One Machine, One Vote for Everyone

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Background

✓ 2000 Presidential Election
  ➢ Debacle
  ➢ Recounts ... Remember those?
  ➢ Voter intimidation and trust
(REPUBLICAN)
George W. Bush - President
Dick Cheney - Vice President

(DEMOCRATIC)
Al Gore - President
Joe Lieberman - Vice President

(LIBERTARIAN)
Mary Browne - President
Art Olivier - Vice President

(GREEN)
Ralph Nader - President
Winona LaDuke - Vice President

(SOCIALIST WORKERS)
James Harris - President
Margaret Trowe - Vice President

(REFORM)
Pat Buchanan - President
Ezola Foster - Vice President

(SOCIALIST)
David McReynolds - President
Mary Cal Hollis - Vice President

(CONSTITUTION)
Howard Phillips - President
J. Curtis Frazier - Vice President

(WORKERS WORLD)
Monica Moorehead - President
Gloria La Riva - Vice President

WRITE IN CANDIDATE
Background

- **Punch Cards**
  - Used in the US in 1890’s to do census
  - Adapted in the 1960’s to be used for voting

- **How it works**
  - Votomatic
  - Datavote

Image taken from Douglas W. Jones’ Website at U. of Iowa
Hanging Chad

Image taken from Douglas W. Jones’ Website at U. of Iowa
Pregnant Chad

Image taken from Douglas W. Jones’ Website at U. of Iowa

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- The voter’s intent was not accurately captured and after the voter left the polling place, the intent was lost.

- As a result, people moved to more electronic voting machines
  - Optical Scan Machines
  - Direct Recording Equipment (DRE)
Background

✓ Elderly and disabled users
  ➢ UI hard to read
  ➢ Touch screen issues ... vote flipping
  ➢ 2002 Help America Vote Act (HAVA)
    ➢ Requires all Citizens equal access to vote

✓ 2006 Mid-Term Elections
  ➢ Delayed decision in Sarasota County, Florida
    ➢ 18,000 undervotes, 15% of voters failed to vote for either candidate
  ➢ Other problems with accessibility and long lines

✓ Paper ... The Issue
  ➢ To Print or Not To Print?
Issues With Paper

✓ Ballot Design
  ➢ The ballot design caused several issues in 2000

✓ Lost, Stolen or Damaged
  ➢ Paper ballots were found in poll worker’s home
  ➢ 2000 election had damaged ballots (hanging chad)
Issues With Paper

- Manual recount ability
  - Recounts take a great deal of time and very difficult

- What about a voter-verified paper audit trail (VVPAT)?
Issues With Paper - VVPAT

✓ VVPAT Study at Rice University

- Participants counted completed VVPAT ballots which were based on those actually in use in DREs today.
- Two races from of a spool of 120 ballots were manually counted, which includes separating ballots from the spool and removing rejected ballots.
- This task was time-consuming and prone to high error rates, with only 57.5% of participants’ counts providing the correct election results.

Goggin, S.N. & Byrne, M.D., USENIX-EVT 2007 Workshop.
American Bar Association’s Commission on Law and Aging

✓ Working symposium in March 2007

- *Facilitating Voting as People Age: Implications of Cognitive Impairment*

- Experts in law and aging, medicine, long term care, voting technology, and elections administration on the topic, *Facilitating Voting as People Age: Implications of Cognitive Impairment*.

- This collection of multidisciplinary experts recommended:
American Bar Association’s Commission on Law And Aging

✓ Voting systems should be developed with the goal of achieving universal design, such that all voters in a given polling place, including voters with disabilities, can cast ballots on the same type of system, adaptable to multiple needs.

✓ The system should be universally accessible so that persons with any disability -- physical, sensory, cognitive, intellectual, or mental -- can vote privately and independently.
American Bar Association’s Commission on Law And Aging

- The system design should be clear, redundant, and multi-modal. If computers are used, they should display one race per screen.

- Voting systems should incorporate memory aids, include the full names of all candidates, include icons, produce the same type of ballot for all voters, and record voter selections anonymously.

- The efficiency, effectiveness, and satisfaction of the voter experience should not be degraded by the system used.
Voting Systems

✓ I define voting systems by generation.

✓ 1st generation systems are manually operated.
   ➢ Paper, levers, etc.

✓ 2nd generation systems use computers.
   ➢ DRE, Optical Scan

✓ 3rd generation systems are multimodal
   ➢ Prime III
Prime III

User Interface
Voter - Multimodal

✓ Multimodal Interactions
  ➢ Voters can speak and touch interchangeably
Voter

 ✓ Be accessible to a wide range of voters
   ➢ 2002 Help America Vote Act (HAVA)
   ➢ American Bar Association Recommendations
   ➢ Use multiple means of interaction (Touch, Voice, or Both)
   ➢ Large screen layout

 ✓ Voter can change vote
   ➢ Voter can change their vote at anytime before casting the actual ballot

 ✓ Voter verification is required
   ➢ Voters must confirm ballot (touch or voice)
Voter - Visual

✓ Large touch screens
  ➢ Large fonts
  ➢ Images or No Images
  ➢ Touchable Names

✓ Voter touches the screen to make selection
  ➢ Confirmation is visual

✓ Ballot layout is unique
  ➢ One race per screen
  ➢ Voters choose the order to vote on races
Voter - Verbal

✓ Headset
  ➢ The system speaks to the voter through the headset
  ➢ Conversation is confidential – no one can hear the machine’s speech, but the voter
  ➢ System’s speech is pre-recorded using ballot creation tool

✓ Embedded microphone in the headset
  ➢ Candidates are randomly assigned to numbers
  ➢ Voter speaks the number for a candidate
  ➢ Confirmation is verbal
Voter - Accessibility

- Sighted
- Blind
- Deaf
- Illiteracy
  - Sighted and Blind
- Physical Disabilities
  - Limited or no use of hands
  - For example, military wounded in Iraq, elderly, etc.

- All of these voters can independently vote!
Demo
Prime III

Nuts and Bolts
Nuts & Bolts

✓ Prime III, TouchScreen
  ➢ 100% Pure Java
  ➢ CMU Sphinx 4 Speech Recognition Engine
  ➢ Open Source

✓ Prime III, Telephone
  ➢ VoiceXML
  ➢ MySQL Database

✓ Prime III, Web
  ➢ Java
  ➢ X+V, see contest entry
Conclusion
Conclusion

✓ Multimodality can break into novel domains, e.g. voting

✓ There’s more than one way to do multimodality, but none of them are easy right now
  ➢ Java, X+V, C#, etc.

✓ Multimodality enables a broader user base.

✓ Standards are essential!
Questions???

HCCL
HUMAN CENTERED COMPUTING LAB

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