From Alzheimer's to physical disabilities
case studies in context aware access

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Context Aware Computing group
Ted Selker, Associate Professor MIT Media lab
Using Sensors and Virtual sensors
To understand and respect human intention
Mentoring dozens of companies
Context Aware Platforms

Demonstrations and design tools for recognizing and respecting intention across domains and scenarios

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1. Annotated smart kitchen
   Recognizing and coaching activity in kitchen
2. Alzheimer’s Living Center
   Adaptive interface to support communication for people with dementia
3. Attention vending machine
   Socially interpreted interactive media in a vending machine
4. Audio interface tool
   Tool for exploring audio interface for voting and telephones
5. Attention meter
   Camera input for interactive
6. Bike alert
   Auto system for telling bike car door might open
7. Car coach
   Feedback to improve driving
8. Climbing interface
   Platform for museum interactive
9. Context builder
   Context aware application engine
10. Considerate thing
    Sensor/electronics platform for making considerate things
11. Chameleon tables
    Computer interactive tables with height control and sensing
12. Digital cigarette
    Motivation and relationship building demonstration
13. Disruption manager
    Semantic based system to mediate desktop interactions
14. Driftcatcher
    Socially aware email annotation interactive
15. Dishmaker
    Recycling kitchen manufacturing
16. e-Bed
    Eye gesture based GUI
17. e-Clay
    24 degree of freedom design input tool
18. e-Floor
    Socially aware floor interactive
19. e-Helmet
    Wearable for mediating communication for bicyclist
20. e-Threshold
    Context aware receptionist
21. EyeaRe
    Glasses that can tell interest alertness
22. Exercar
    Pedaling accelerator improves acuity and reduces fatigue
23. Face Interface
    Caricature teaching of facial gesture interface affordances
24. Gesture music ball
    Instrument builds itself for you
25. Haptic tuner
    Adaptive feedback to coordinate and improve peoples musical collaboration
26. Interruption Manager
    GUI mediation for any platform
27. Kitchen phone
    System to control and enhance grocery experiences
28. Low Error Voting Interface
    Eye gesture based preference system
29. Media jukebox
    New approach to ballot design for improved access and accuracy
30. Media windshield
    Model and feedback smart interactive for selection of media
31. Minerva
    Augmented reality car
32. Mobile essence
    Viewing food to suggest recipes
33. MrWeb
    Meeting collaboration support system
34. PlaceMap
    Collaborative web tools
35. Power bra
    Location aware engine
36. Secure Architecture For Voting Electronically
    Power harvesting system collects 1 watt from breathing
37. SMS mediator
    New approach to reliability/security
38. Smart dice
    No cell phone software meeting mediator
39. Smart sink
    Progressive math teaching interactive
40. Smart spoon
    Sensors for teaching cooking
41. Smart refrigerator
    Sensing use of sink for ease and safety
42. Smart utensils
    Energy reducing, food improving preservation
43. Talking Trivet, e-sleeve, shoulder pet
    Sensing to teach and coach food preparation
44. Thought for food
    One sensor systems that react to intention
45. USPS concept truck
    Systems to use common sense and feedback to interact with food and recipe
46. Voyager
    Annotation, location awareness support for commercial delivery, (8 demos)
47. Voyager
    Location aware system for interactive campus, grocery store, etc.
48. Wireless dashboard
    Harvested power for sensing and control
Care from others or care for ourselves?

- WOW … you are an intimidating: for your abilities!
- We want things to feel good about ourselves and impress others
- What does it take to understand us enough to help?
- LEARN, TRY, DO

R & D
- Voice robot at VA
- TrackPoint..
- OS/2 Special needs package
- E-bed
- Pedaling car
- Voting audio improvements
- Ballots for cognitive disabilities
- Singing prosthetic
- Autism teaching system

For individuals
- Tom Whitakers prosthetic
- Car for 4 foot woman
- house adaptations
Finger Control Everywhere!

In Keyboard Pointing
Remote Controls
Air Traffic Control
Surgical Instruments
Haptic pointer
Sightless Pointing
Prosthetics pointing
Steering
Two Handed
Industrial Controllers
Arcade Games
In Mouse Scrolled
Trackpoint: Knee bars and race cars

- Knee bar better than mouse for novices? Mouse takes 1.7 seconds to grab
- Joysticks have always had over-shoot problems people want to drive a Ferrari .. but they crash it
- TrackPoint; 10 years of human factors work ergonomic, ambidextrous device
- Matching human visual and motor abilities
TrackPointIII

- Grippy Top
  - Consistent grippiness
- Drag Buttons
  - Aids to fine pixel manipulation
  - Aid to people with Special needs
- Negative Inertia
  - more precise
  - faster getting to object
Towards a Behavioral Motor Match

- Placement
- Eye Tracking
- Wiggly Fingers
- Going Fast
- Movement Feedback
- Gripiness
- Mouse Lockout
- One handed use
  - Locking buttons
  - 3D TrackPoint
• Where We Use Computers

• Wishes from Eye Gestures
  • Closed: going to sleep
  • Open: no alarm
  • Blinks: doesn’t like something
  • Wink: selection
  • Stare: interest
  • Gaze: thinking

Sleep With Your Computer?

MIT Researcher Computerizes Life

This bed, invented by an MIT scientist, has many high-tech features. (ABCNEWS.com)

April 10 — Imagine a bed that gently wakes you up at the crack of dawn and reminds you of your upcoming appointments.
• Activities to interact with people with dementia

• Public Television Network:
  Living Center interactive website: http://www.pbs.org/theforgetting
ALZ: Productively Challenged, Critically sophisticate

- Room
- Places
- Puzzle
- Arranging flowers
- Art
- Radio
- Catalog
VTP improving voting process

Profs: Ted Selker, Mike Alvarez, Ron Rivest, Charles Stewart, Steve Ansolabehere, Steve Graves, Dan Jackson, Michael Siegel, Jonathon Katz,++

Soyini Liburd, Ben Adida, Joy Marie Forsythe, Bil Lewis, Sarah Sled, Jon Goler, Sharon Cohen, Betsy Sinclair, Gary Sivek, ++
Reducing lost votes Universally

• Accessible voting places!
• People select at eye level
• Perceptual, Physical, Cognitive

AAPD Thomas Paine award for voting 2006
Physically Accessible?
Selection accessibility

• All voting technologies losing votes today
  – Typically 1 mistake in 30 selections
    • Easy to reduce by 50 to 80%
• Reading Disabilities 14%
  – Multiple times the errors of able bodied
• Short term memory problems 6.5%
• …
LEVI VS Standard DRE

- 50% fewer errors
- Highly preferred
Cognitive Science meet sightless voting shouldn’t take 45 minutes

- Voices
- Voice changes
- Earcons
- Environmental sound
- 3D sound
- …
What does a designer do?

Necessity: mother of invention?

- Plan to create something?
- Limits to planning
  - Practice helps (chess)
- Empathy does it exist?
  - I know what the designer will do
  - I know what the engineer will need
  - I know how this will be used
- Assign a designer?
  - Domain, evaluation and technology matter
Camp Invent!  
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- Invention
  - Things are made of other things by us
- Mechanical
  - Visible and understandable
- Electricity,
  - Invisible things can be understood
- Other things,
  - Taking apart, fixing and salvaging to learn
- Inventing
  - Defining problems,
  - Finding the things to realize them
  - Modifying with what you find and learn
Invention:
things are made from other things

• Wizard of oz?
  – Imagine It exists
  – Make it a skit with props
    • Savor when the skit doesn’t work
  – Gradually make the props more sophisticated
  – Even real products have props

• Problem: Mom’s hands were burned
  – Open Fridge, drawers
  – Dial Phone
  – Care for and carry baby ...
Invention is a performance

Personal credo

- Inventing is like an action movie
  - Grab for a branch, it brakes, land in the water and swim…
  - The way it doesn’t moves you forward
- Audition Stories and roles
  - Think of many possible ways out
    - keep thinking about it
- All the world is a stage.
  - Slowly replace pantomime for real sets and actors
- Have things/ideas compete not people
- Pretend things are the way you want them
- Create it from anything
  - All tools are made of other tools
  - Prototype here and now
What do we want

- Congruence,
  - Personal comfort
  - Personal image
- Add things to use or carry?
- Reduce transcription
Wearable technology not news

- Telemetry has been with us 40 years
  - Now cheap ($35 temperature pill)
  - Enzymes on capacitor coming
- Telemedicine becoming common
  - 6 million web upgradeable pacemakers in use
- Hearing aids (three on plane)
- Patch drugs ubiquitous
- Tattoos are in (public key code ...)

[Image of a person in a winter setting, possibly related to the topic of wearable technology.]
Bike for amputees…
to use back and thighs?

• Stump socket and upper chest holder
• Sliding seat power
• On and off???
• Future Feel of Tools

• Complete freedom