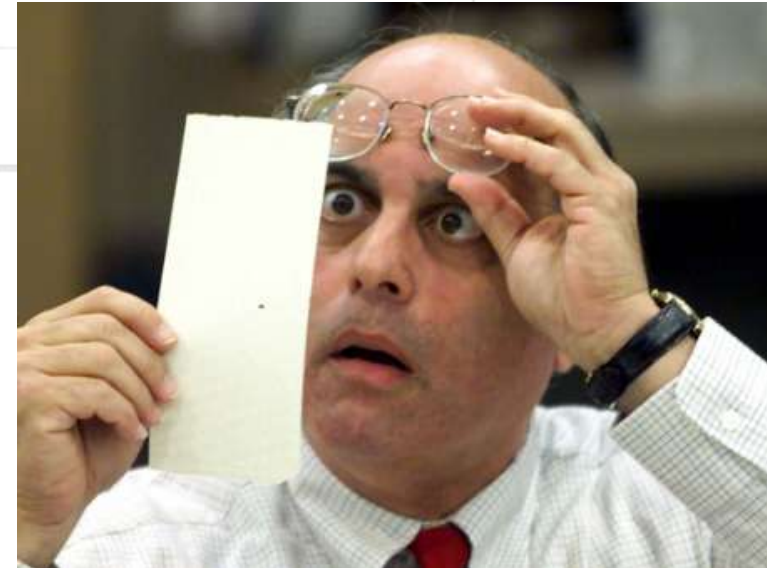# Do paper trails help?
## CalTech/MIT Voting Project
## Ted Selker selker@media.mit.edu

❑ Familiarity /(Complexity + import)

❑ Perceptual & Motor Accessibility
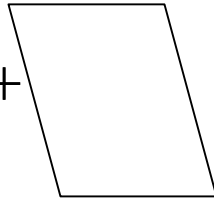
❑ Feedback

❑ Consider Review and Change

Registration 1- 3 million +
*Registration is obsolete?*

Caltech/MIT voting project
Votes that could  counted…
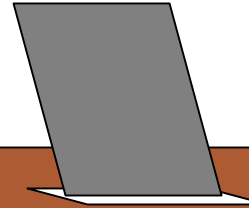*The process has to want the votes*

Confusing ballot 1 - 2 million
*Incumbent top on ballot?*
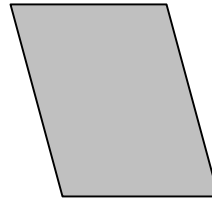
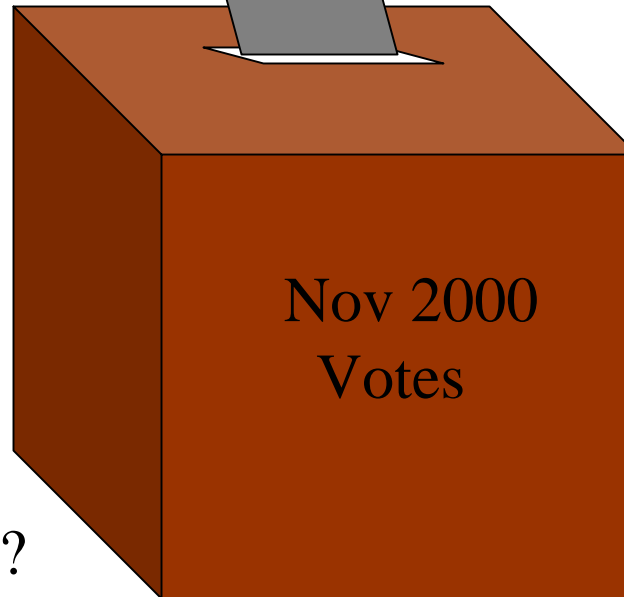Polling place operations 1 million
*Intermediaries improve confidence?*

Absentee ballots ??
*Rampant coercion?*

Nov 2000
Votes

Stolen or changed?
*People make mistakes*

# 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

UI readers

Authenticators                      Verifiers

Databases
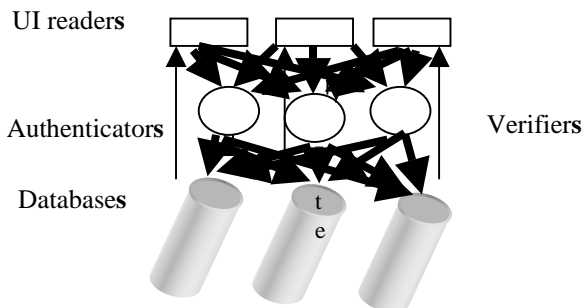
- ❑ Token
- ❑ Pointers
- ❑ Slider
- ❑ Check Lever
- ❑ Ecology
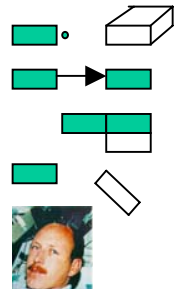
# A+ checklist & Performance Standards

*Knowledge and Action will help*

| hi | hi | hi | hi | hi | hi | hi |

❑ 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
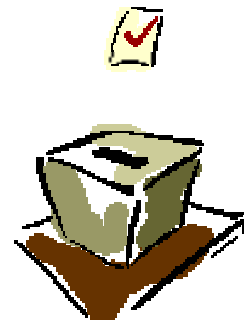
❑ **Distinguish ability**

    ✓ Ambiguity: mislabel, association        Democrats under "Republican" NY

    ✓ Alignment        Wrong odometer Boston

    ✓ Viewable height/position in list        Everywhere

    ✓ Poor audio: 1 ... to select gore 2…to select Bush        Accessibility?

❑ **Feedback and Side effects**

    ✓ Action        Several levers below referendum

    ✓ Undo … action symmetry?        Punch cards, marked ballots…

    ✓ Visual      (x not counted)        Optical Scan

    ✓ Completion        All but lever

❑ **Validation**

    ✓ Counted        Ballots, Registration - In trunks

❑ **Mechanical**

    ✓ Difficult to pull, push, turn grab or reach        Philadelphia …

    ✓ Dexterity, accuracy,        Punch cards!

    ✓ Button pressure        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 Maters

    ✓ Androgynous Voice…

❑ **Cognitive Styles**

    ✓ Verbal/ Visual

    ✓ Procedural/Conceptual

    ✓ Myers Briggs

    ✓ Physical, perceptual, psychological, neurological

# "Bad ballot design gave highest error rates"

Keeting etal

- ☐ 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

# Voters oriented and able to focus

# Voters oriented and able to focus

# 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.

<span style="color:magenta">People can't verify their recipts: Chicago (2002, 2003)</span>

- 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 demonsratable  products for bid

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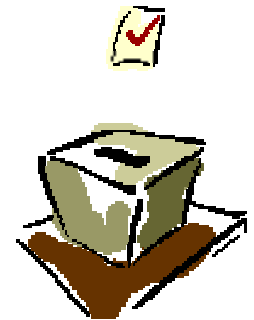
# What will improve Voting

❑ Follow Brasil's example (assoicate 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                                   Iowa Election Board
  - ✓ Systems and ballot design
- ❑ Connie McCormack                          LA Registrar
  - ✓ What happens and what registrars want
- ❑ Clyde Terry                                 NH Disabilities Council
  - ✓ Universal Design
- ❑ Ben Bederson                               UMD HCI Lab
  - ✓ How It could look
- ❑ Cliff Nass                                   Stanford Communication Dept
  - ✓ Work with me please…
- ❑ John Cugini                                 NIST Visualization Lab
  - ✓ Focusing on Voting and usability
- ❑ Paul Herrnson                           UMD Political Science
  - ✓ Focusing on Voting and usability
- ❑ Ted Selker                                 CalTech/MIT Voting Technology Project
  - ✓ Demonstrating usability improvements

## ACM CHI Pannel on User interface inVoting 1/31/2003

- ❑ **Eric A. Fischer**,            Congressional Research Service, Library of Congress s, efischerR@crs.loc.gov
- ❑ **Benjamin B. Bederson**,    Human-Computer Interaction Lab, University of MD, bederson@cs.umd.edu
- ❑ **Conny Mccormack,**        Registrar-Recorder /County Clerk, LA County CA , cmccorma@rrcc.co.la.ca.us
- ❑ **Clifford Nass**,               Department of Communications, Stanford University,
- ❑ Ted Selker                    CalTech/MIT Voting Technology Project

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