Fogarty International Center

Global mHealth Research Training Institute

June 6- 9, 2016

Center for Global Health Studies



NIH Fogarty International Center

Maribeth Gandy, PhD

User-centered Design of Mobile & Wearable Health Applications

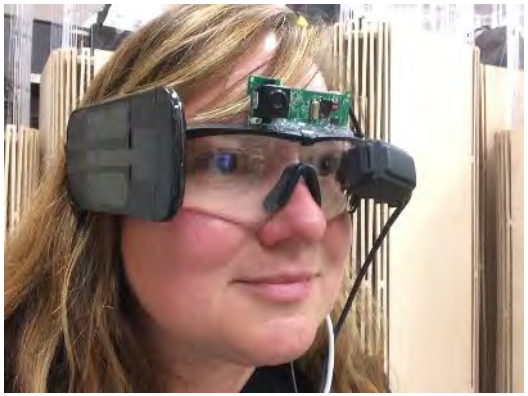
MPTCRM
Enabling Customer Focus

Definition of User-Centered Design

- *"…the process of designing a tool, such as a website's or application's user interface, from the perspective of how it will be understood and used by a human user."*
- *"…tries to optimize the product around how users can, want, or need to use the product, rather than forcing the users to change their behavior to accommodate the product."*
- **Guiding principles**
  - Start with the users rather than the technology or even solutions
  - Consider all the stakeholders
    - System must provide immediate value to the user
  - Wearable (and mobile) systems must mesh with the users environment, culture, and lifestyle.
    - And should support users doing a primary task separate from application
  - For what kind of research is this field helpful?
    - Systems meant to be integrated into existing workflows, lifestyles, communities, and environments
  - Who are the experts?
    - Human Computer Interaction (HCI) Experts come from a variety of disciplines
      - Computing, Engineering, Psychology, Sociology, and Design

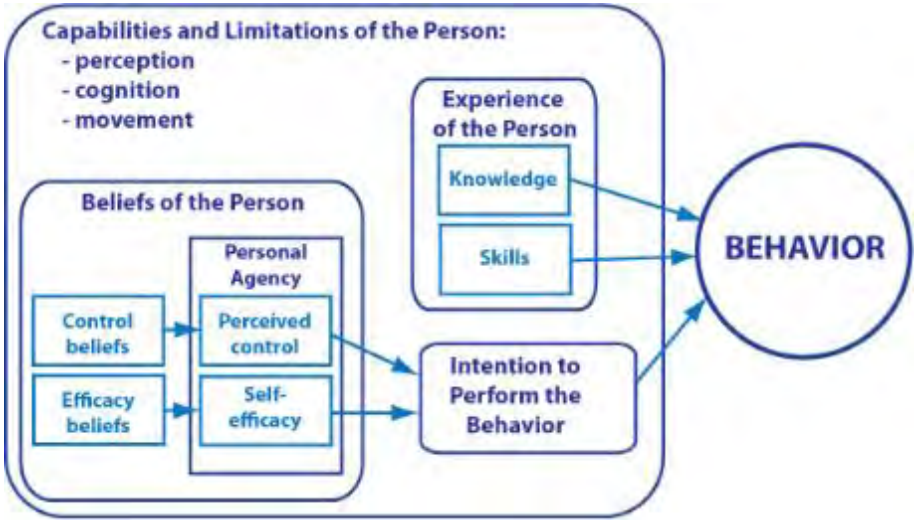
Guiding Principles and Key Terms

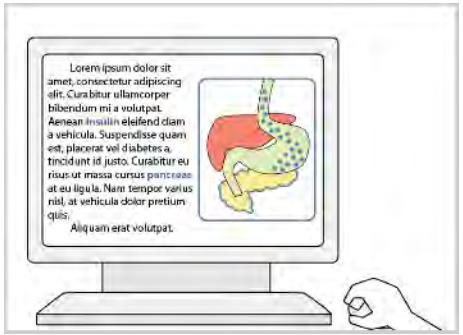
- **The Process and Keywords**
  - *Futures-based Approach*
    - Extended Present, Familiar Future, Unexpected Futures
    - Disregarded signals
    - Consensus is not the goal
  - *Participatory Design*
    - focused on collaborative decision-making
    - moving end-users into world of researchers. *Empathic Design* moves researchers into world of end users.
  - *Prototyping*
    - *In situ* ideation (e.g. DART authoring tool)
    - Low fidelity for ease and to garner the best feedback
      - Google Glass
    - *Wizard-of-Oz* techniques can be used to produce systems with realistic behavior with little development required
      - "Voices of Oakland"

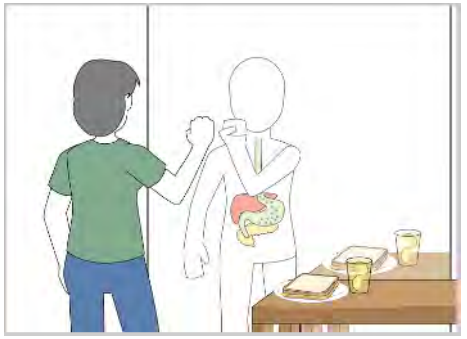


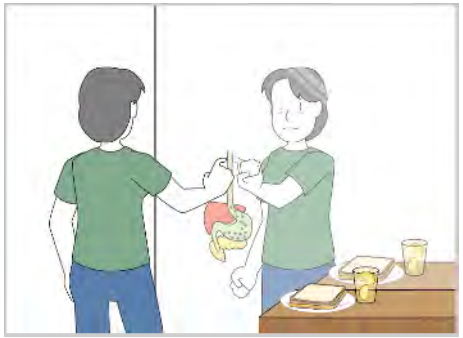
Consider the Context

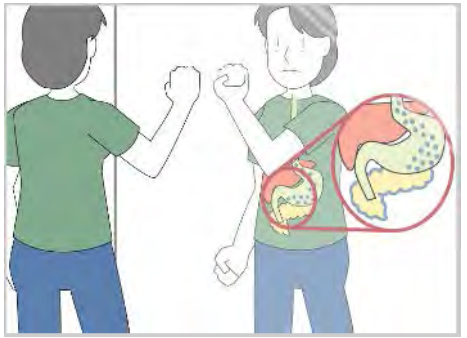
- **First step is awareness, but there is a large jump to positive behavior change**
  - Sensing/measures/logging -> producing insights/presenting data -> sensemaking-> guiding toward effective strategies
    - Lifemash, Diabetes Detective, Voice Stress Analysis
- **Adherence is the challenge. Novelty/motivation fades**
- **Social considerations. Users may be self-conscious**
  - Wearable touchpad design
- **Make the user experience positive rather than negative**









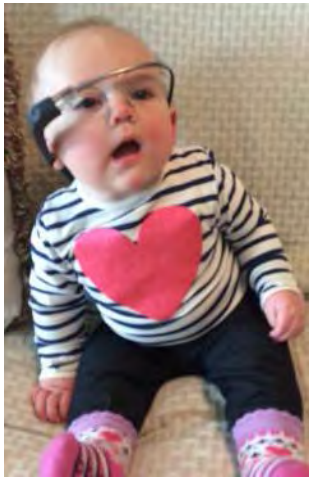


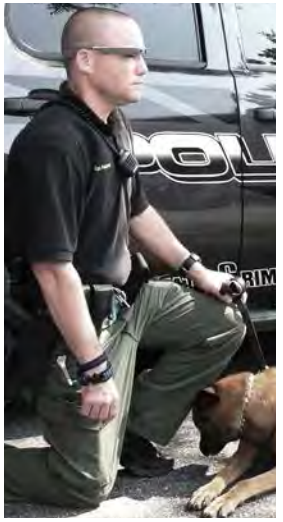
Consider the Context: an assistive technology device

- How to provide situational awareness to a user with vision impairment?
- Participatory design with all stakeholders
- *in vivo* versus *in vitro* design
- Guide dog as inspirational "technology"
- Convention, Public Policy, and Regulation
- Requirements
  - Controllable conspicuousness
  - Technology as "ice breaker"
  - Avoid information overload
  - Transparency of sensing & mode

Dimensions of Design: Elements of the user experience

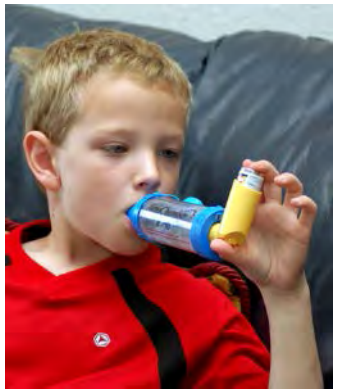
- **Results from early user-centered design activities help you tune the following parameters**
  - Physical Parameters and Wearability
    - Size, weight, battery life, heat produced, body placement
  - Conspicuousness & Aesthetics
    - Fashion, community norms, hide or flaunt the technology?
  - Social Conventions
    - What is considered "normal", "cool", "weird" etc. in this community?
  - Context of Use
    - Users will accept inconvenience, privacy reduction, discomfort etc. for substantive value
    - Who, What, When, Where, Why
  - Privacy & Security
    - Transparency of system and awareness on part of user are critical
  - Observers' Experience
    - How do others experience and perceive this system/device?
  - Sensory Requirements
    - Cognitive and sensory demands of use (e.g. attentional demands, occlusion of visual field, use of auditory frequency spectrum, space taken up on the body)?
    - Often must evaluate system *in situ*
  - Regulation and Legislation
    - ADA, FCC, HIPAA

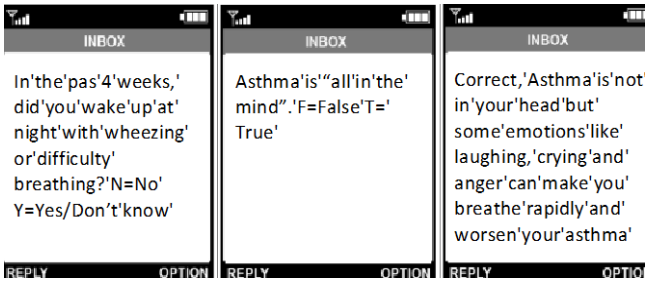




Case Studies: Lessons Learned

- **Wearable systems require considering all aspects of the user experience**
  - Asthma Management for Kids: *Jeong, H., Sung, J., Yun, T., and Arriaga, R.I. (2011) A user-centered approach to support ubiquitous healthcare for pediatric chronic illness: Asthma as a case study. Proc. of IASDR 2011*
  - *kidshealth.org/parent/medical/lungs/teen_asthma.html*
  - *forums.webmd.com/3/asthma-exchange/forum/1973/9*
- **Consider community (geography and culture)**
  - Nutrition in Food "Deserts": *Andrea Grimes, Vasudhara Kantroo, and Rebecca E. Grinter. 2010. Let's play!: mobile health games for adults. In Proceedings of the 12th ACM international conference on Ubiquitous computing (UbiComp '10). ACM, New York, NY, USA*
- **Nudge the user toward good choices**
  - Peripheral Display of Nutrition Information: *Chhabra, J., Singh, J., Baquero, D.S. (2008). Abstracting nutritional information of food service facilities using the Pervasive Healthy Diet Adviser. Proceedings of the International Conference on Smart Home and Health Telematics (ICOST 2008)*.
- **One approach does not work for all users or conditions**
  - SMS for Asthma: Yun, T. & Arriaga, R. I., A Text Message a Day Keeps the Pulmonologist Away. Proceedings of the ACM SIGCHI Conference on Human Factors in Computing Systems (CHI 2013), May 2013
  - SMS for Heart Disease: Teresa Lyle, Wendy Book, Rosa Arriaga, Joanie Jackson, SMS Heart Text Messaging Intervention: A Tool for Enhancement of Self-Care and Symptom Awareness in Adults with Congenital Heart Disease
- **Perceived value and comfort are relative**
  - Wearable device for workers: *Daniel P. Siewiorek, Asim Smailagic, Thad Starner, Application Design for Wearable Computing, Morgan & Claypool Publishers, 2008, Computers, 65 pages*
- **Don't be a technology "hammer" looking for an application "nail"**
  - Breast Pump Hackathon: *breastpump.media.mit.edu*





Breakout Discussion Questions

1. How do you approach your team's problem, given what you have just learned?
2. What did you incorporate into your project from what you learned?
3. What new subject matter experts do you need to work with? Why?