]
  - Location disclosure [Consolvo et al 2004]
- Context-triggered ESM
  - Interruptability [Intille et al 2005]
    - Using the CAES Tool
  - Place preferences [Froehlich et al 2006]
    - Using the Me Tool


My Experience Tool

My Experience Tool

- Advantages
  - Multi-media capture (audio, video, etc.)
  - Reduces some human factor issues
    - Audio playback of questions/answers
    - Settable fonts, colors, sizes
    - Simplified interaction
  - Real-time wireless connectivity
  - Context-triggers
    - Sensor combinations…
  - Modern platform support
    - Mobile phones and PDAs



My Experience Tool

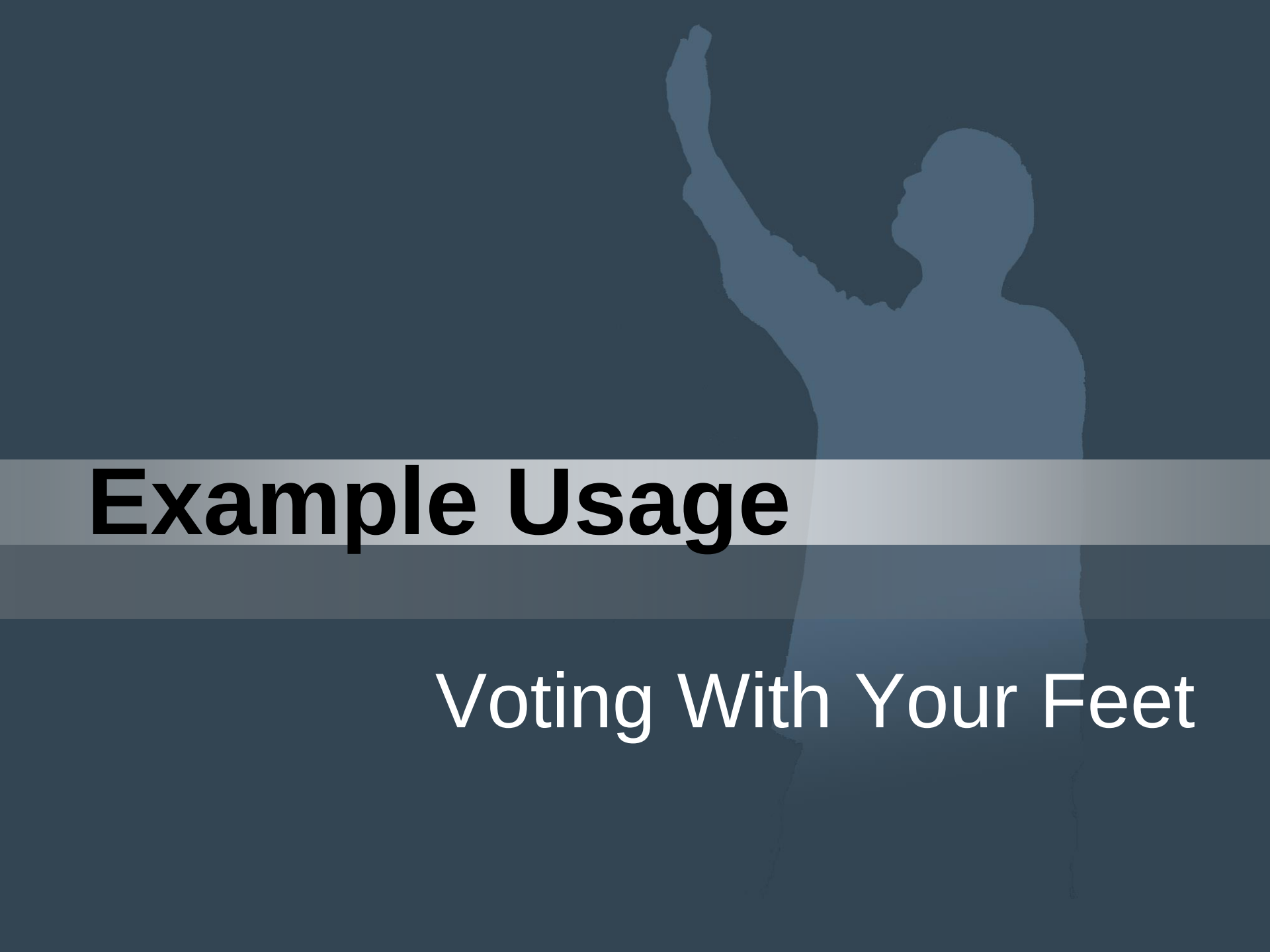
- Disadvantages
  - XML input file with sensor scripts
    - Limited usability for non-programmers
    - Brightside: Looking into creating a front end!
  - Equipment costs
    - Currently requires modern device
      - Windows Mobile 5.0
    - Brightside: Prices continue to decline
      - Reuse equipment

Context-Awareness

- Advanced sensor support
  - Scenario: Fitness Study
    - Detect: Running
    - Wait to prompt…
  - Scenario: Elderly Study
    - Detect: Medication bottle picked up
    - Trigger survey if it's past lunch and not detected
  - Scenario: Sensor failure
    - Watchdog
    - Trigger survey if no sensor state change

Evolving Context-Awareness

- Use machine learning
  - Real-time customization of inferencing algorithms
  - Hopefully prompts become more targeted
  - Provide evidence that algorithms being tested can be tailored per person



Example Usage

Voting With Your Feet

Voting With Your Feet

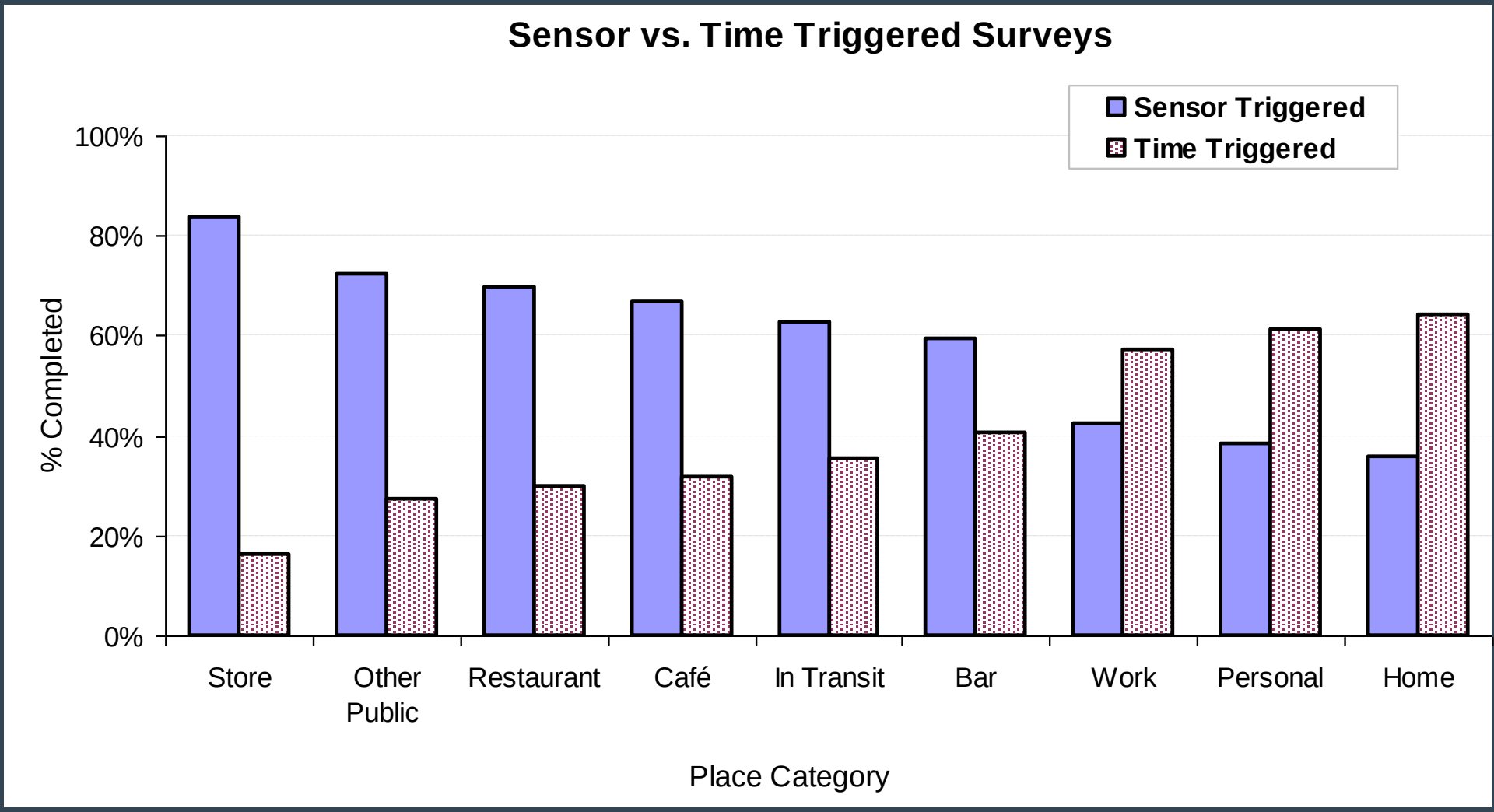
- Investigated relationship between place visit behaviors and place preference
  - How often you go to a place…
  - How far you travel to get there…
- 4-week study, 16 participants
  - Participants recruited from Seattle area
  - My Experience Tool
  - Online web diaries

ESM Triggers

- Two triggers
  - Mobility
    - Using GSM signals, can detect movement
    - When stationary for 10 mins, trigger survey
  - Time
    - Essentially a fail-safe
    - No movement sensed for 1 hr, trigger survey

High Level Results

- 4,295 ESM questionnaires administered
  - 3,458 Completed (80.5%)
- 368 web diary sessions completed
- On average,
  - 28 days of ESM data per participant
  - 216 completed ESM surveys/participant
  - 1.5 minute survey completion time
- 1,981 individual place visits
  - 862 public place visits (~1.9/day)


Sensor vs. Time Triggered Surveys
Sensor Triggered
Time Triggered
100%
80%
60%
40%
20%
0%
% Completed
Store
Other Public
Restaurant
Café
In Transit
Bar
Work
Personal
Home
Place Category

Demo


AUDIOVOX
ESM
Cingular
4:09 PM
08/31/05
Profile: Normal
intel
Start
Contacts
1
2ABC
3DEF
4GHI
5JKL
6MNO
7PQRS
8TUV
9WXYZ
*T9
0 +
#

Fox Sports on Thursday, September 8 ★★★☆☆ *(3 stars)*

1. What was the primary reason for your rating?

2. How did you find out about this place?

3. Why did you go to this place?

4. Would you recommend this place to others? Why or why not?

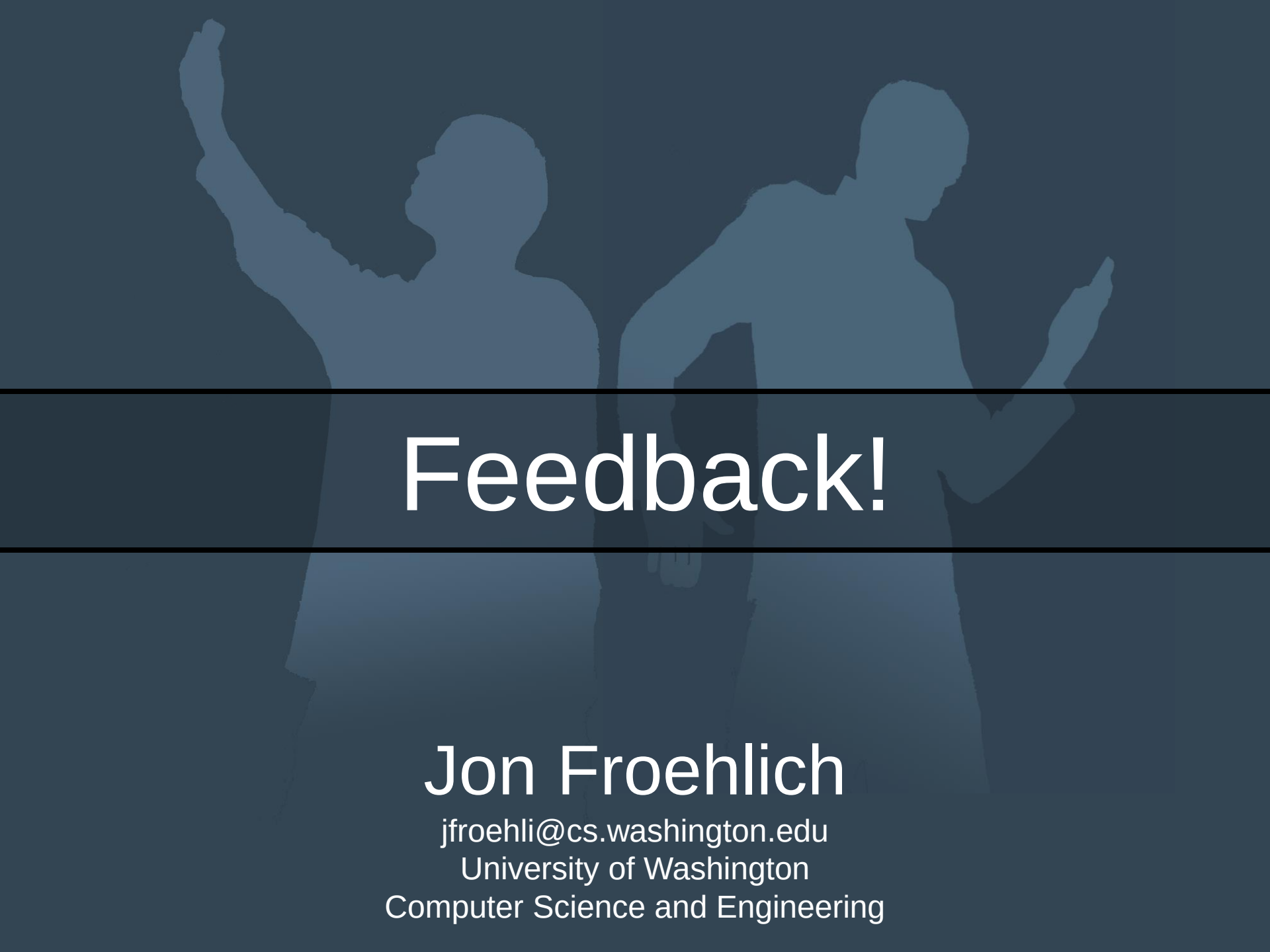
5. If you were with a group, how did the group decide to go to this place? If you were not with a group, type "N/A"

Timeline for 09/08/2005

8:32 pm (Wed) ~ 8:23 am	*My House*
8:30 am ~ 8:38 am	*Car*
9:12 am ~ 12:09 pm	*Net Desk - Seattle*
12:17 pm ~ 12:28 pm	*Walk*
12:28 pm ~ 12:46 pm	*Chez Dave - Union Square*
12:55 pm ~ 2:20 pm	*Walking*
2:20 pm ~ 3:48 pm	*Net Desk - Seattle*
3:48 pm ~ 3:50 pm	*Walking*
4:42 pm ~ 4:44 pm	*Rock Bottom-Seattle*
4:51 pm ~ 5:01 pm	*Walking*
6:35 pm ~ 6:39 pm	*Elephant and Castle*
6:46 pm ~ 7:34 pm	*Walking*
8:07 pm ~ 9:16 pm	*Fox Sports*

Planned Studies

- UbiFit 2.0 (Summer 2006)
  - w/Sunny Consolvo et al
- Elderly Care (Fall 2006)
  - w/Beverly Harrison et al
- Rehabilitative Medicine (Planning Phase)
  - w/Mark Harniss & Kurt Johnson



Feedback!

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Compliance

- Can be an issue…
  - Stone et al [2002]
  - Paper diaries fitted with photosensors that detected light and recorded when the binder was open and closed
    - Self-report compliance: 90%
    - Actual compliance: 11%

My Experience Tool

- C# (.NET CF 2.0)

Goals

- Extend computerized self-report to mobile phones
- Provide evidence to support context-triggered sampling
- Use machine learning techniques to customize sampling per subject in real-time