HCCL
HUMAN CENTERED COMPUTING LAB

Prime III
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   3➤

DICK CHENEY - VICE PRESIDENT

(DEMOCRATIC)

AL GORE - PRESIDENT   5➤

JOE LIEBERMAN - VICE PRESIDENT

(LIBERTARIAN)

HARRY BROWNE - PRESIDENT   7➤

ART OLIVIER - VICE PRESIDENT

(GREEN)

RALPH NADER - PRESIDENT   9➤

WINONA LaDUKE - VICE PRESIDENT

(SOCIALIST WORKERS)

JAMES HARRIS - PRESIDENT   11➤

MARGARET TROWE - VICE PRESIDENT

(REFORM)

➤ 4   PAT BUCHANAN - PRESIDENT

EZOLA FOSTER - VICE PRESIDENT

(SOCIALIST)

➤ 6   DAVID McREYNOLDS - PRESIDENT

MARY CAL HOLLIS - VICE PRESIDENT

(CONSTITUTION)

➤ 8   HOWARD PHILLIPS - PRESIDENT

J. CURTIS FRAZIER - VICE PRESIDENT

(WORKERS WORLD)

➤ 10   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
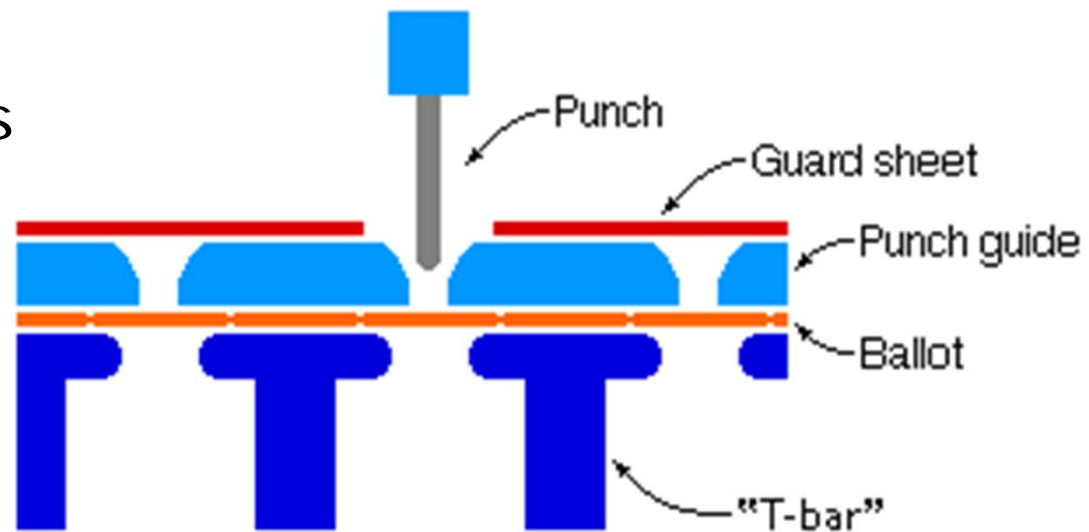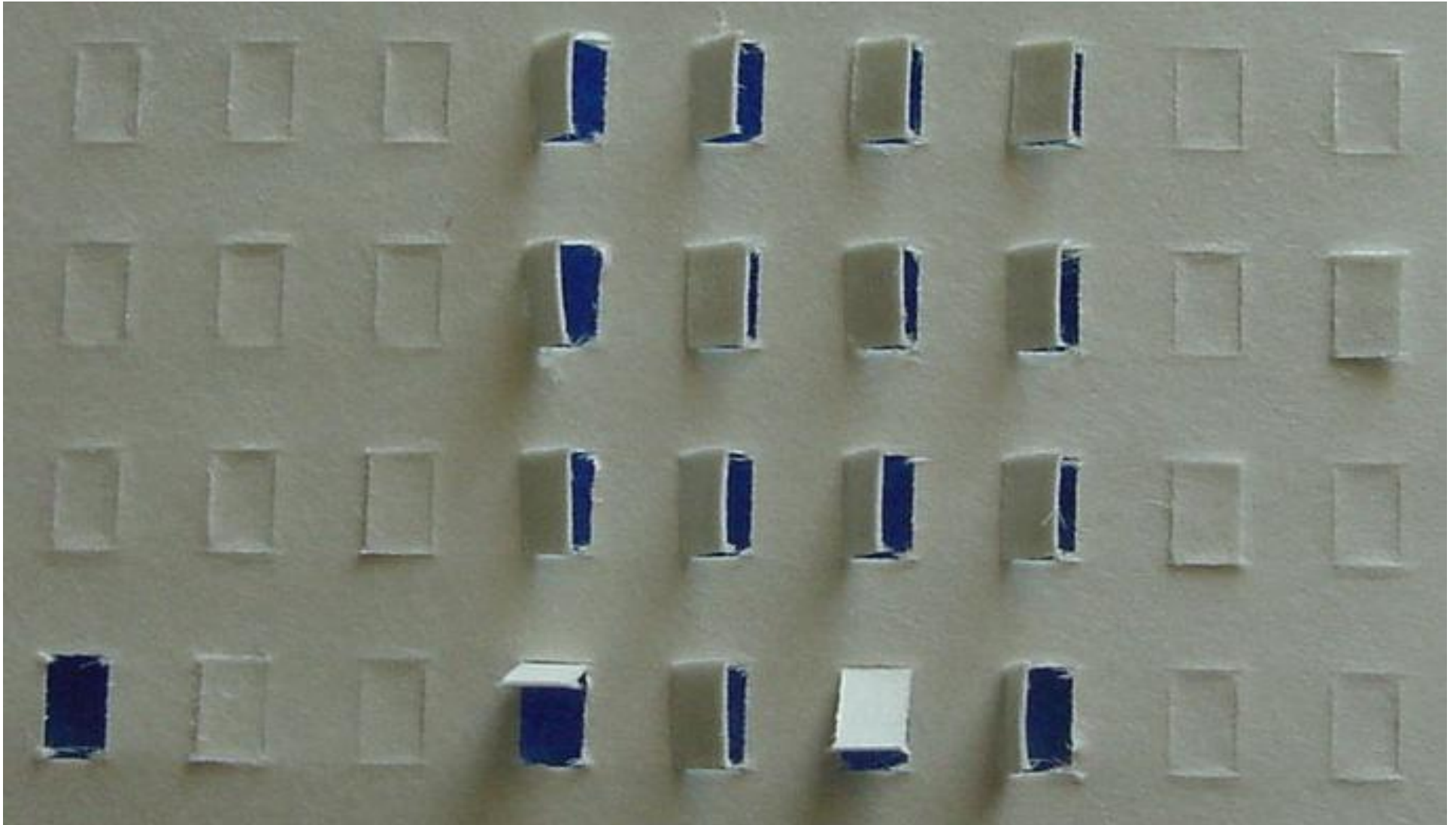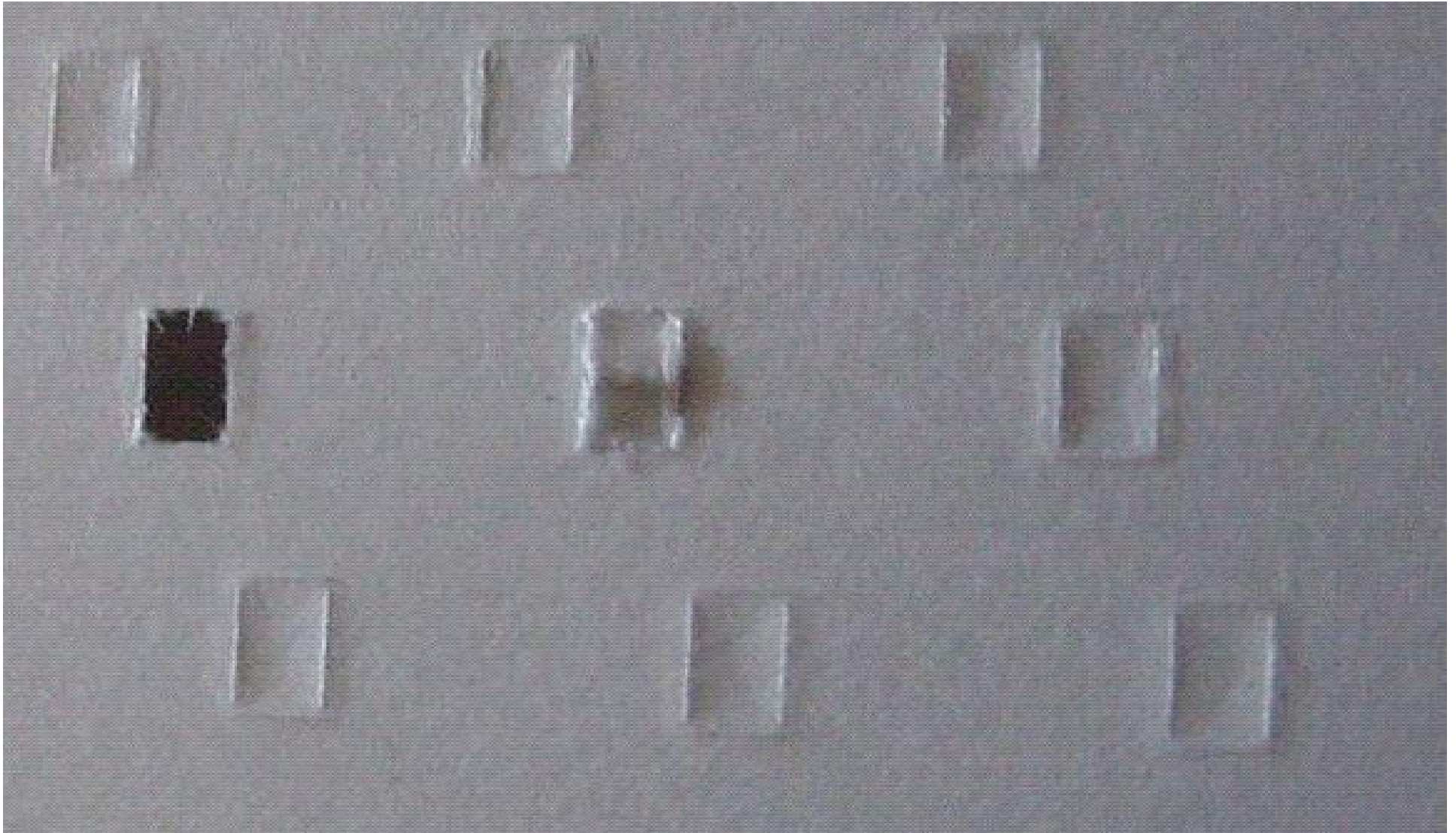

- Punch
- Guard sheet
- Punch guide
- Ballot
- "T-bar"

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

Background

✓ 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 Assocation's Commission on Law And Aging

✓ Working symposium in March 2007
  - ➤ *Facilitating Voting as People Age: Implications of Cognitive Impairment*
  - ➤ Experts in 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 Assocation'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 Assocation'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

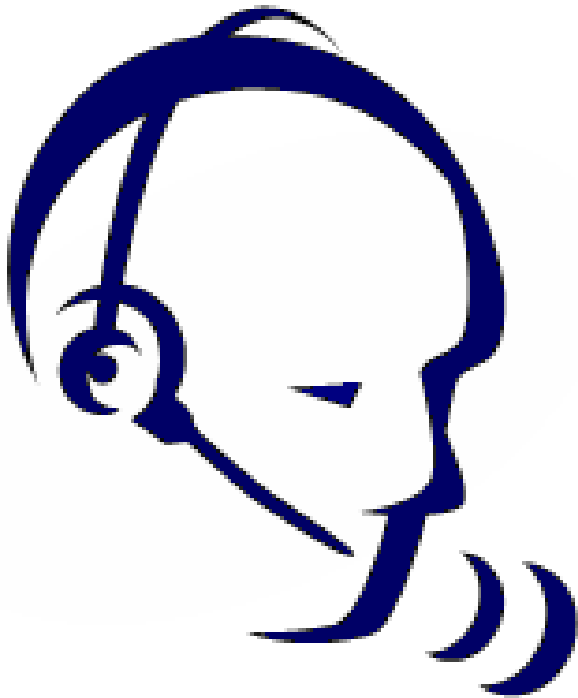✓ 3rd generation systems are **multimodal**
  ➢ Prime III

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!
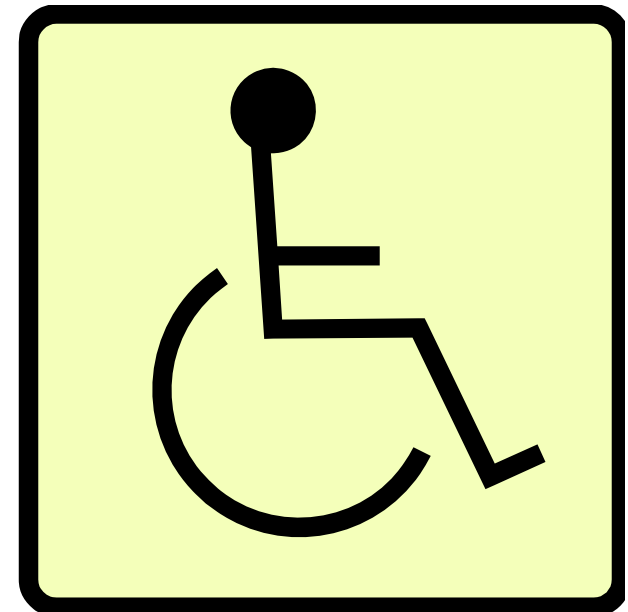
Demo

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???

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