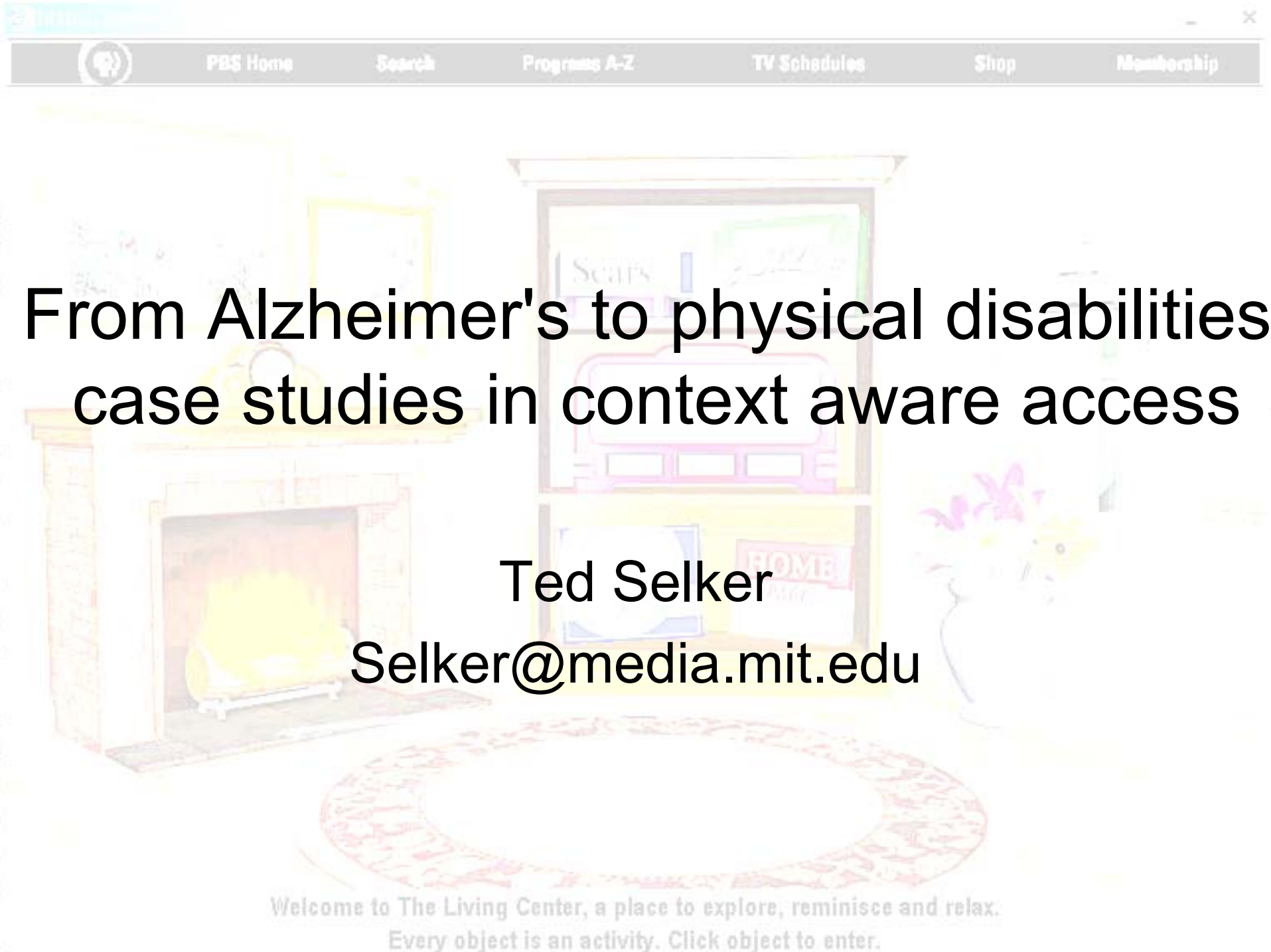
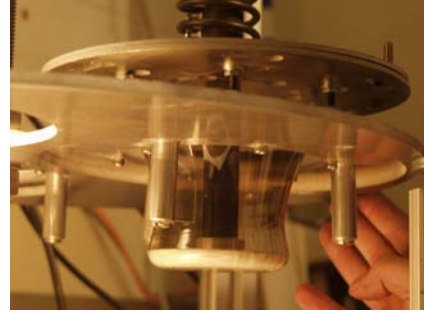


From Alzheimer's to physical disabilities case studies in context aware access

Ted Selker

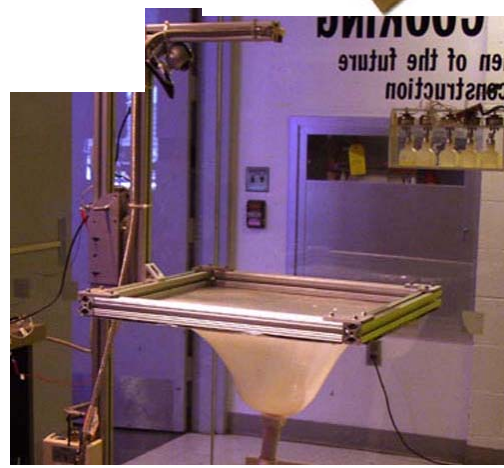
Selker@media.mit.edu



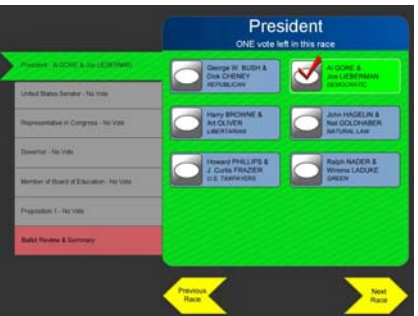
Context Aware Computing group

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

Ted Selker
Selker@media.mit.edu

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.	Invision	Eye gesture based preference system
29.	Low Error Voting Interface	New approach to ballot design for improved access and accuracy
30.	Media jukebox	Model and feedback smart interactive for selection of media
31.	Media windshield	Augmented reality car
32.	Minerva	Viewing food to suggest recipes
33.	Mobile essence	Meeting collaboration support system
34.	MrWeb,	Collaborative web tools
35.	PlaceMap	Location aware engine
36.	Power bra	Power harvesting system collects 1 watt from breathing
37.	Secure Architecture For Voting Electronically	New approach to reliability/security
38.	SMS mediator	No cell phone software meeting mediator
39.	Smart dice	Progressive math teaching interactive
40.	Smart spoon	Sensors for teaching cooking
41.	Smart sink	Sensing use of sink for ease and safety
42.	Smart refrigerator	Energy reducing, food improving preservation
43.	Smart utensils	Sensing to teach and coach food preparation
44.	Talking Trivet, e-sleeve, shoulder pet	One sensor systems that react to intention
45.	Thought for food	Systems to use common sense and feedback to interact with food and recipe
46.	USPS concept truck	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

Interactive floor by MIT Media Lab. Installation by Archi-Tectonics.

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

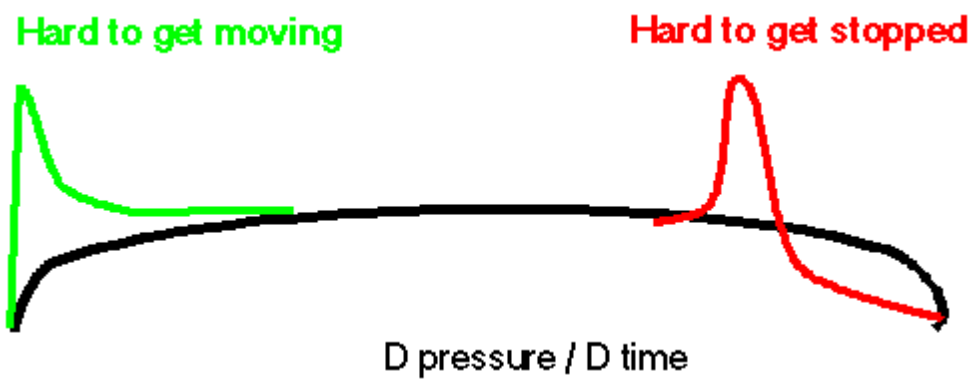
TrackPoint

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

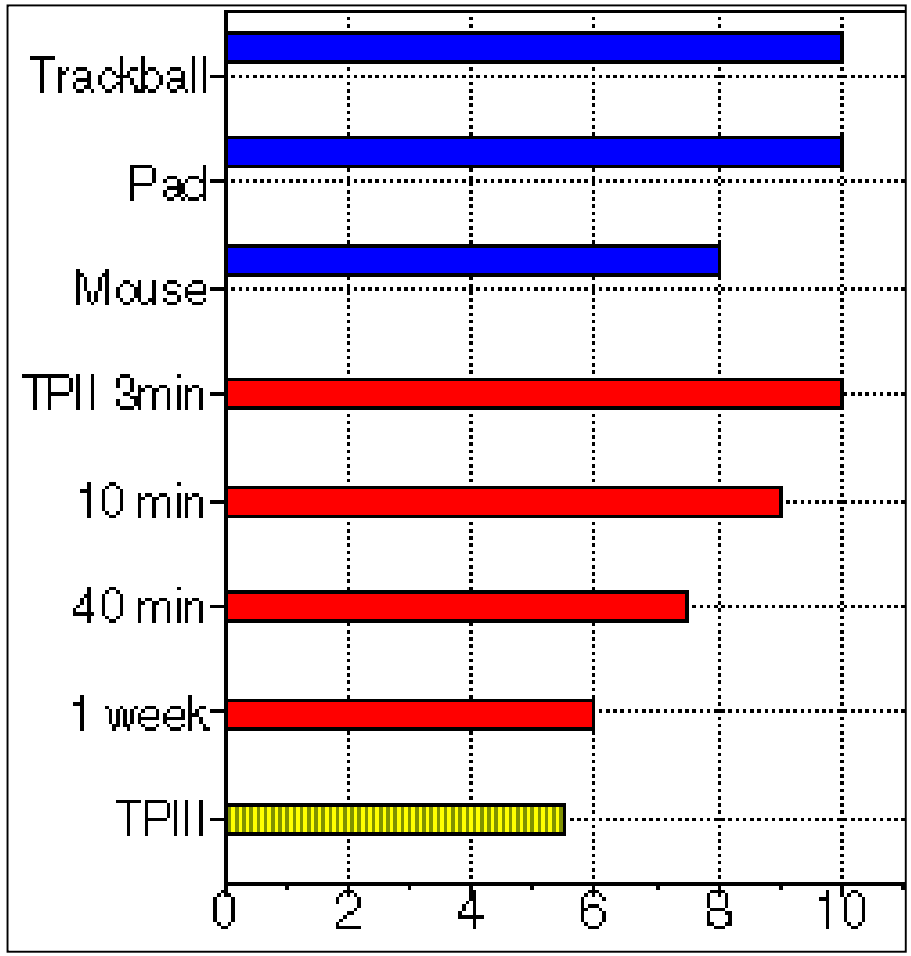
TrackPointIII

- 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



Select and Type

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

abcNEWS.com

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.

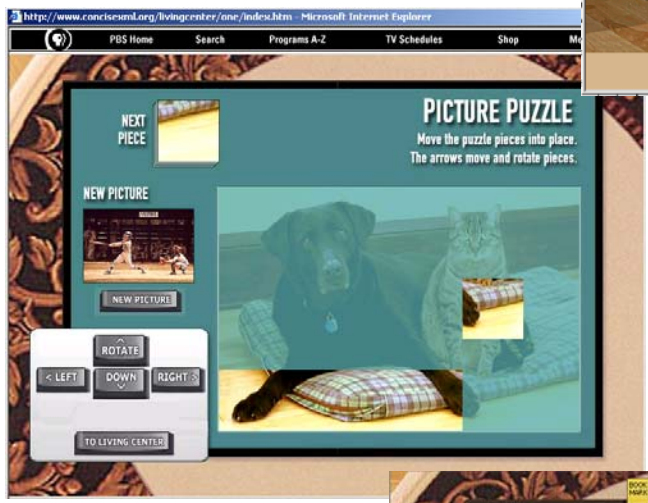
- Activities to interact with people with dementia

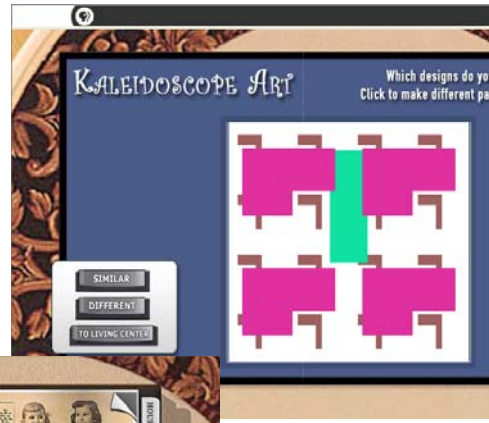
- Public Television Network :

Living Center interactive website: http://www.pbs.org/theforgetting

ALZ:
Productively Challenged, Critically sophisticate

- Room
- Places
- Puzzle
- Arranging flowers
- Art
- Radio
- Catalog

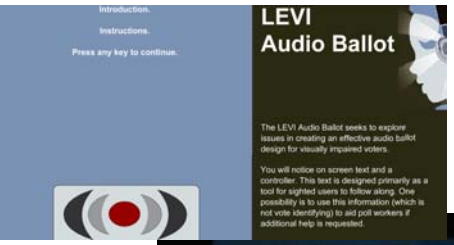


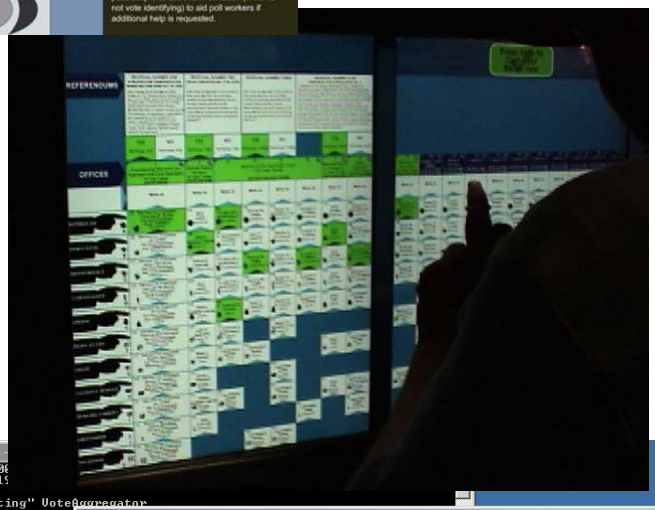


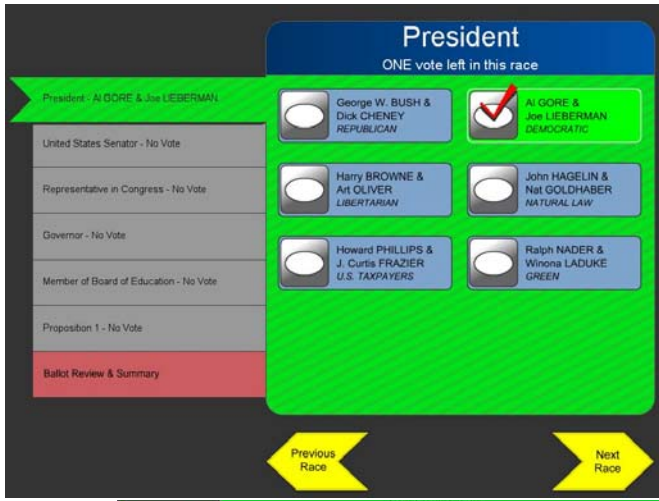
VTP improving voting process

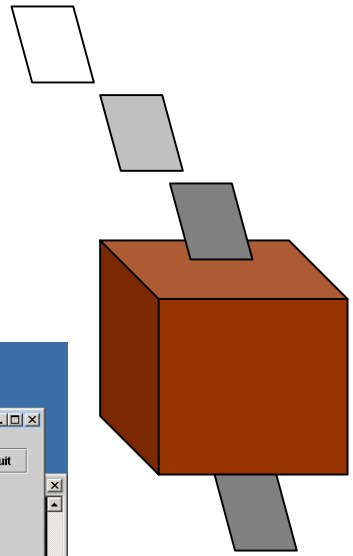
Profs: Ted Selker, Mike Alvarez, Ron Rivest, Charles Stewart, Steve Ansolabehere, Steve Graves, Dan Jackson, Michael Siegel, Jonathon Katz,++

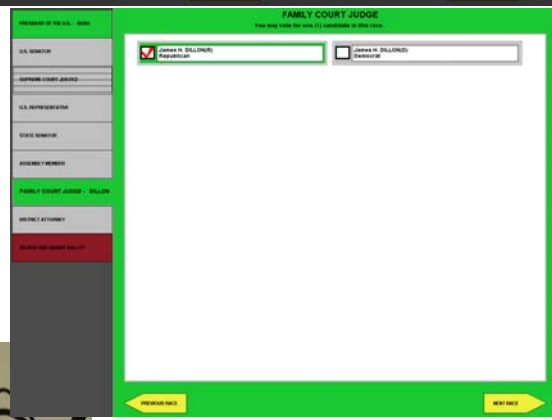
Soyini Liburd, Ben Adida, Joy Marie Forsythe, Bil Lewis, Sarah Sled, Jon Goler, Sharon Cohen, Betsy Sinclair, Gary Sivek, ++

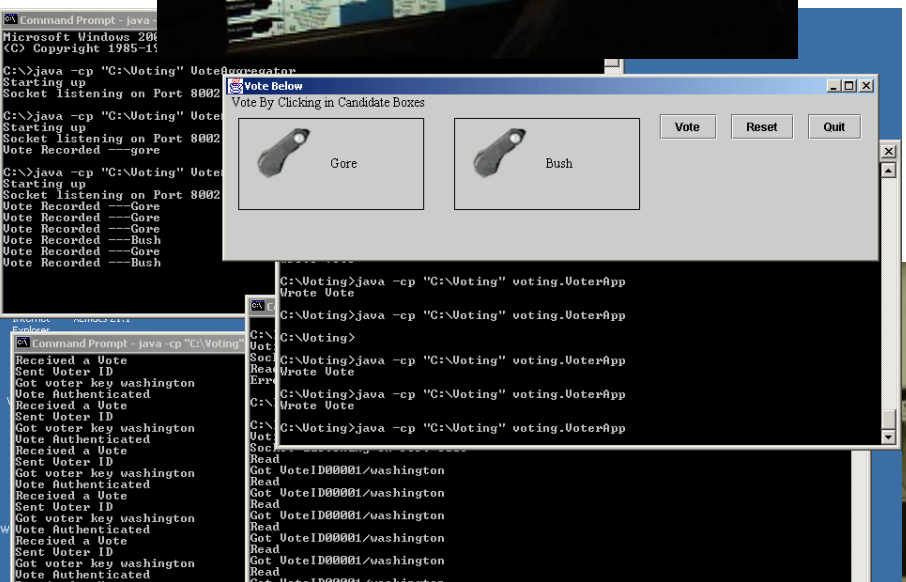












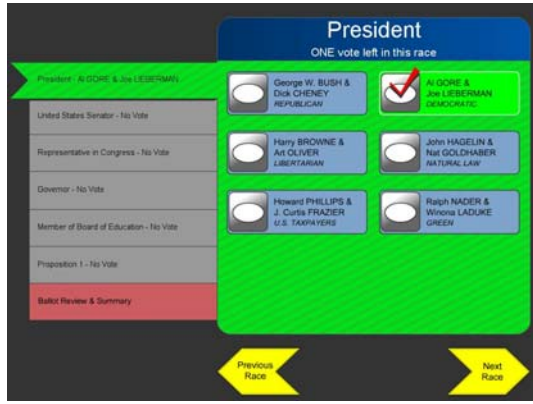
Reducing lost votes Universally

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

AAPD Thomas Paine award for voting 2006

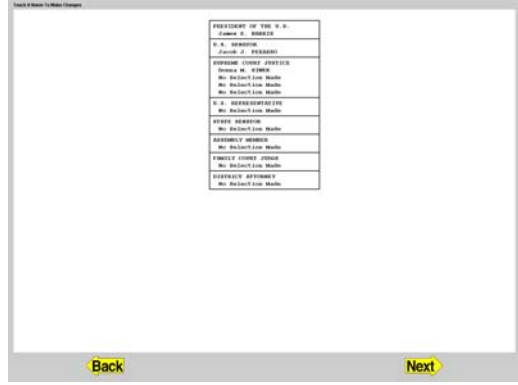
Physically Accessible?

Selection accessibility

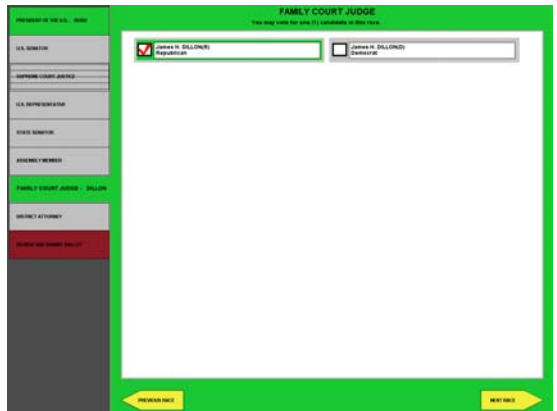


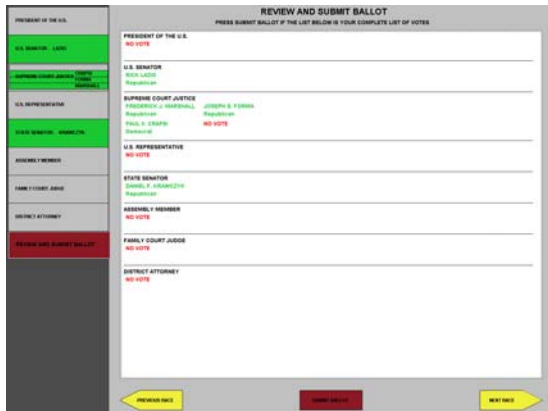
- All voting technologies losing votes today
  - Typically 1 mistake in 30 selections
    - Easy to reduce by 50 to 80%
- Reading Disabilities 14%
  - Multiple times the errors of able bodied
- Short term memory problems 6.5%
- …

LEVI
VS
Standard DRE



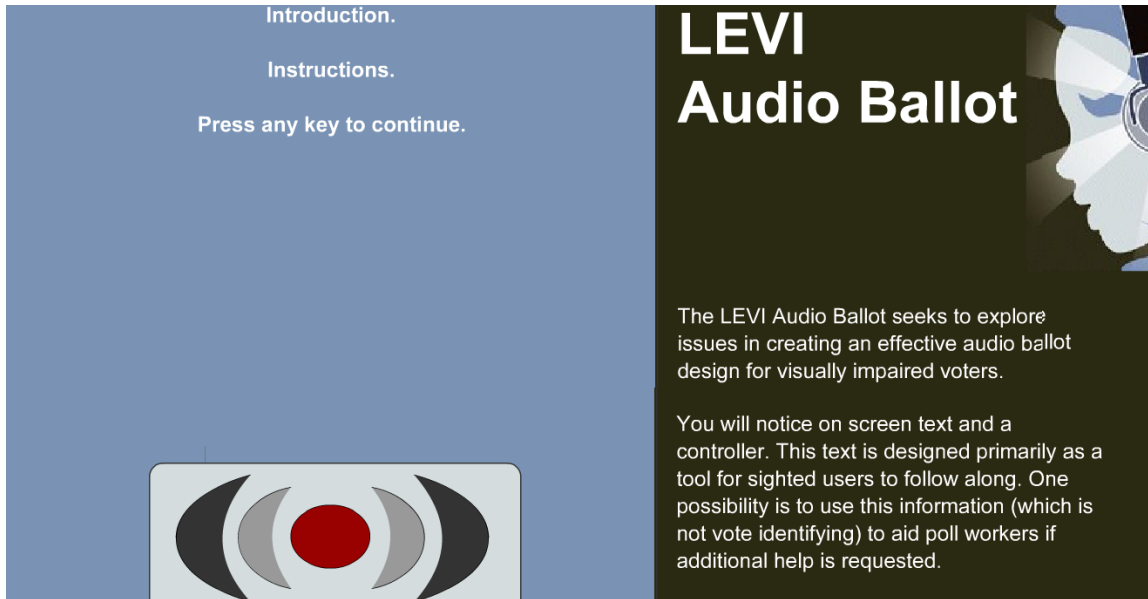
- **50% fewer errors**
- **Highly preferred**





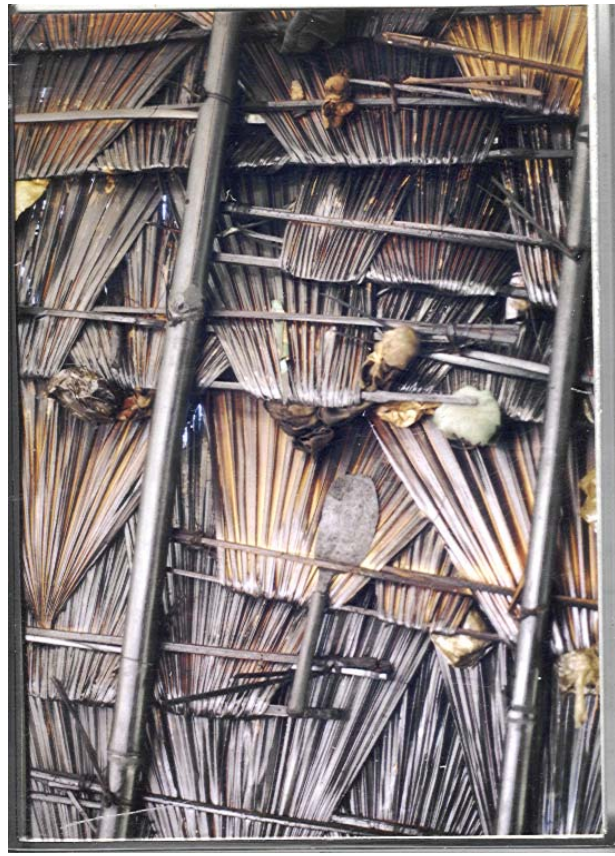
Cognitive Science meet sightless voting shouldn’t take 45 minutes

- 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!

Ted Selker
Selker@media.mit.edu

- 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

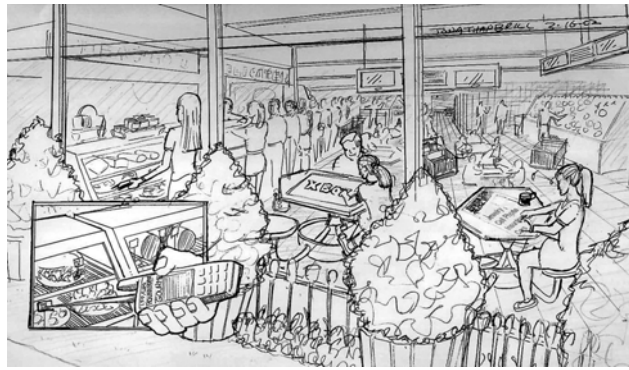
Invention:
things are made from other things

- 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

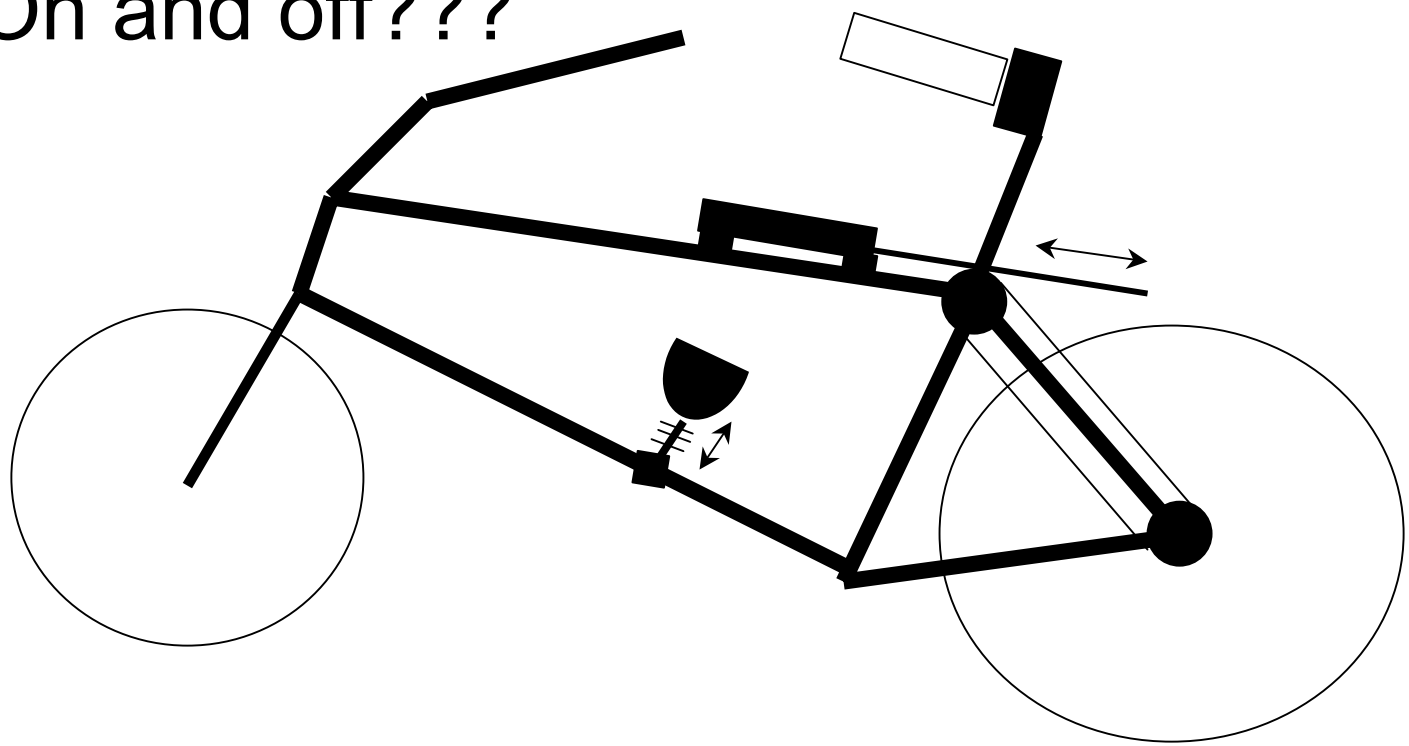
- Congruence,
  - Personal comfort
  - Personal image
- Add things to use or carry?
- Reduce transcription

Wearable Technology not news

- Telemetry has been with us 40 year
  - Now cheep ($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 …)

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**