personal transportation is the greatest contributor of CO₂ emissions in the average U.S. household.


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

Transportation accounts for more than two-thirds of oil consumption in the U.S.

we help people reflect on their transportation
ubigreen
Investigating a Mobile Tool for Tracking and Supporting Green Transportation Habits

Jon Froehlich$^1$, Tawanna Dillahunt$^3$, Pedja Klasnja$^1$, Jen Mankoff$^3$, Sunny Consolvo$^{1,2}$, Beverly Harrison$^{1,2}$, James Landay$^{1,2}$

$^1$University of Washington
$^2$Intel Research, Seattle
$^3$HCI Institute, CMU
ubigreen transportation display

design influences
1. activity-based computing
2. feedback literature
3. ubifit
4. formative studies
   • an online survey
   • an *in situ* (ESM) study
activity-based computing

• long-lived activities in our everyday lives
  – staying healthy, graceful aging, etc.
  – high-level, physical, dynamic, high-value

• key elements
  – social
  – natural interactions
  – always at hand

[Li and Landay, CHI2008]
feedback
feedback resulted in typical energy savings of between 5 and 12% [Fischer, 2008]
ubiFit

- fitness monitoring application
- automatically senses activity
- at-a-glance goal information

3-month study; **those with ambient display outperformed those without**

[Consolvo, CHI2008]
formative study #1
online survey

• 73 respondents
• Determine people’s attitudes about transportation
• Get feedback on early design concepts
formative study #1
online survey

Factors that influence transportation choices

- Speed: 44%
- Flexibility: 50%
- Cost: 23%
- Carry things: 23%
- Eco-friendly: 23%
- Comfort: 16%
- Exercise: 16%
- Fresh air
- Safety
formative study #2
experience sampling study

- 7 participants over 7 days
- explore consistency of responses with online survey
- acquire in situ data on num trips/week
- get additional feedback on revised visual designs
formative study #2
experience sampling study

[Froehlich, MobiSys 2007]
for 73% of car trips, participants indicated that greener options existed
visual design
transit activities

<table>
<thead>
<tr>
<th>Drive Alone</th>
<th>Train</th>
<th>Carpool</th>
<th>Bus</th>
<th>Walk</th>
<th>Bike</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;not-green&quot;</td>
<td>&quot;green&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
value icon bar

money savings  relaxation  exercise  do other things
everything resets on sunday
implementation
architecture

wearable sensor (intel msp)

activity data sent via BT

ubigreen running as an extension of the myexperience tool

study data

sql server mobile 2005 on phone

transit data (sent over gprs)

activity server

new screen sent back to phone

next screen generated

logic applied
The simulator displays the user's screen at the selected moment in time. It has the ability to scroll back in time and play through events received. Displays events chronologically as sent by the user's phone. [Li, CHI2008]
three data sources

1. msp
2. cell towers
3. user

- Drive Alone
- Walk
- Bike
- Train
- Carpool
- Bus

minimum activity duration: 7 minutes
three data sources

1. msp
2. cell towers
3. user

minimum activity duration: 7 minutes
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.

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

Approximately how long did this trip last (in minutes)?

[Input Field]

Value: 15
study
3-week field study

- obtain preliminary feedback on prototype
- evaluate sensing algorithms for recording transit activities
- Level of environmental concern lower in Pittsburgh
- Range of professions
- Participation: 1-4 weeks
- Compensation: $100-300
study timeline

<table>
<thead>
<tr>
<th>Study Begins</th>
<th>One Week Checkup</th>
<th>Study Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>dispense equipment</td>
<td>small software update</td>
<td>post-study questionnaire</td>
</tr>
<tr>
<td>application training</td>
<td>equipment check</td>
<td>post-study interview</td>
</tr>
<tr>
<td>pre-study questionnaire</td>
<td></td>
<td>equipment returned</td>
</tr>
</tbody>
</table>
RESEARCH PARTICIPANTS

Monday

Saturday

ubigreen1
ubigreen2
ubigreen3
ubigreen4
ubigreen5
ubigreen6
ubigreen7
ubigreen8
results
mobile data

• Over **8 million** sensor events
• Over **1,000 travel events (72% green)**
  – 4 travel events/day
• **18 minute trips** on average
  – **green trips** 5 minutes longer
observed transit

Num of Observed Events

- Walk: 400
- Drive Alone: 300
- Carpool: 200
- Bus: 100
- Bike: 0

Source of Transit Activity Data

- Manual: 41%
- Cell Tower: 35%
- MSP: 24%
qualitative results
visual design

images revealed progress
I liked the tree because it was, to my mind, a pretty progress bar. I could tell the difference at a glance.
- Participant 11

need for quantitative data
I would like to see some graph or raw data.
- Participant 13
I would like more information about carbon emission savings.
- Participant 15
It definitely **keeps you more aware** of it [personal transportation] every single day. **You use your phone every single day** so you know.

- Participant 6

It’s **omnipresent**

- Participant 9

**increased awareness**
engagement

anticipation
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

sustaining anticipation
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
Social Engagement

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

Leverage online social networks to tap into social influence [Mankoff, HICSS 2007]
I want to see the final stage I can get to…

- Participant 7

One participant stated that when a trip hadn’t been automatically recorded, “I felt like I was being cheated out of my ‘points’”

- Participant 15

Future designs could incorporate more overt gaming models
contributions

1. ubigreen prototype
2. semi-automatic transit detection
3. visual design capable of raising awareness and engaging users
4. implications for the design of future green applications based on 3-week field study
future work

- longitudinal deployment
- social sharing
- real-time recommendations
- quantitative carbon-tracking
- home resource usage
- eliminate sensing device

[Saponas, UW TR 2008]
What if the 76 people in these cars...
...rode buses
thank you!

This research was sponsored by Intel Research and NSF grants IIS-0205644 and IIS-0803733. Jon Froehlich is funded by a Microsoft Research fellowship. We thank designer Beth Corry for helping with the tree and polar bear designs.

http://dub.washington.edu/projects/ubigreen
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
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.
source of data

Manual | GSM | MSP

Train
Carpool
Walking
Runs
Bus
Biking
Driving Alone
Total

35.3%
40.6%
24.2%
reasons why people drive

- Public transit unavailable/impractical: 79%
- Need car to carry things: 47%
- Takes too much time: 39%
- Too far: 16%
- Safety: 10%
- Other: 8%
- Flexibility: 8%
- Weather: 3%
- Too physically strenuous: 3%
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

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

- Participant 15

“It really encourages you to analyze your own performance”

- Participant 8

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

- Participant 7