

# Vote Verification:

## Herrnson, Niemi, Bederson, Hanmer

- Designed voting interface to replicate the Diebold DRE
- Evaluated 4 add-on vote verification systems and a control system with no verification
  - Paper
  - Separate monitor
  - Audio
  - Cryptographic receipt

# Research Design (similar to earlier work)

- Expert Review
- Field Experiments
  - 815 participants; variation on background characteristics
  - Locations in MD: offices, malls, senior citizen complexes, and university locations
  - Ballot with 5 offices: free choice, structured choice, change vote, voting for multiple candidates, & write-in
  - Questionnaire with core and system specific questions

# No Verification: Diebold Accuvote-TS



# Paper Verification: Diebold Accuvote-TSx with AccuView Printer Module

- Prints vote choices
- Receipt under glass cover with
  - Magnification option
  - Plastic cover
- Paper rolls into machine to a spool
  - Rolls kept intact



# Separate Monitor: Scytel Pnyx

- Separate monitor (verification module)
- After voting is complete, presents races one by one for verification
- Does not provide name of write-in candidate selected



# Audio Verification: MIT Audio System

- Tape recorder and headphones
- Voice repeats name after each selection is made
- Vote choices recorded on an analog audio tape



# Cryptographic Receipt: VoteHere Sentinel

- Stand alone printer
- Cryptographic
- As tested
  - Prints take home receipt to verify ballot was counted
  - Does NOT verify votes
- Advanced system allows for verification



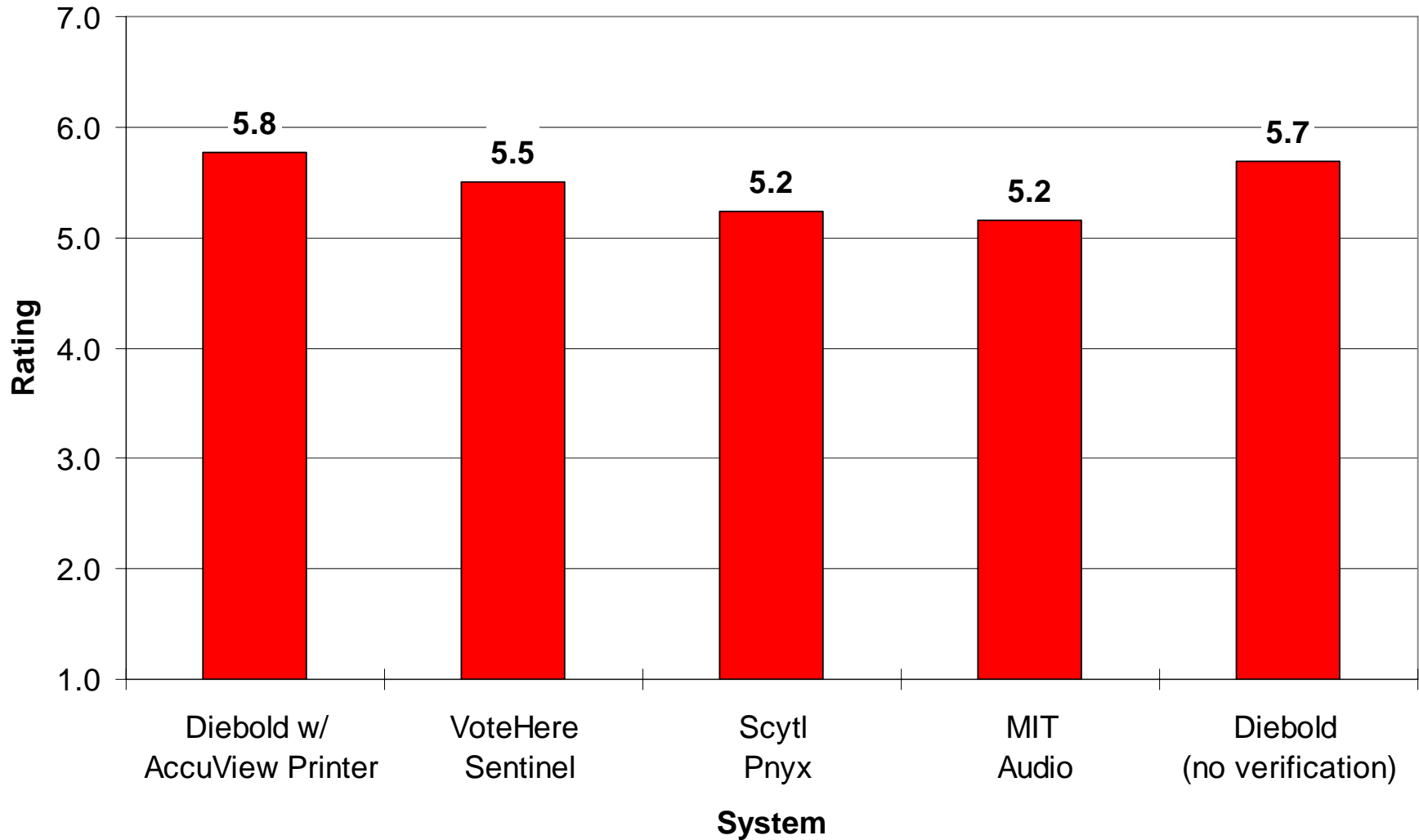
# Expert Review

- Trade-off between actual & perceived security
  - Cryptographic methods should be more secure but are harder to understand
  - Gave the edge to paper due to ease of understanding
- Privacy concerns
- Trade-off between after the fact vs. simultaneous verification

# Field Experiment Results

- Satisfaction
  - Overall, systems were rated favorably
    - Combined core items on confidence votes were accurately recorded, counted properly, & privacy
- Need for Help
  - Varied by VVEAS & adds to demands for help above and beyond those with the basic system
- Accuracy
  - Varied by VVEAS & task
  - Some VVEASs resulted in a net improvement in accuracy

**Average Satisfaction with Verification Systems**  
(combines confidence votes were accurately recorded,  
counted properly, & privacy)  
(7 = Most Favorable)



# Ease of Use & Distraction

- Ease of Use

<b>Diebold w/ Printer</b>	<b>VoteHere Sentinel</b>	<b>Scytl Pnyx</b>	<b>MIT Audio</b>
6.0	5.6	5.1	4.9

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- Overall, Verification System Was Distracting

<b>Diebold w/ Printer</b>	<b>VoteHere Sentinel</b>	<b>Scytl Pnyx</b>	<b>MIT Audio</b>
2.8	3.1	3.2	4.0

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# Need for help

- % Received help

<b>Diebold</b>	<b>VoteHere</b>	<b>Scytl</b>	<b>MIT</b>
<b>w/ Printer</b>	<b>Sentinel</b>	<b>Pnyx</b>	<b>Audio</b>
4.7	6.0	8.2	8.1

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# Voter Accuracy by Vote Verification/Election Audit System

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<b>Office</b>	<b>Diebold w/ Printer</b>	<b>Vote- Here Sentinel</b>	<b>Scytl Pnyx</b>	<b>MIT Audio</b>	<b>Diebold no verifica- tion</b>
President	93.6	93.6	92.8	91.9	95.1
U.S. Senate	93.9	94.8	90.8	90.9	93.1
U.S. House	74.0	66.6	66.6	65.5	70.6
State Rep.	92.0	92.3	91.5	90.0	90.1

# Voter Accuracy, Voter Verified/Election Audit Systems versus a Control System

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<b>Performance comparison</b>	<b>Diebold w/ Printer</b>	<b>VoteHere Sentinel</b>	<b>Scytl Pnyx</b>	<b>MIT Audio</b>
Fewer errors on the VVEAS	14.7	13.3	15.6	12.4
Same number of errors	73.1	77.6	73.8	73.1
Fewer errors on the control	12.2	9.1	10.6	14.6

# Administrative Issues

- Verification systems add additional steps and complexity
- Scytl Pnyx was especially difficult to program and integrate with the voting system
- Paper on Diebold AccuView Printer had to be changed frequently – process was not simple
- Scytl Pnyx, MIT Audio, and Diebold AccuVote-TS w/ no verification were down for portions of the study

# Conclusions/Discussion

- Verification systems did not rate higher than system with no verification
- Verification systems do not always perform better than system with no verification
- Few differences across individual characteristics (results not shown)
- Some systems posed significant administrative challenges

# For More Information

[www.capc.umd.edu](http://www.capc.umd.edu)

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Voting Technology and  
Ballot Design

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