6.S196 / PPAT: Principles and Practice of Assistive Technology

Today: Course Summary

Wednesday, 12 Dec. 2012
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Today

- Review of PPAT
- Other relevant MIT courses
- Graduate study related to AT
- Early stop to fill out course evaluations
  - http://web.mit.edu/subjectevaluation

What is Assistive Technology?

- A device, service or process that eases or facilitates performance of some daily living task and/or participation in some activity in some environmental/social context
- Assistive technology is a broad and necessarily interdisciplinary field, involving mechanical design, materials, electronics, software, cognitive science, human-computer interaction …

PPAT Goals, Structure

- **Lecture:** Broad introduction to AT discipline
  - Terminology, models, approaches, characteristics
- **Lab:** Exposure to a variety of actual AT devices
  - Mobility, alternative text input & pointing, AAC etc.
- **Project:** Term-long, in small teams, with one client
  - Team works directly with a person living with a disability
  - Practitioners (clinicians, therapists, technicians)
  - Practice contextual inquiry, systems thinking, spiral design and implementation, evaluation
  - Guidance, feedback from staff/practitioner panels
- **Unmet needs:**
  - Identification of many areas in which AT is needed
- Exploration of opportunities beyond end of term
  - Subjects; MIT AT group; IDEAS Challenge; MIT100K

In Scope: Functional Deficits

- Human performance!
- Mobility impairment
- Motor impairment (manipulation)
- Communication impairment
- Sensory impairment
- Cognitive impairment

Activity and Participation

- Activity: "execution of tasks" [ICF]
- Participation: "involvement in life situations"
- Concepts are not entirely distinct
- Example components of activity and participation: "learning, applying knowledge, communication, mobility, self-care, community, social and civic life;" access to public, private, built and natural spaces; access to people and animals that provide support.

ICF = *WHO International Classification of Functioning, Disability and Health*

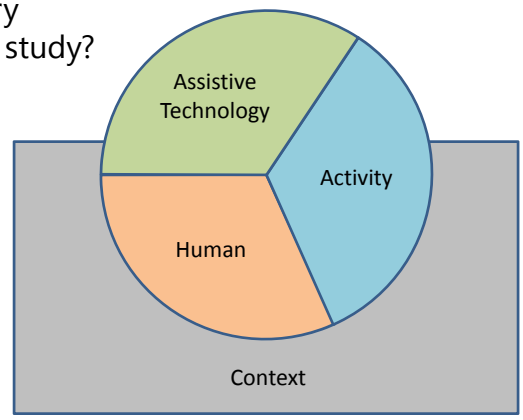
Assistive Technology System

- Assistive technology:
  - A device facilitating performance of some task or activity in some context
- Assistive technology system view:
  - Assistive technology device
  - Human operator
  - Functional activity
  - All of which occur in some context
  - … with human performance our key focus!

HAAT Model

- Someone doing something, somewhere, involving the use of an assistive technology

… What was our very first example / case study?



Lab: People-First Language

- Deprecated terms (no longer in common use)
- Disability no longer the sole adjective that defines the person; it is something that a person is living with, just as s/he has other characteristics
- Focus on the *person* (and the *function* to be enabled or augmented or provided), not on the disability
- Thus: person with developmental disability, person with epilepsy, person who uses a wheelchair
- But: choice of language is complex and can often be contentious.

Lab: Campus Accessibility

- Wheeled mobility
- Manipulation tasks
- Physical barriers to access, participation
- Brainstorming about improvements
  - Of mobility devices
  - Of physical infrastructure

Ethics

- Respect for persons
  - voluntary participation
  - informed consent
  - protection of vulnerable populations (children, prisoners, people with disabilities, esp. cognitive)
- Beneficence
  - do no harm
  - risks vs. benefits: risks to subjects should be commensurate with benefits of the work to the subjects or society
- Justice
  - fair selection of subjects

User Testing

- Formative user tests vs. summative controlled experiments
- Treating users with respect
- Critical observation of user tests

Lab: Human Subject Protection

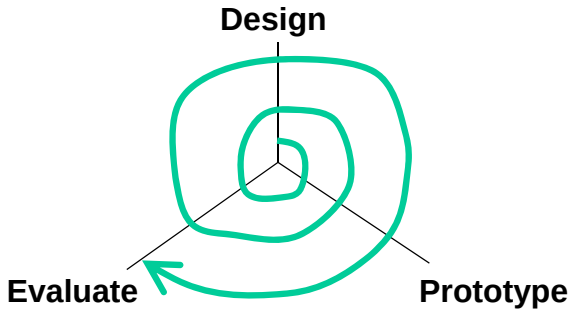
- History of human subject ethics
  - Nuremberg, Tuskegee, Fernald
- Definition of research
- Assessing risks to subjects
- Informed consent
- Privacy and confidentiality
- Protected populations

Projects: Client Matching

- Capsule description of each client
  - Skill set likely to be involved in project
- Each student ranked each client
  - Excited, neutral, or not a good match
- Staff composed teams with skills mix
  - Typically mechanical, electronics, software
- Staff distributed term agreements
  - Team member agreements
  - Team-client agreements

User-Centered Design

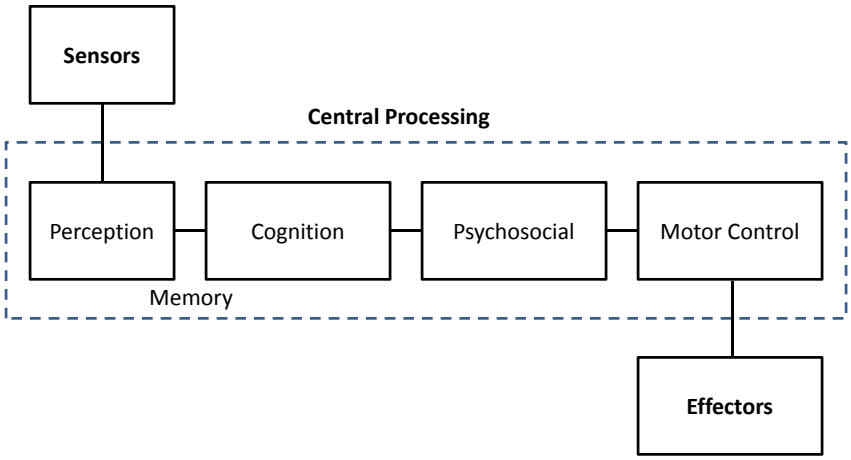
- Spiral model of design
- Early focus on users and tasks
- Frequent evaluation



Projects: Contextual Inquiry

- Initial meetings with clients
- Task observations and analysis
- Discussions with clients, caregivers
- Contact with AT practitioners
- Definition of success metrics
- Signing of client agreements

Information Processing Model



Info. Processing Model Applied

- Motor impairment
- Sensory impairment
- Cognitive impairment
- Communication impairment
- Aging

Guest Lecture: Blindness

- Information available through vision
- Alternative strategies for O&M, info access
- AT for blind and visually impaired people
  - Optical character recognition
  - Screen readers and augmented interfaces
  - Outdoor navigation aids
  - Braille printers, labelers, refreshable displays
  - Sensory substitution devices (e.g. Optacon)

Lab: Screen Readers

- VoiceOver
- WebAnywhere
- Web design with aDesigner
- Optacon

Guest Lecture: ATIC

Augmentative Communication	*Assistive Chat*
Screen Reading	*VoiceOver for Mac OS X*
	VisioVoice
Magnification	*Amigo magnifier*
AISY book reader	*Victor Reader Stream*
One-handed keyboard	*BAT*
Foot Mouse	*Bili Slipper Mouse*
Alternative keyboard	DataHand

Guest Lecture: Usability

- "The user experience is the careful alignment of human behaviors, needs, and abilities with the core value delivered through a product or service. Depending on the context, this experience may have psychological, cultural, physiological, and emotional components – most likely, a combination of the four." (Gribbons, BostonCHI, Sept 2011)

Guest Lecture: AT at TBH

Lab: Alternative Text Input

- Dasher predictive text input
- Web-based speech recognition
- Speech-to-text correction interfaces
- Alternative keyboards

Lab: Alternative Pointing Devices

- Fitts's Law
- Adaptation to user's modes of volitional motion
- Adaptive mice and trackballs
- Head/gaze trackers

Lab: Augmentative & Alternative Communication

- Dimensions of the AAC design space
- Observing users of AACs
- Trying out Proloquo2Go (picture communication) and Proloquo (speaking typewriter)
- Identifying as-met unmet communication needs

Guest Lecture: Brain Injury

- Origin (congenital, trauma, illness)
- Functional deficits
  - Paralysis
  - Motor impairments
  - Problems with speech, cognition
  - Loss of long-term or working memory
  - Fatigue, loss of motivation, social isolation
- Useful AT
  - PT/OT, exoskeletons, cognitive aids

Guest Lecture: Living with ALS

- Progressive functional deficits
- Functional deficits
  - Strength, balance
  - Problems with speech, cognition
  - Loss of long-term or working memory
  - Fatigue, loss of motivation
  - Social isolation

Projects: Prototypes, Panels

- Iterative design of prototype solutions
- Regular discussions with PPAT staff
- Presentation to clients
- Documentation of reaction, metrics
- Scope adjustments as needed

- Mid-term panels!

Guest Lecture: Hearing Loss

- Social difficulties
- Environmental challenges
- Effective AT
- Wish list of AT to be developed

Guest Lecture: Deaf culture

- Tension between user-centered and society-centered adaptation
- Advocacy by those with disabilities to occupy a more central role in ongoing discussion of strategies for increased access and participation

Other Guest Lectures

- Cognitive-Linguistic disabilities
- Usability and universal design
- Personalized adaptive accessibility
- Living with ALS
- Web accessibility
- Assistive communication

Lab: Low Vision

- Different types of requirements
  - Static vs. punctuated vs. dynamic tasks
  - Near-sight vs. far-sight tasks
  - Natural vs. artificial light
  - Stationary vs. moving user
- Assistive technologies
  - Large print
  - Monoculars
  - Display magnifiers
  - Board magnifiers
  - Unmet needs

Opportunities Beyond PPAT

- Consider taking other MIT subjects
- Consider the IDEAS Global Challenge to carry on and scale up your work
- Sign up and contribute to the AT@MIT mailing list: http://bit.ly/atmit
- Share your work with others through design competitions and other venues
- Unsolved problems remain in making AT widely available and affordable

MIT Subjects

- 2.009 Product Engineering Processes
- 6.813/6.831 User Interface Design & Implementation
- 6.170 Software Studio
- 6.141 Robotics: Science & Systems
- 6.S078 Entrepreneurship Project
- 6.S976 Founder's Journey
- ESD.051J Engineering Innovation & Design
- D-Lab
  - EC.721 Wheelchair Design
  - EC.722 Prosthetics
- MAS.600 Human 2.0
- MAS.863J How to Make (Almost) Anything

Graduate Schools

- U Washington (Richard Ladner, Julie Kientz, Jake Wobbrock)
- U Wisconsin Trace Center (Gregg Vanderheiden)
- U Colorado (Clayton Lewis)
- UMass Lowell (Holly Yanco)
- CMU (Rory Cooper et al.)
- Georgia Tech (Charlie Kemp, Greg Abowd)
- Northeastern (Harriet Fell)
- Rochester (Jeff Bigham)
- Harvard (Krzysztof Gajos)
- MIT (Seth Teller, Rob Miller)

- *(... apologies to those we may have forgotten)*

Summary

- We've covered a lot of ground!
- Hopefully, this was a useful, effective introduction to AT in the real world
- Many potential future directions exist
- We're excited to see what you do next!

Subject Evaluation

- Please visit

  http://web.mit.edu/subjectevaluation

- Why?
  - Help future students make informed choices
  - Help PPAT staff improve future offerings
  - Help raise profile of AT curriculum at MIT