ubigreen

Using Mobile Phones as a Persuasive Technology to Affect Daily Transportation Practices

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dub design: use: build:

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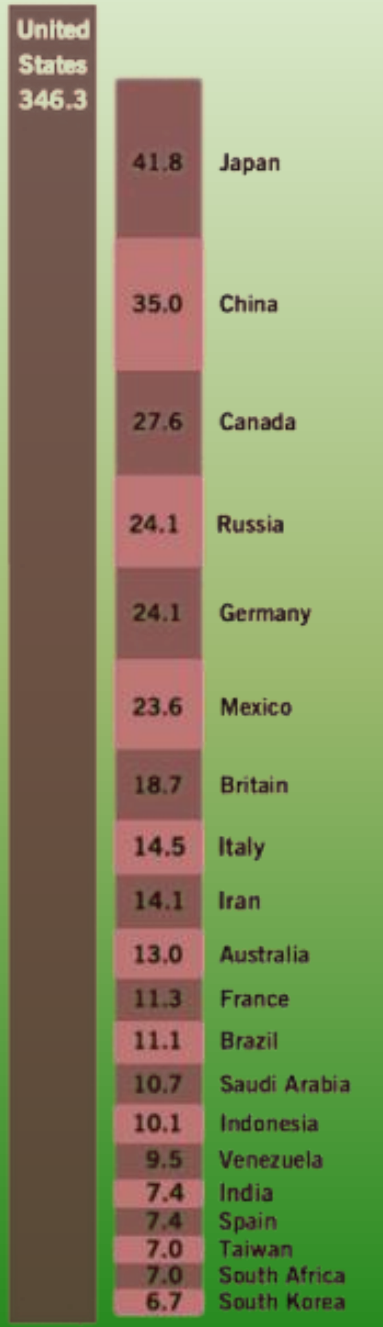


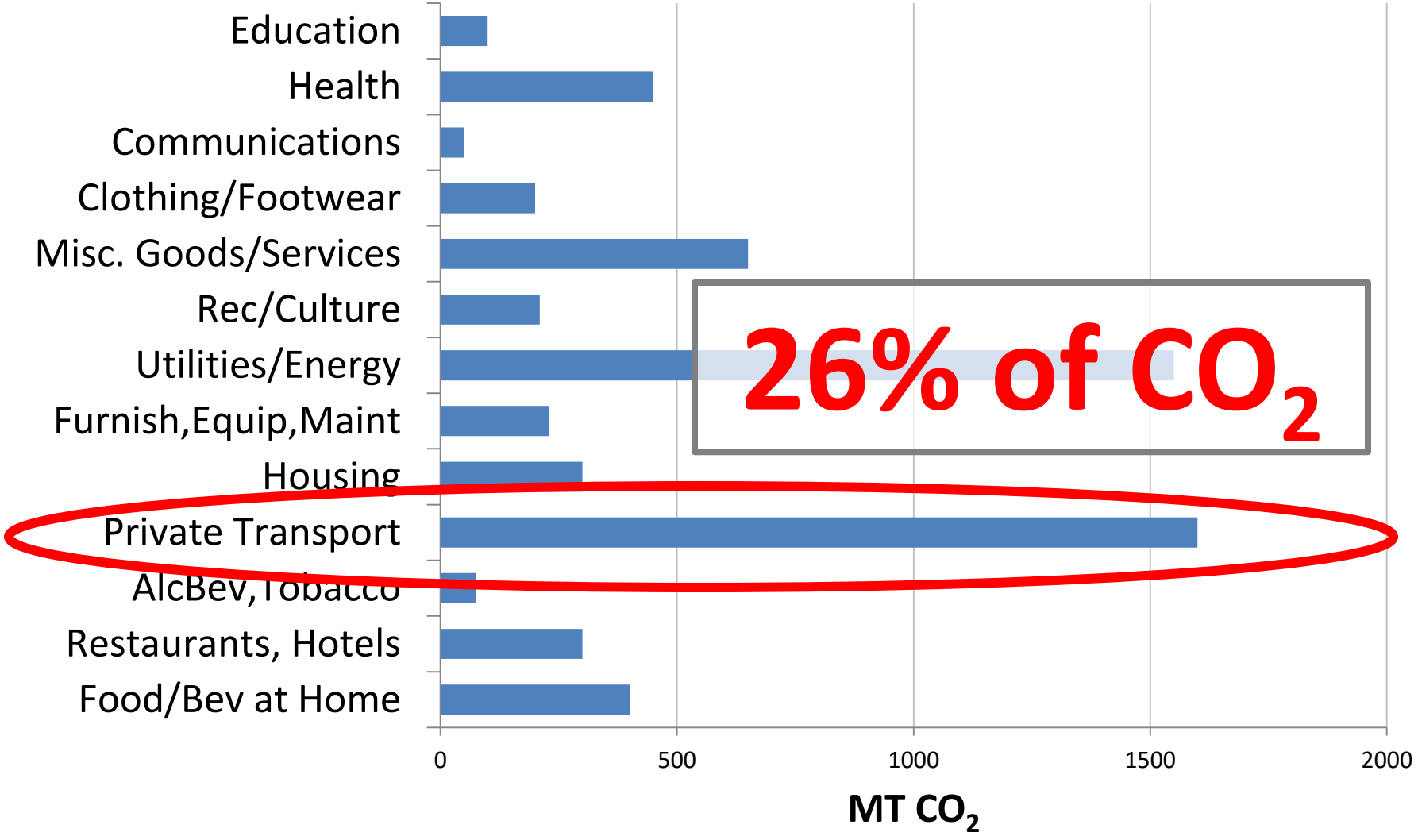
America is addicted to oil.

- President George W. Bush

State of the Union Address, January 2006

Metschies, Gerhard. Prime Numbers: Pain at the Pump, *Foreign Policy*, July/August 2007

CO_2 Emissions (Mt/yr) from Household Consumption



Weber, C.L., Matthews, H.S., Quantifying the global and distributional aspects of American household carbon footprint, *Ecological Economics* (2007)

persuasive technology

technology that intentionally changes attitudes or behaviors through persuasion and social influence

- B.J. Fogg,
Persuasive Technology: Using Computers to Change What We Think and Do, 2003

we're interested in studying how **mobile phones** can be used as **persuasive technologies** to affect **daily transportation practices**

why mobiles?

1. always with you
2. always on
3. always connected
4. highly available display
5. sensing capabilities
6. advanced input/output

ubifit

runs on the background screen of mobile phones, so it's frequently seen by the individual

- fitness monitoring application
- automatically senses activity
- at-a-glance determination of
  - active or inactive week
  - variety in routine
  - this week's goal met
  - recent goal met


strength


cardio


flexibility


walk


week's goal met

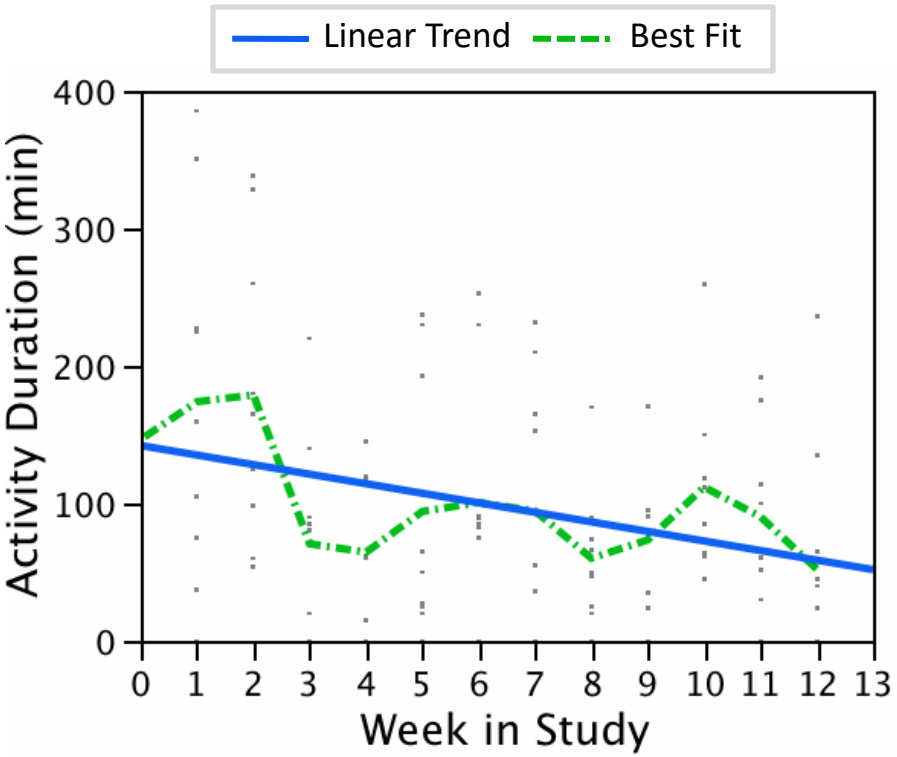

recent goal met



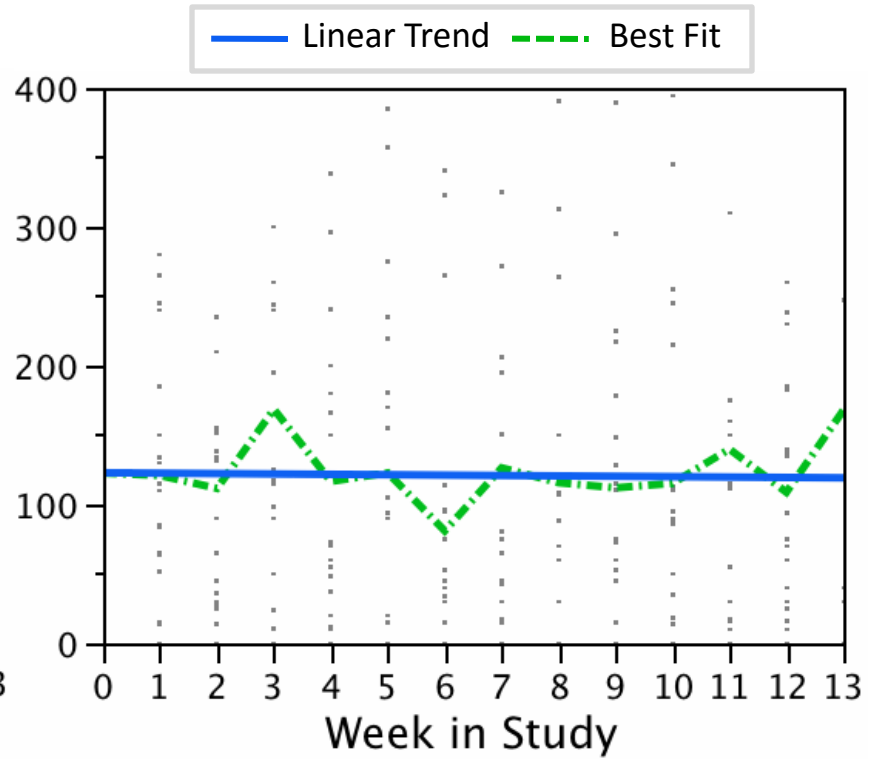


Consolvo, S., et al. "Flowers or a Robot Army? Encouraging Awareness & Activity with Personal, Mobile Displays" *UbiComp 2008,* COEX, Seoul, South Korea, September 21-24, 2008.

effectiveness of the ubifit glanceable display



No Glanceable Display



Glanceable Display

Study occurred over Thanksgiving, Christmas, and New Years.

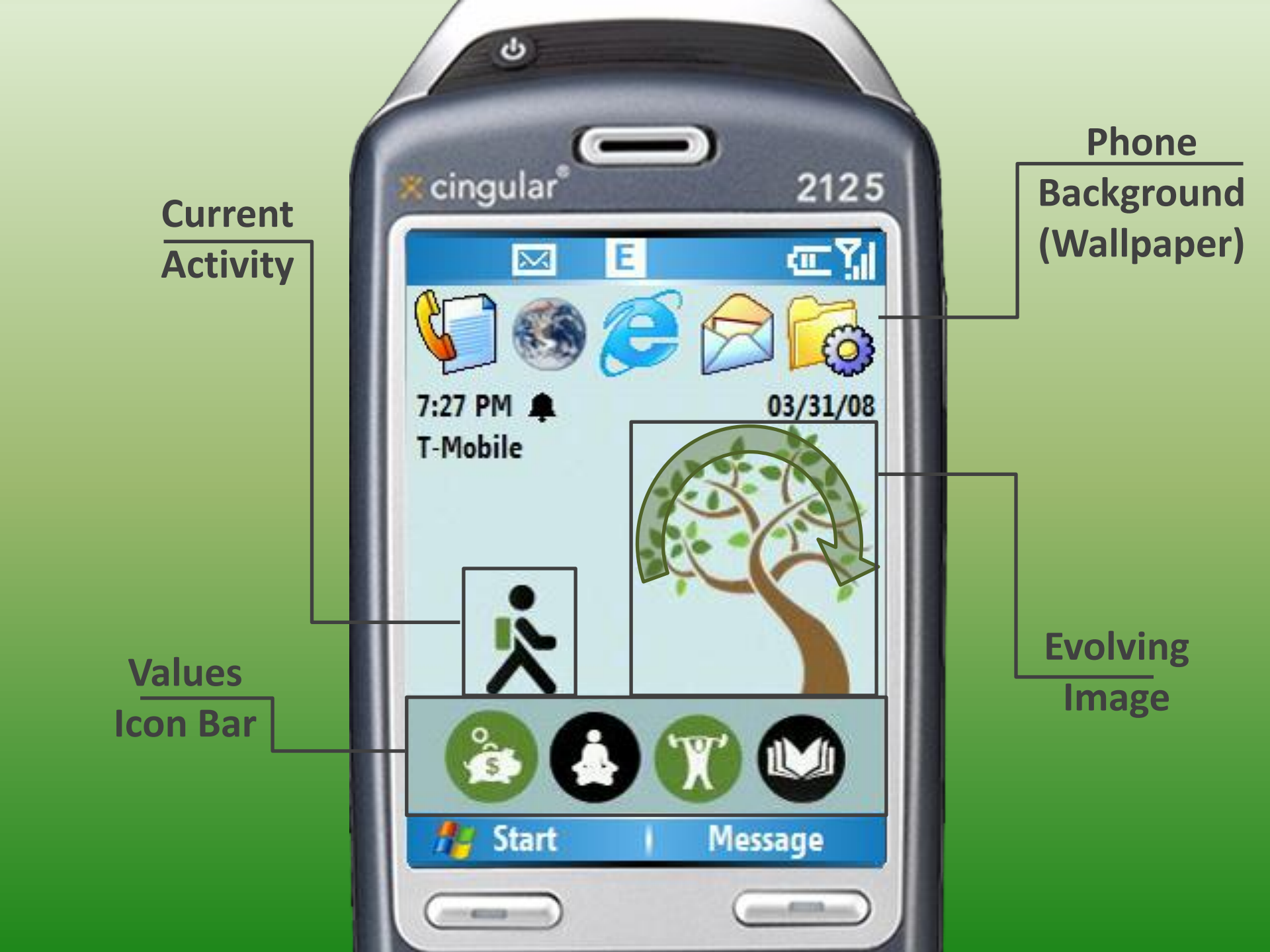
ubigreen

ubigreen combines sensors and user feedback to track transportation activity & "reward" green transit behaviors through ambient imagery on mobile phone.

transit activities

Drive Alone | Train | Carpool | Bus | Walk | Bike

"not-green" | "green"


Current Activity
Phone Background (Wallpaper)
Values Icon Bar
Evolving Image
cingular
2125
7:27 PM
03/31/08
T-Mobile
Start
Message

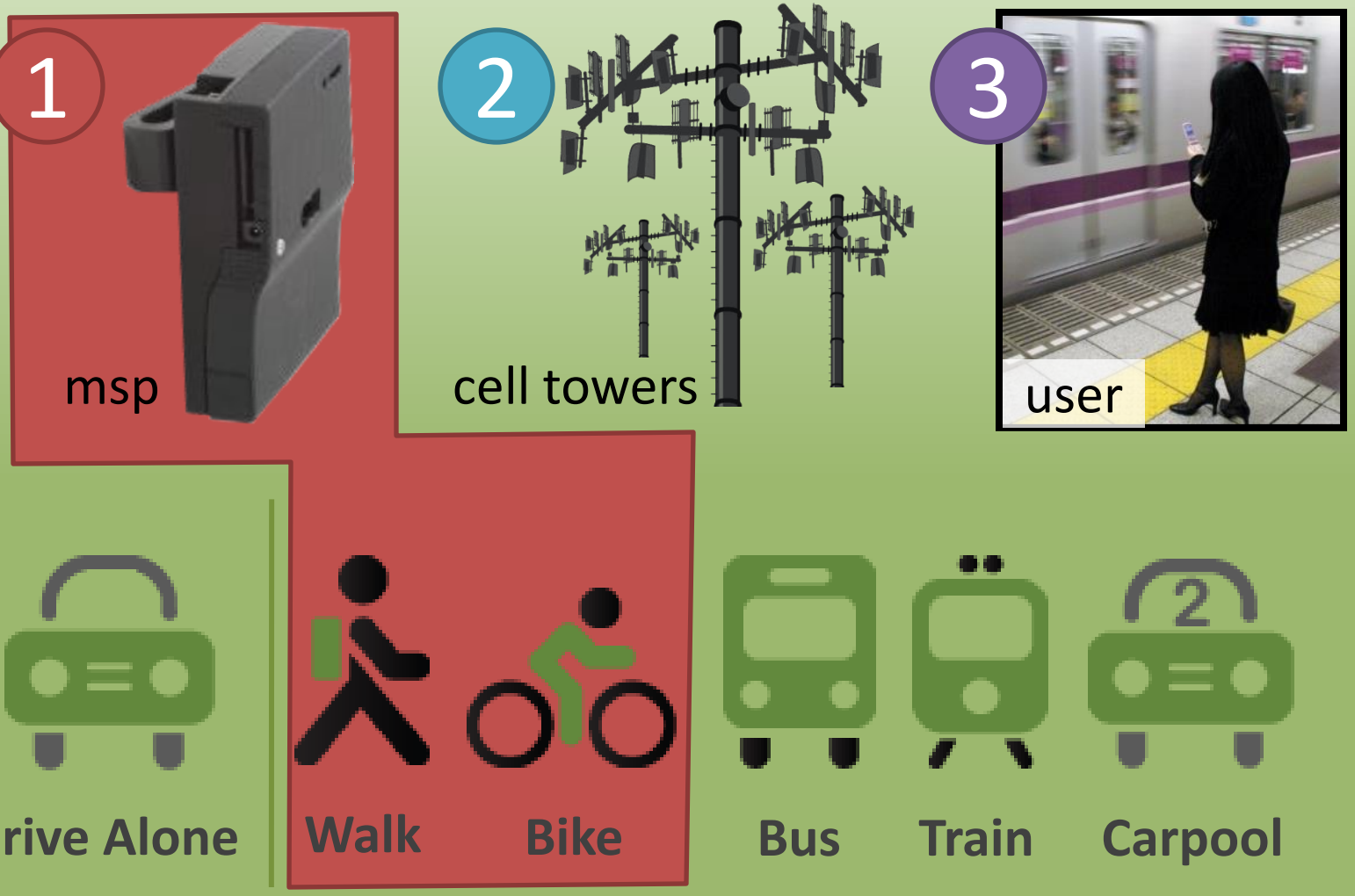
values icon bar

Money savings | Relaxation | Exercise | Do other things


cingular
2125
7:27 PM
03/31/08
T-Mobile
Start
Contacts


cingular
2125
12:15 PM
11/05/08
Start
Contacts

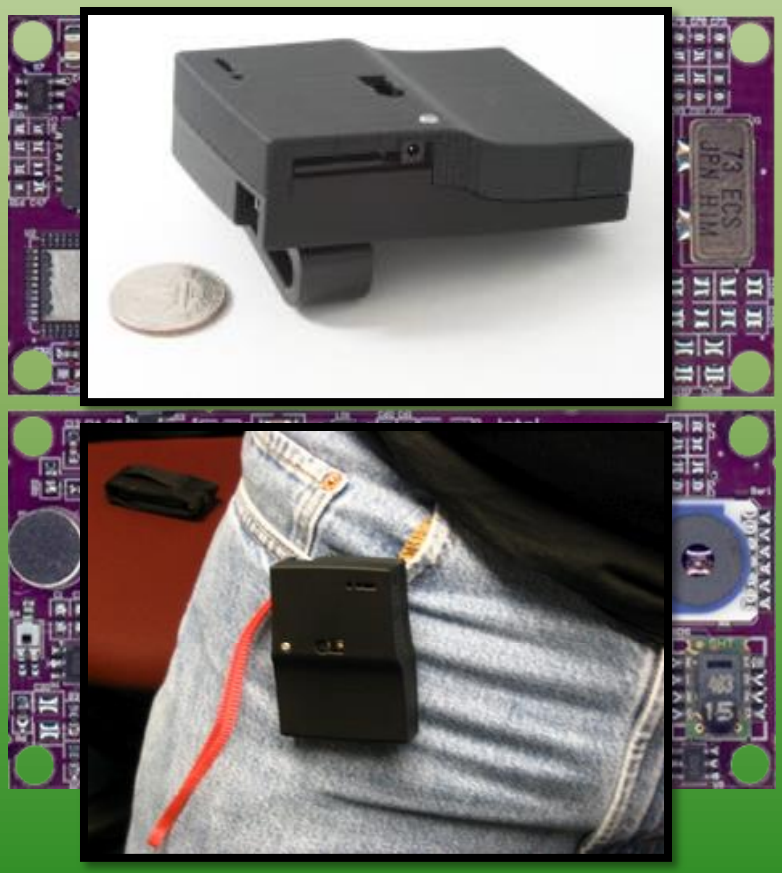
3 data sources



minimum activity duration: 7 minutes

mobile sensing platform (msp)

- automatically track physical actions throughout the day
  - walking, bicycling, going up stairs, elevator, etc.



- 2-sided sensor board with
  - 3D acceleration
  - digital compass
  - audio (8kHz, 16bit)
  - barometric pressure/temperature
  - light: HF, ambient, IR
  - humidity/temperature
- packaged w/ processor, storage, Bluetooth
- ~90% accuracy detecting actions real-time

Choudhury, T., et al. The Mobile Sensing Platform: An Embedded System for Capturing and Recognizing Human Activities, IEEE Pervasive Computing, 7(2), (Apr-Jun 2008).

raw sensor data to transit activity

mean, median, range, etc.

measure of confidence for particular activities

collect raw sensor readings → calculate features → produce margins

generated at varying rates

generated at ¼ second intervals

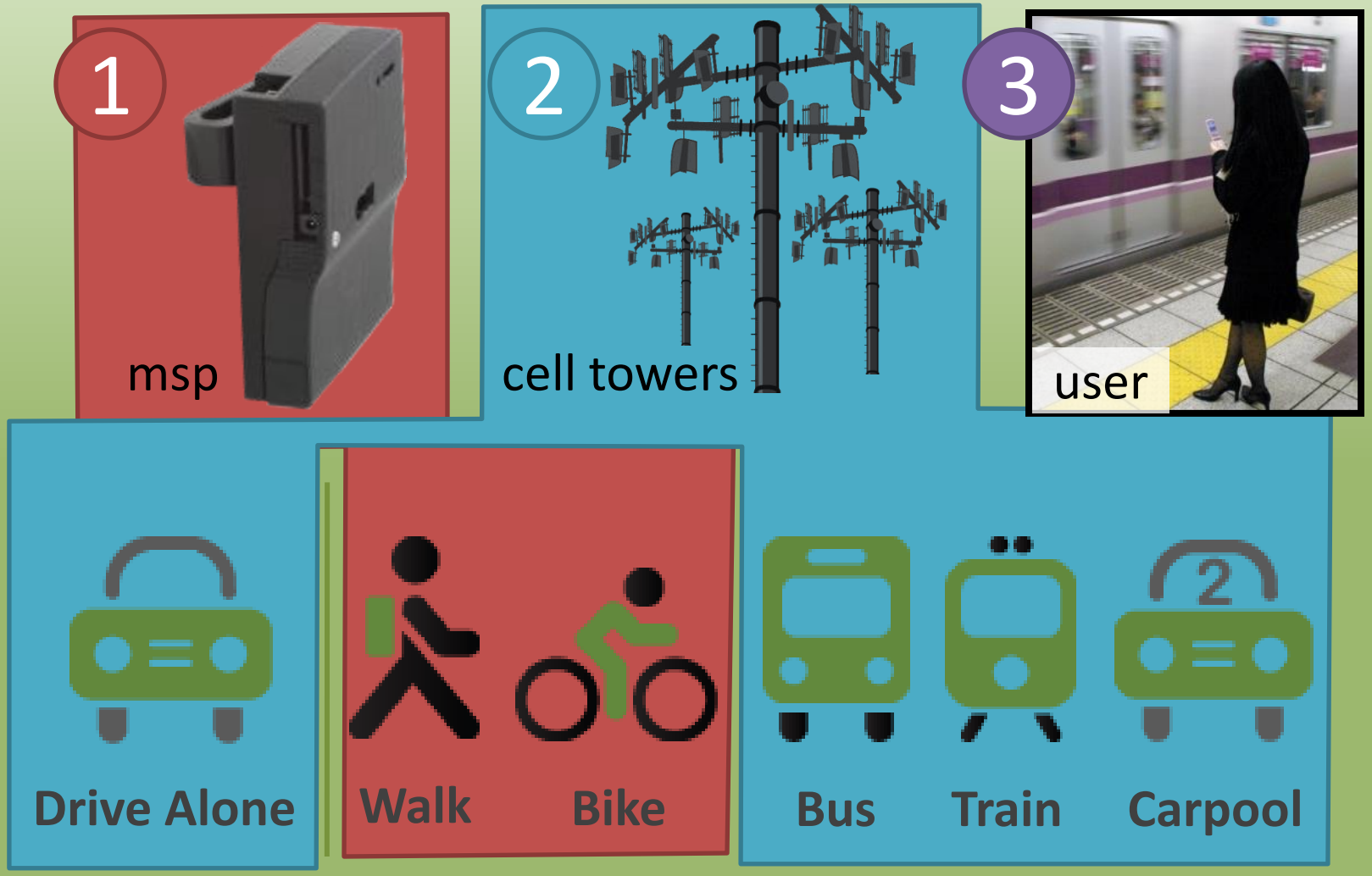
Send margins to phone via bluetooth

smooth margins into meaningful actions

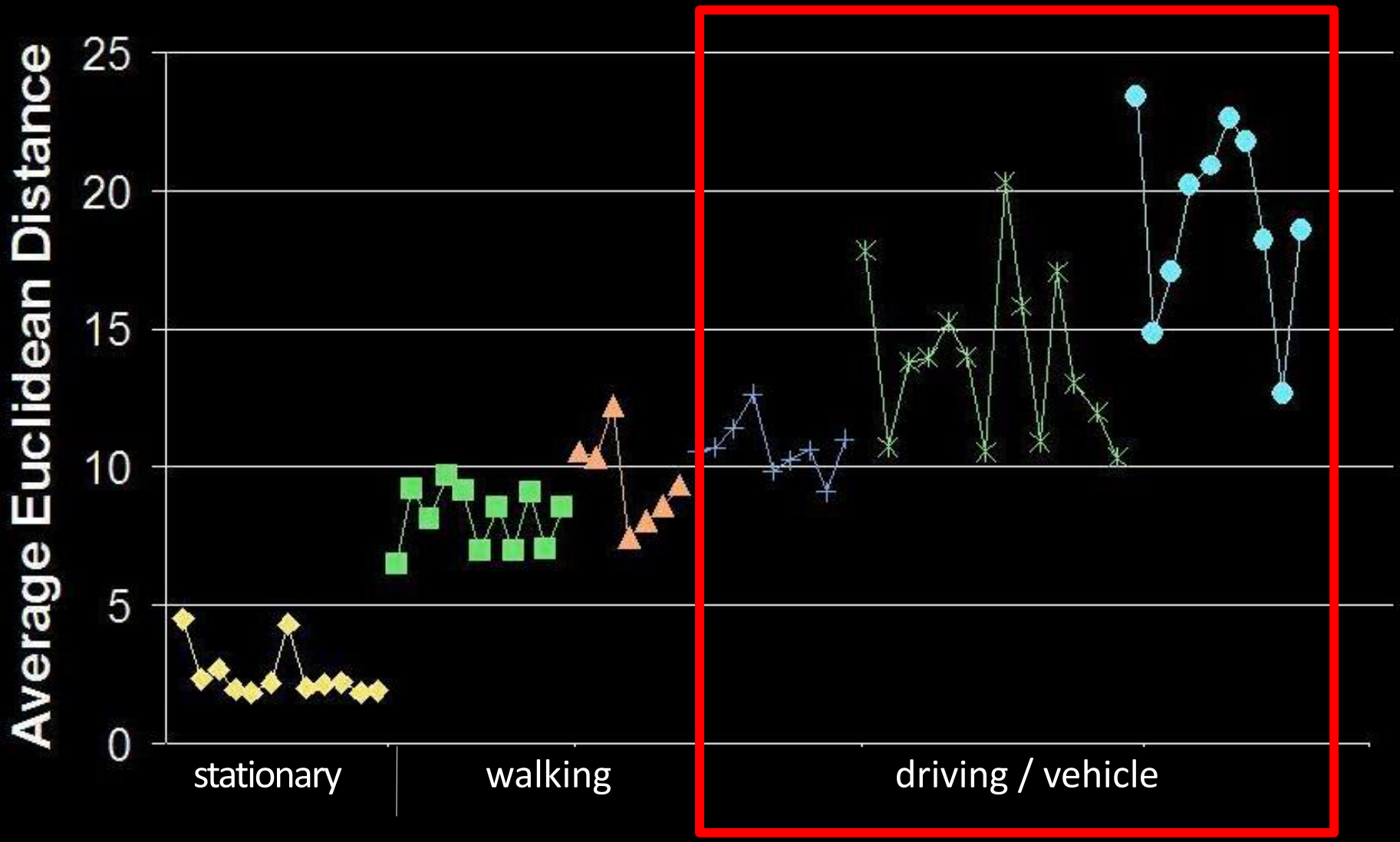
smoothing is defined by the application, not the MSP

Saponas, T., Lester, J., Froehlich, J, Fogarty, J., Landay, J. 2008. iLearn on the iPhone: Real-Time Human Activity Classification on Commodity Mobile Phones. *University of Washington CSE Tech Report UW-CSE-08-04-02*.

3 data sources



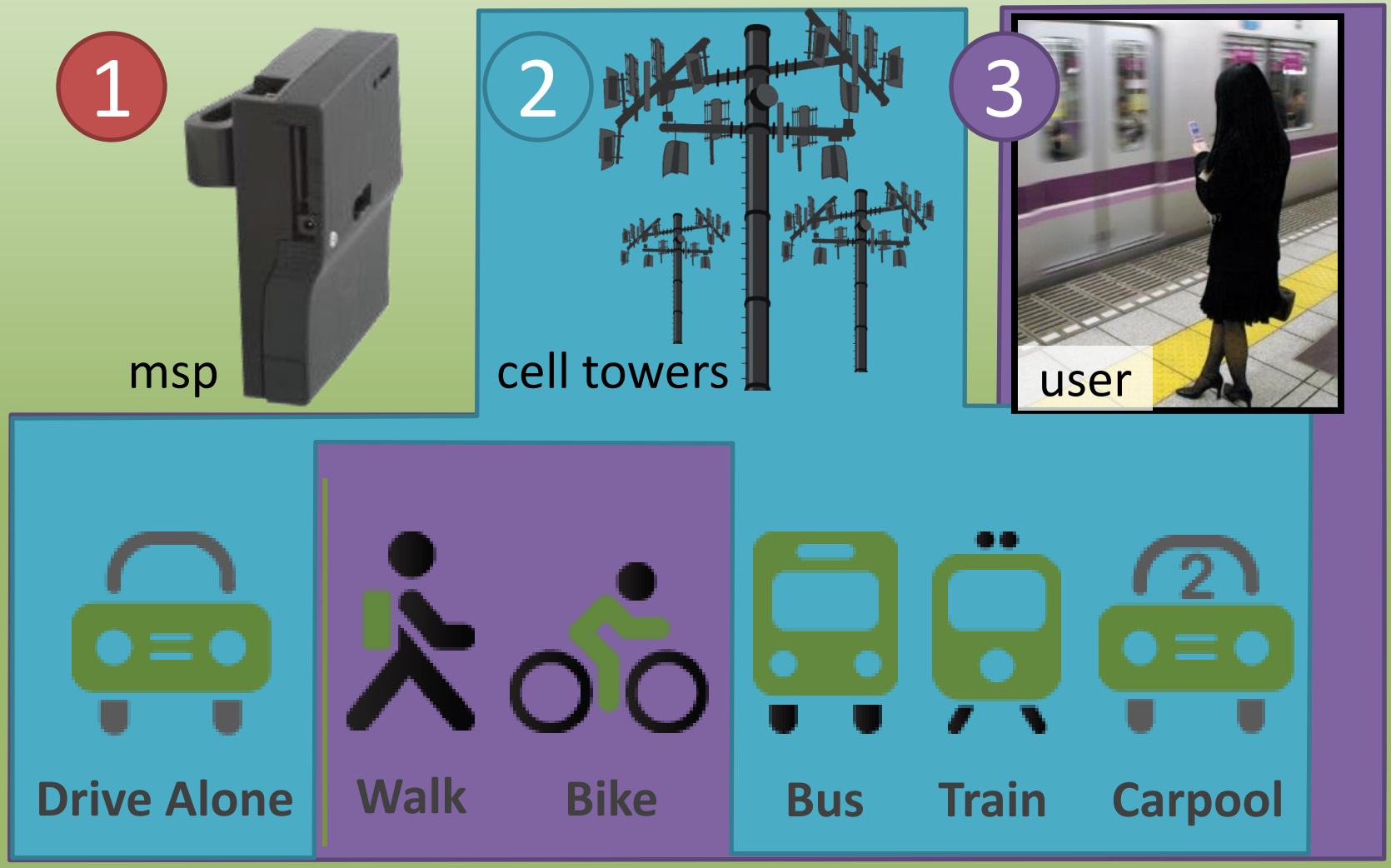
gsm sensing

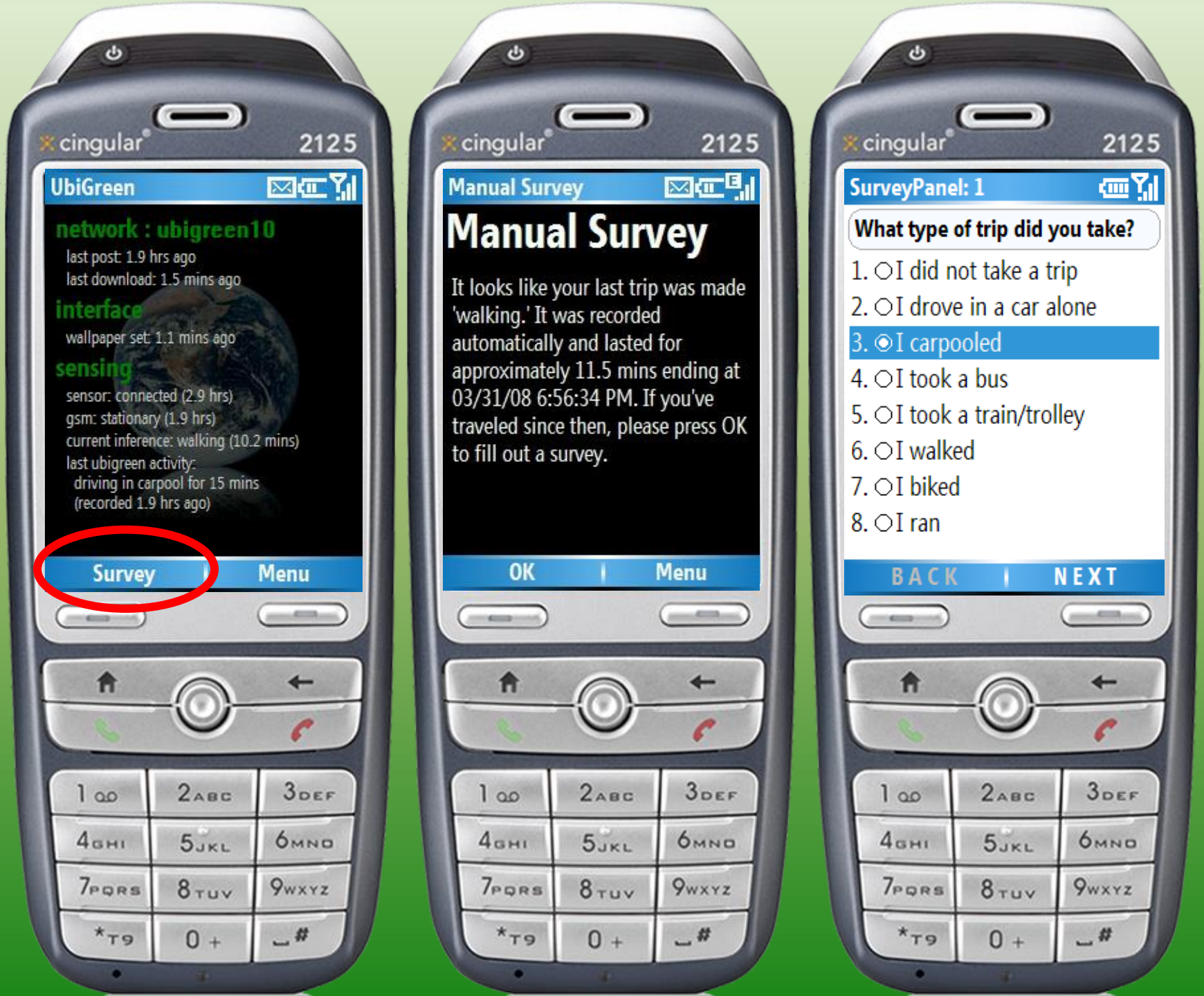


Timothy Sohn, et. al. Mobility Detection Using Everyday GSM Traces *UbiComp 2006*. Irvine, California, September 2006


cingular
2125
Travel Survey
Travel Survey
It looks like you just took a trip. If this is correct, please fill out a short travel survey. If not, you can dismiss this survey notification.
OK
Menu
cingular
2125
SurveyPanel: 1
What type of trip did you take?
1. I did not take a trip
2. I drove in a car alone
3. I carpooled
4. I took a bus
5. I took a train/trolley
6. I walked
7. I biked
8. I ran
BACK
NEXT
cingular
2125
SurveyPanel: 2
Approximately how long did this trip last (in minutes)?
15
BACK
NEXT

3 data sources




cingular
2125
UbiGreen
network : ubigreen10
last post: 1.9 hrs ago
last download: 1.5 mins ago
interface
wallpaper set: 1.1 mins ago
sensing
sensor: connected (2.9 hrs)
gsm: stationary (1.9 hrs)
current inference: walking (10.2 mins)
last ubigreen activity:
driving in carpool for 15 mins
(recorded 1.9 hrs ago)
Survey
Menu
cingular
2125
Manual Survey
Manual Survey
It looks like your last trip was made 'walking.' It was recorded automatically and lasted for approximately 11.5 mins ending at 03/31/08 6:56:34 PM. If you've traveled since then, please press OK to fill out a survey.
OK
Menu
cingular
2125
SurveyPanel: 1
What type of trip did you take?
1. ○I did not take a trip
2. ○I drove in a car alone
3. ◉I carpooled
4. ○I took a bus
5. ○I took a train/trolley
6. ○I walked
7. ○I biked
8. ○I ran
BACK
NEXT

3-week field study

- obtain preliminary feedback on prototype
  - visual design
  - engagement
  - potential for social use
  - ideas for future designs
- evaluate sensing algorithms for recording transit activities
  - the eventual goal is to reduce/eliminate the need for explicit user feedback

participants

	Location	Condition	Days	Occupation
P1	Pittsburgh	Tree	27	Sales Clerk
***P2**	Pittsburgh	Tree	N/A	Attorney
P3	Pittsburgh	Tree	21	Law Enforcement
P4	Pittsburgh	Tree	9	Student
P5	Pittsburgh	Polar Bear	20	Technical/Engineering
P6	Pittsburgh	Polar Bear	12	Student
P7	Pittsburgh	Polar Bear	16	Student
P8	Seattle	Polar Bear	6	Student
P9	Seattle	Tree	42	Office Admin
P10	Seattle	Tree	19	Consultant
P11	Seattle	Tree	25	Program Manager
P13	Seattle	Polar Bear	37	Programmer
P14	Seattle	Polar Bear	30	Consultant
P15	Seattle	Polar Bear	6	Student

Participants had a pre-established interested in being “green”

equipment

+


T
·Mobile·
Sim Card


cingular
2125
7:27 PM
03/31/08
T-Mobile
Start
Message

current ubigreen phone images

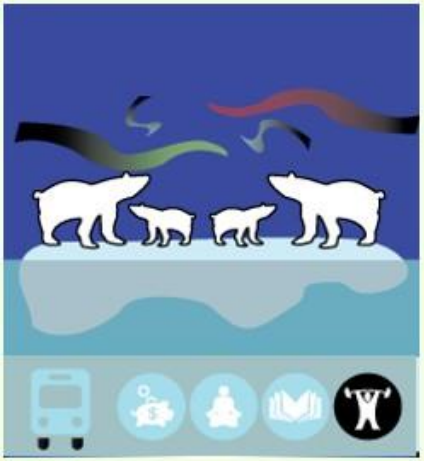
march 2008 field study

RESEARCH PARTICIPANTS

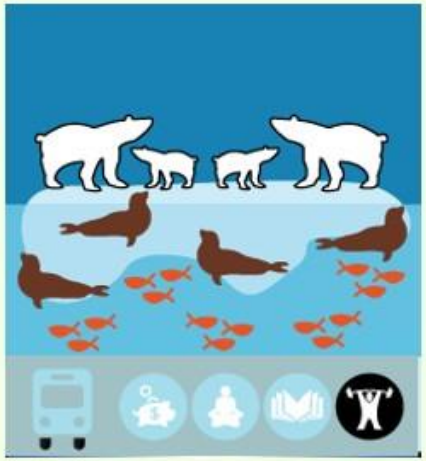
ubigreen9
Updated: Thu, 27 Mar 2008 07:00:09 GMT

ubigreen10
Updated: Thu, 27 Mar 2008 15:21:28 GMT

ubigreen11
Updated: Thu, 27 Mar 2008 19:10:10 GMT



ubigreen13
Updated: Thu, 27 Mar 2008 16:04:33 GMT



ubigreen14
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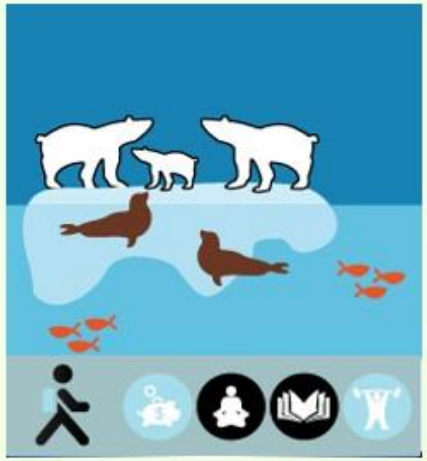
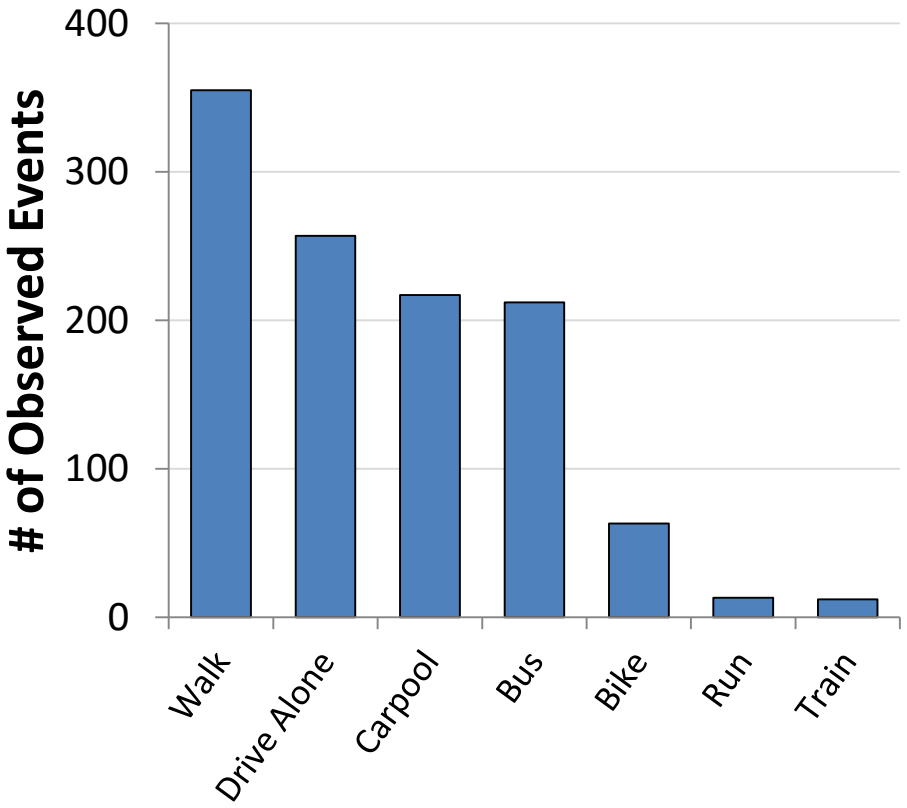


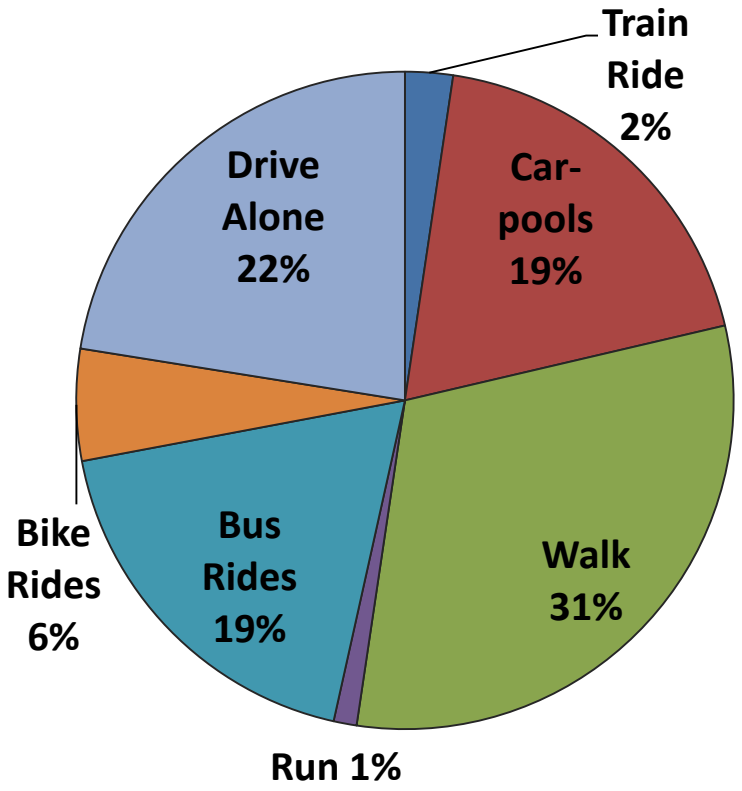
ubigreen15
Updated: Thu, 27 Mar 2008 19:01:13 GMT

data collected

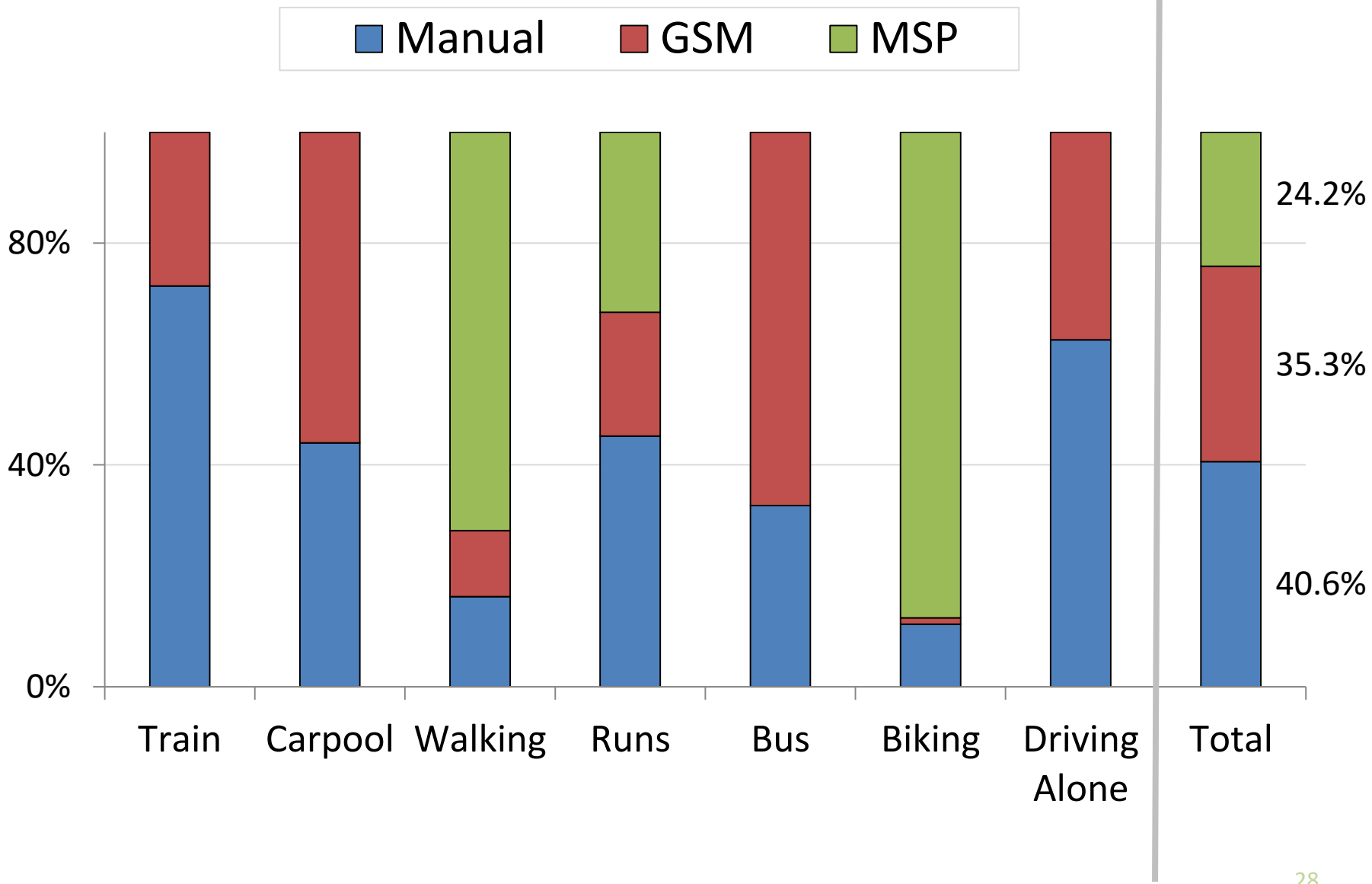
- two online questionnaires
- pre- and post-interview data
- 8.4 million logged sensor events
- 1,129 travel events (72% green)
- 4.2 travel events per participant per day
- average trip length: 18 minutes
  - 23 minutes for green trips

observed transit





source of data



visual design

"I liked the tree because it was, to my mind, a pretty progress bar. There was enough of a clear distance between each state that I could tell the difference at a glance."

- Participant 11

"I would like to see some graph or raw data. Even some sort of notification of this is how often you took the bus this week. Something that provides some utility back to me."

- Participant13

"I would like more information about carbon emission savings."

- Participant 15

Participants liked visual design but requested more quantitative data and interfaces to explore that data

engagement

"It's omnipresent"

- Participant 9

"I liked that we didn't know what it was going to do. Like when your phone turned from leaves into flowers and then apples."

- Participant 15

"I want to have different stories every week … to maintain curiosity in the app"

- Participant 8

"If you opened it up, people would generate their themes online and share them. It would be cool"

-Participant 10

How do we design for long-term engagement?

real-life game

Our real-world interactions as input to games

One participant complained that when a trip hadn't been automatically recorded, "I felt like I was being cheated out of my 'points'"

- Participant 15

"I think negative reinforcement would also be good. I think maybe my polar bear should drown though if I am bad."

- Participant 14

Future designs could incorporate more overt gaming models

social

"Some people at work knew about the polar bear and every day they asked me about it. 'Did you get a seal today?'"

- Participant 14

"I would show my friends, 'look at my tree, isn't it cool, look at the flowers…' They thought it was pretty cool."

- Participant 9

How can we leverage online social networks to tap into social influence?

Mankoff, J, et al.. (2007). Leveraging social networks to motivate individuals to reduce their ecological footprints. *HICSS '07*

real-time recommendations

- post-study survey, “what could help you take more green trips”
  - Reliable transportation (76.8%)
  - Financial incentives (71.4%)
  - Knowledge about alternatives (56%)
- future designs could suggest alternative forms of transit based on trip history
- recommendations could also come in form of neighborhood:
  - “42% of the people who live in your neighborhood and work in Capitol Hill take the bus.”

potential for behavior change

"The motivation for me is more of the tracking and kind of seeing how I am doing and just the reminder factor of it. "

- Participant 11

"It really encourages you to analyze your own performance"

- Participant 8

"I feel I already travel in a relatively eco-friendly way and the study did not change that"

- Participant 15

"This can be connected with government incentives somehow… For example, government could encourage people with tax refund."

- Participant 7

future work

- longitudinal deployment focused on studying behavior change
- interfaces for self-comparison
- exploring social sharing/influence
- real-time recommendations
- quantitative carbon-tracking features
  - ability to project footprint into the future
- new types of story boards/themes
  - ability to navigate story board in non-linear fashion
- what about reward **and** punishment?

iphone

ecorio

After installation, Ecorio runs in the background on your phone, keeping track of when you're moving in a car or a bus and tallies up the trips that you take each day.

When you first start Ecorio, you will see a summary of your activity and the current trip that Ecorio is tracking.

How many generations in all of human history have had the opportunity to rise to a challenge that is worthy of our best efforts. A challenge that can pull from us more than we think we can do.

-Al Gore

TED Conference, March 2008

thankyou!

http://dub.washington.edu/projects/ubigreen

jonfroehlich@gmail.com

Behavior-based energy efficiency poster at a bus stop outside conference hotel.

Acknowledgements: We would like to thank Intel Research for providing financial support for this project and Microsoft Research for funding Jon Froehlich.

dub design: use: build:

university of washington

CSE, UW

Intel Research, Seattle

iSchool, UW

HCI Institute, CMU