Decision Support and Monitoring at Home & Away

John Zimmerman
HCI Institute and the School of Design, Carnegie Mellon University

DHTI Networking Seminar | 29 October 2014
My background

Interaction designer/researcher

Discover opportunities where people could benefit from new technology
person-place-time-view

learns and routine activities of dual-income families

prevents kids from being forgotten
Tiramisu is a crowd-powered transit information system. Find out in real-time when the bus is coming from your phone.

Visit us on Facebook or Follow @tiramisutransit

About | Tutorial | Live Map | Reports | FAQ | Contact Us

Please select the Region / Transit Agency that you wish to use on this and future visits to Tiramisu.

US, PA, Pittsburgh | Port Authority of Allegheny County

Go!

Real-time location (many or few seats available)

Real-time location (no seats or bus full)

5:46pm | May 14, 2013
reverse alarm clock

keeps small children from waking their parents

abstracts time into three states

reduces stress of morning rush
Design research

Not the technology

Not the problem domain

Investigate many possible futures. Discover an technical opportunity to address a problem worth solving

... some healthcare examples
Detecting Onset of and Remission from Depression

with Jason Hong
Change in technology and people’s behavior

smartphone as rich sensor people carry with them wherever they go

increasing use of computer mediated communication, leaves a trace of social action
Recognizing an opportunity

6% of Americans suffer an episode of major depressive disorder each year.

Correlates with social isolation and reduced activity.

Can changes in online communication patterns and activity level reveal depression?

Can we find a signal within the noise of people’s smartphone use and online communications?
Early actions

Roundtable meetings with psychiatrists and psychologists
- importance of sleep
- importance of seeing transition over state
- refocus of include sleep and transition

Prototype tools to collect social data
- Infer life facets from communication logs
  90% accuracy (work, social, family)
- Infer social tie strength from communication logs
  60% to 90% accuracy

image source: http://www.wired.com/2013/10/computers
Machine learning challenges

How to get data for people transitioning?
- baseline healthy to baseline unhealthy
- baseline unhealthy to healthy

How to get ground truth (labels)?

Recruit people starting medication therapy

Recruit people recently diagnosed with cancer

Prompt participants fill out a weekly CES-D scale on their phone
State of the work

Developed **Toss ‘N’ Turn** sleep detector: light, sound, movement, location, phone usage

Assessment of sleep detector
93% sleep/wake; 84% sleep quality

Developed **BigBlackDog**
social/activity monitor: communications and contacts, location, movement

Pilot of remission monitor
3 participants (starting meds), 4 months

image source: https://www.youtube.com/watch?v=XiCrlOGw6SY
High-level insights on BBD

Need lots of follow-up with participants to get CES-D filled out

Strong correlations between sleep, time spent at home, and CES-D scores

Complex interactions around communications and location

Need big data collection study
Self-monitoring to reduce readmission

with Jodi Forlizzi and Steven Dow
Change in technology for home

Many new networked, commodity, healthcare monitoring devices
Post-discharge self monitoring

Can people self-monitor vitals and care plan compliance at home in order to:

- reduce readmission
- avoid follow up appointments
- alert family and healthcare workers of non-compliance
- better support family care coordination
Elder feasibility study for CHF... but with healthy elders

9 participants (66 to 90) for 7 days

Vitals
- temperature
- blood pressure
- weight

Logged behaviors
- medications
- exercise
- diet

great success at logging vitals

success but also resistance to behaviors, especially medication

next steps: deploy with discharged patients
Decision Support Tool for VAD Implant

with James Antaki
Problematic situation

10k patients don’t get VAD

VADs often implanted too late, poor performance

Aid clinicians and patients in making the decision

image source: http://uanews.org/story/ua-surgeons-implant-southern-arizona-s-first-hvad-pump
Pilot field study with Cardiologists and Patients

Patients overly optimistic they will get a transplant

Physicians think of an implant window: sick enough but not too sick

High uncertainty when case is far from textbook
Sketches for ML system

- focus on life expectancy
- working on how to communicate ML confidence
Decision Support and Monitoring at Home & Away

John Zimmerman
HCI Institute and the School of Design, Carnegie Mellon University

DHTI Networking Seminar | 29 October 2014