Do paper trails help?
CalTech/MIT Voting Project
Ted Selker selker@media.mit.edu

- Familiarity / (Complexity + import)
- Perceptual & Motor Accessibility
- Feedback
- Consider Review and Change
Caltech/MIT voting project

Votes that could counted…
The process has to want the votes

Registration 1 - 3 million +
Registration is obsolete?

Confusing ballot 1 - 2 million
Incumbent top on ballot?

Polling place operations 1 million
Intermediaries improve confidence?

Absentee ballots ??
Rampant coercion?

Stolen or changed?
People make mistakes

Nov 2000 Votes
Technology isn’t only problem

- Cook county card undercount variation .75 % to 39% no random!
- Paper 1.8%
- Punch Card 2.5
- Optical Scan 1.5
- Lever Machine 1.5
- DRE 2.3

Technology we have been making

- XML registration database verifier
- SAVE Secure Architecture for Voting Electronically
- Game machine Voting machines
- Smart Ballot design system
A+ checklist & Performance Standards

Knowledge and Action will help

- Usability standards history: Test with appropriate methods
  - New designs compared to performance bar
  - Many problems found in tests with few people

- Perceptual & Motor Accessibility
  - Perception, Cognition, Action, Social factors

- Feedback
  - Physical, Memory, Emotion

- Consider, Mark, Review, Change and Deposit - Coercion
Perception & Motor Problems in 2000 Elections

- **Distinguish ability**
  - Ambiguity: mislabel, association
  - Alignment
  - Viewable height/position in list
  - Poor audio: 1... to select gore 2... to select Bush
  - Democrats under “Republican” NY
  - Wrong odometer Boston
  - Everywhere
  - Accessibility?

- **Feedback and Side effects**
  - Action
  - Undo … action symmetry?
  - Visual (x not counted)
  - Completion
  - Several levers below referendum
  - Punch cards, marked ballots…
  - Optical Scan
  - All but lever

- **Validation**
  - Counted
  - Ballots, Registration - In trunks

- **Mechanical**
  - Difficult to pull, push, turn grab or reach
  - Dexterity, accuracy,
  - Button pressure
  - Philadelphia …
  - Punch cards!
  - DRE
Interaction design

Many Voting Problems Not Unique

- **Perceptual**
  - **Graphical**
    - View ability, Color, contrast, size,
    - Readability, Distinctions, Distinguishably
  - Precognitive, cognitive,
  - Feedback; Proprioceptive,

- **Cognitive Interface**
  - Precognitive recognition issues, Recognition VS Recall (except when conflicting)
  - Short term memory 7 +- 2 (in 2 d), depth of info 2 or three
  - Cognitive load, syntactic, semantic. bored … overloaded

- **Social issues**
  - You are doing Great…
  - Your Vote Matters
  - Androgynous Voice…

- **Cognitive Styles**
  - Verbal/Visual
  - Procedural/Conceptual
  - Myers Briggs
  - Physical, perceptual, psychological, neurological
“Bad ballot design gave highest error rates”

Keeting et al

- Two line names
- Size
- Crossing two columns
- Two-page designs
- Running partner in same font
- Position
- Language (YES NO)
Voters oriented and able to focus

Please make your selection for President
Click on a candidate's name to select them, or click on a selected candidate to de-select them. Your selection will be indented and darkened.

- AL GORE
- GEORGE W BUSH
- RALPH NADER
- No Choice
- Write In

I'm Finished
Voters oriented and able to focus
Voters oriented and able to focus

Please make your selection for US Senator
Click on a candidate's name to select them,
or click on a selected candidate to de-select them.
Your selection will be indented and darkened.

- Edward Kennedy
- Jackie Robinson
- Loony Independent
- No Choice [SELECTED]
- Write In

I'm Finished
Best of Breed Experience
registration, authentication, inform, intention, counting

- Best practices ameliorate problems
  - Getting filling out reviewing, changing and verifying deposit of ballot

- All Interfaces can be improved
  - Voter scan cards/paper,
  - take pictures of odometers…
  - Current DRE’s can change software
  - Hot voting machines in a trailer

- Best of breed interaction designers
  - Shadows, short term memory

- Best of breed testing
  - Test on 1 to 5 people first
  - Different tests/people for different stages/purposes
Problems have not been voter verifiable

- Brevard 4000 Back end software
- Volusia 16022 Back end software
- Boone County 10000 Back end software
- Washington State Altered paper ballots
- Dallas Destroyed paper ballots
- Many places replaced paper ballots
- Georgia Not close enough to recount
- Indiana ? User interface (Straight vote)
- Recent Republican shown on UI
- Mail in Absentee No secrecy
Problems with a separate paper trail.

People can’t verify their receipts: Chicago (2002, 2003)

- Connection broken
- Paper out
- Paper Jam
- Ink out
- Printer broken
- Paper looks different
- Different format than DRE
- Separate thing to look at
- Extra time & step for voting
- No way for ballot worker to help

- Lighting, readability
- Special needs (Dyslexia, ADHD, blind)
- Several extra steps for ballot worker
- Collecting the ballots
- Ballots could be exchanged
- Revoting a machine at end of day
- Rereading ballots
Problems are normal

Experience is not enough;
metrics and interaction design expertise needed

- Admin & registration 20+% incorrect?
  - 2 of 3 motor can be registered

- Setup
  Complex but uncommon

- Voting difficulty matters:
  - Perceptual, Cognitive and Physical Special Needs
  - 11PM voting (1 minute or only vote for…)
  - Separate decision from information?

- Advocacy
  - palm cards
  - Absentee
  - …

- Backend
  - Bear kept them from submitting ballots, behind a door
  - Reporting tallies, Volusia…
  - Un controlled computer rooms …
Ways to foil paper trails

- Disenfranchise in all the normal ways
  - Registration, ballot design,
- Change, lose, or add paper
- Question paper result in any way
- Print what they want to see (but don’t check)
Coersion?

- *We* disagree so lets neither vote
  - ✓ 15 years later one spouse had been voting all along
- Ballot marking parties at churches
- *We* like this guy
  - ✓ Said a 45 year old child to their parent in a voting booth
- Nursing homes
  - ✓ *They* have a right to vote
- Palm cards
- Precinct Captain
- Ballot layout
- Order on Ballot
- Stand in voters

- Humiliation,
- Intimidation,
- Hand over hand voting
- Misinformation
- Parallax and other physical access
  -(arm extension)
Defense in Depth?

- Registration?
- Access to polling machine
- Orienting and focusing to know
- No coercion (other hands, palm cards, money...)
- Actions and undo obvious and available
- Feedback that is interpretable
- Obvious chance to consider and change
- Demonstration that the vote was recorded
Reference Platform: Brazil

*Renewed belief in government!!*

- **Electronic voting; 96, 98, 2000**
  - 96 Unisys 7% failure
  - 98 Procomp
  - 2000 Procomp .02% failure 106,000,000 votes

- **Trusted Scientific organization**
  - Create requirements

- **Trusted Technical organization**
  - Create reference platform

- **Companies (5)**
  - Create demonstratable products for bid

- **Government election officials**
  - Create open viewing and decision of vendor
What will improve Voting

- Follow Brasil’s example (associate with best scientists)
- Separate Election commission, Equipment manufactures and design activities
  - Funded requirements gathering team outside election commission
  - Funded reference platform coding team outside election
  - Equipment inexpensive and replaceable through open competitions
- Performance based standards:
- All standards are relative to best of breed
Bringing in the HCI community
Ted Selker, technologist
Selker@media.mit.edu

Workshop on Elections Standards Technology Conference 1/31/2002

- Doug Jones
  - Systems and ballot design
- Connie McCormack
  - What happens and what registrars want
- Clyde Terry
  - Universal Design
- Ben Bederson
  - How it could look
- Cliff Nass
  - Work with me please...
- John Cugini
  - Focusing on Voting and usability
- Paul Herrmann
  - Focusing on Voting and usability
- Ted Selker
  - Demonstrating usability improvements

ACM CHI Pannel on User interface in Voting 1/31/2003

- Eric A. Fischer,
- Benjamin B. Bederson,
- Conny McCormack,
- Clifford Nass,
- Ted Selker

NIST 12/11/2003
New Technology and Testing

*Sorry partisans;*
Defense in Depth

- Registration and Registration Checking
- Polling place worker training materials
  - LA simple procedures, Chicago vague concepts
- Ballot design (guidelines, experts and testing)
- Simple voting technology that makes it easy
  - Secure Architecture for Voting Electronically?
  - Specially handled Standard game machines or PCs?
  - Never before used
  - Each one has its own CD
- Funded innovation everywhere (contracts & prizes)

...Information and long voting times could reduce coercion