Secure & Fair Elections

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Expert Opinion

`http://avirubin.com/vote/dailyshow.mov`

Is Voting Really That Difficult?

Actually, YES.

- The stakes are high
- Problems are not easily detected
- The Requirements seem contradictory
- Experts vs. Electorate

Today's Discussion

- Paper Trail?
- Voting System Requirements
- A Complex Threat Model
- Components of Voting
- Future Solutions

The Paper Trail

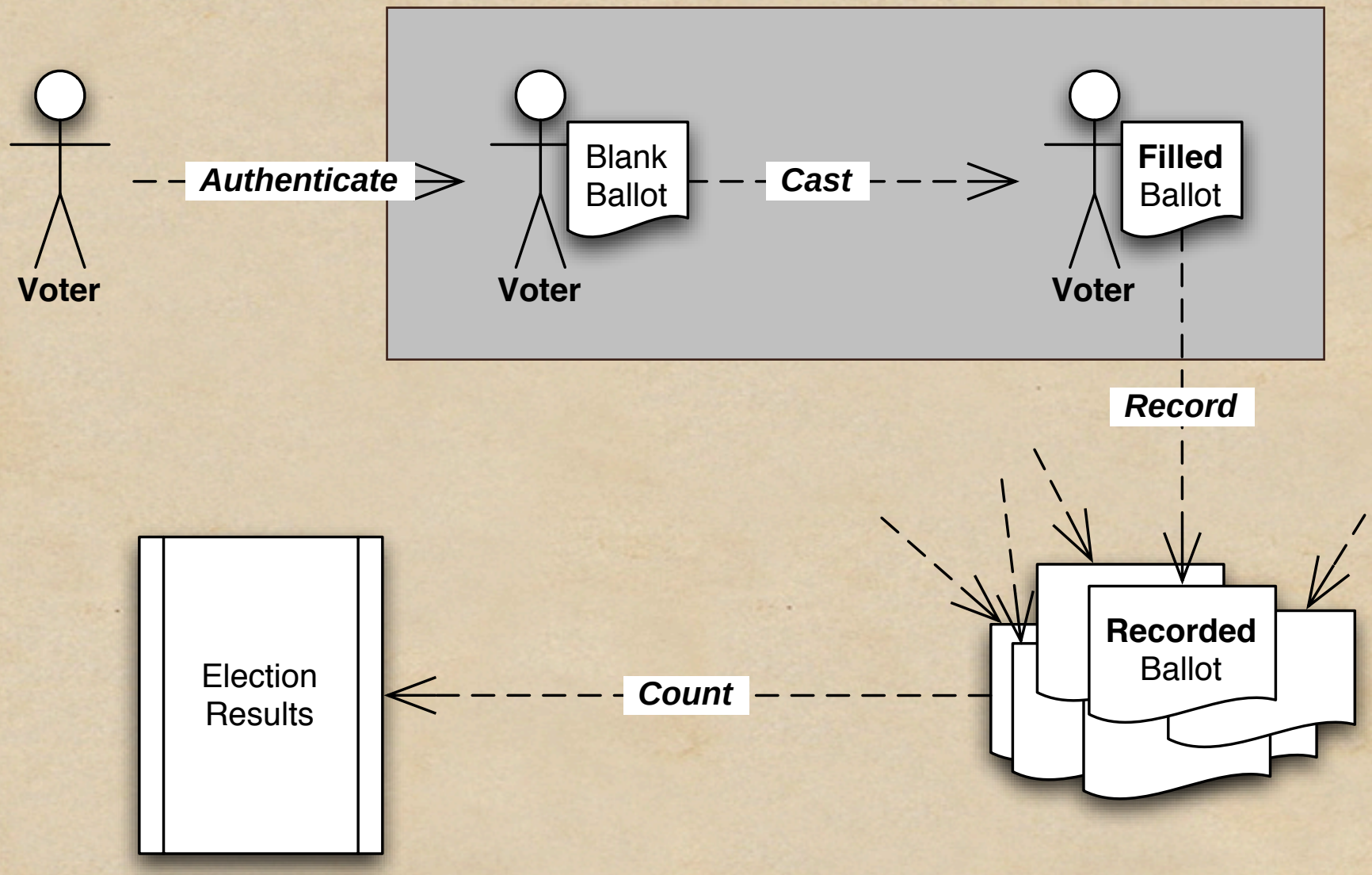
- Yes, paper is actually expensive (multi-language, logistic costs)
- Yes, all machines are vulnerable
- No, not as simple as ATM
- No, Paper is not the only way

- BUT...
  Paper is the quickest fix today

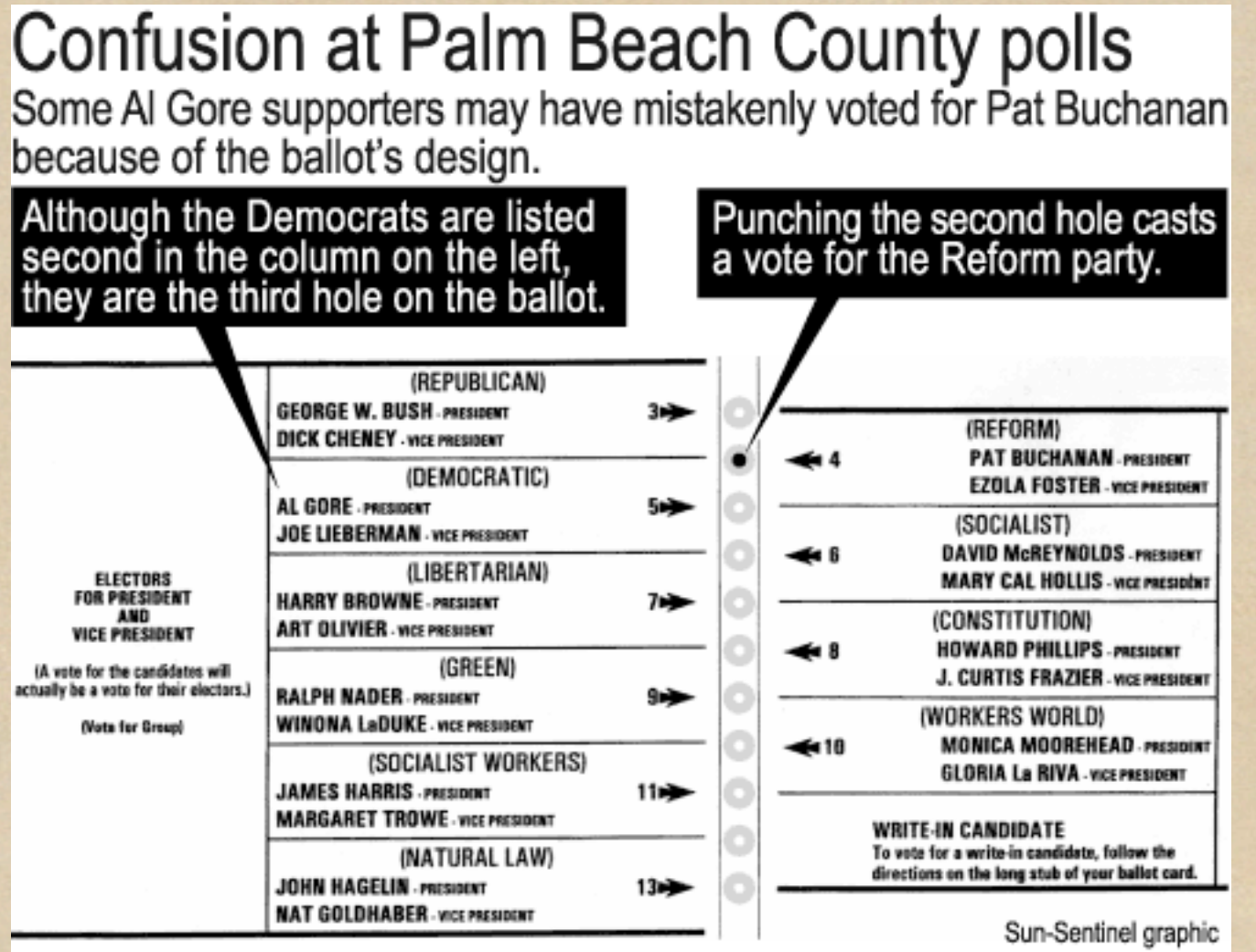
Voting Requirements

- Registration & Check-in
  - not too onerous (disenfranchisement)
  - not too easy (fraud)
- Vote Verification
  - voter is confident of his vote
  - voter cannot sell his vote

The Voter Is An Adversary!


Voter
Authenticate
Voter
Blank
Ballot
Cast
Voter
Filled
Ballot
Record
Recorded
Ballot
Count
Election
Results

Cast as Intended

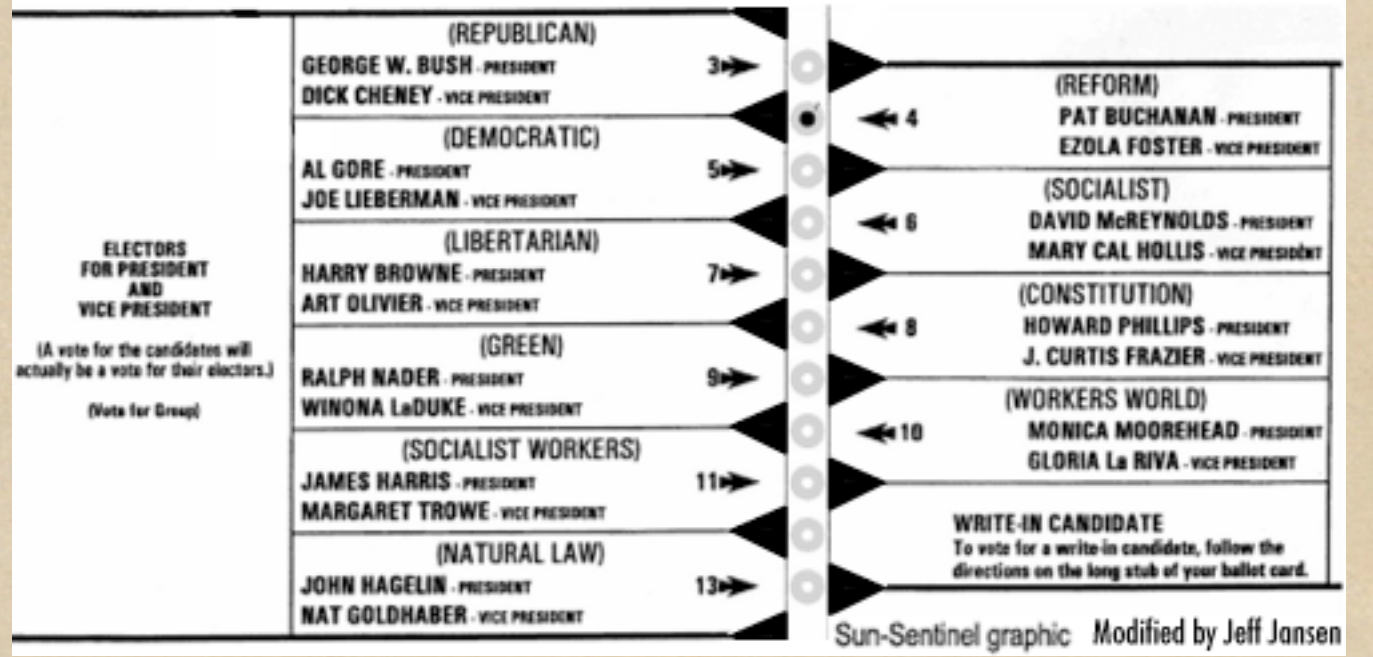


http://www.mit.edu/~jtidwell/ballot_design.html

Confusion at Palm Beach County polls

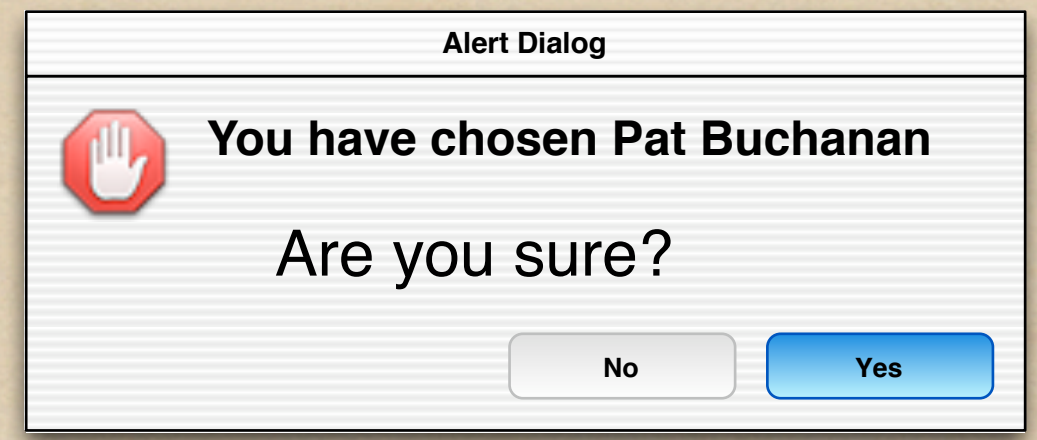
Some Al Gore supporters may have mistakenly voted for Pat Buchanan because of the ballot's design.

Confusion could have been avoided with a simple redesign.

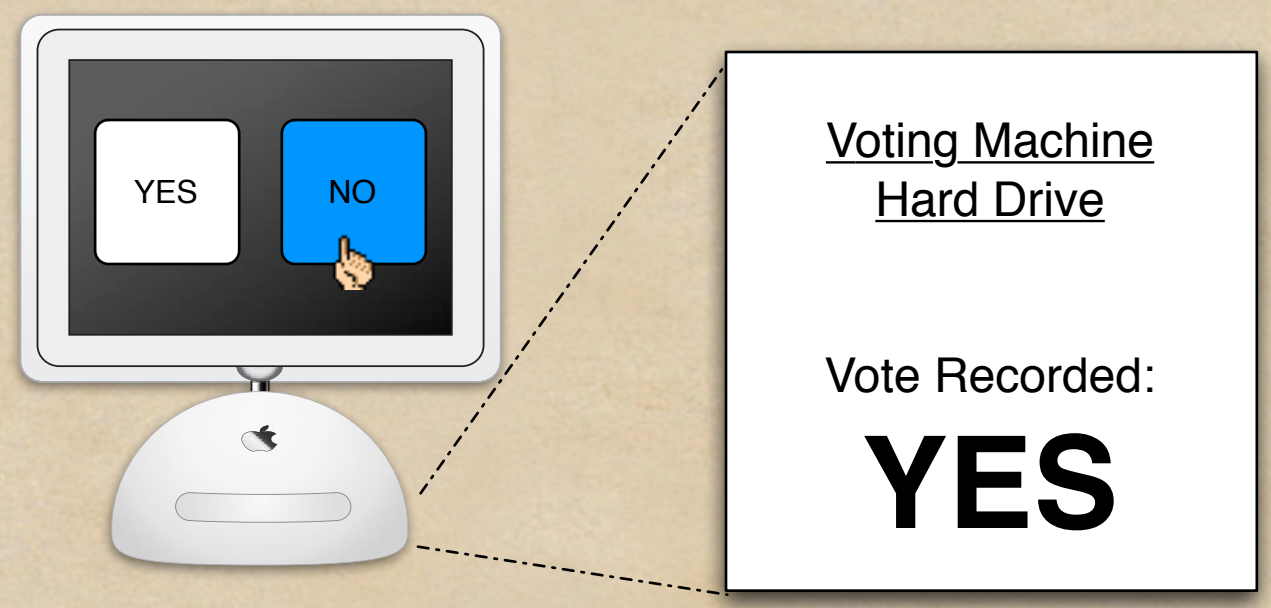


http://www.mit.edu/~jtidwell/ballot_design.html

Verify Before Casting



Recorded as Cast


YES
NO
Voting Machine
Hard Drive
Vote Recorded:
YES

Counted as Recorded

Helicopter Crash Delays Afghan Vote Count

Helicopter Sent to Pick Up Afghan Ballots in Remote Province Crash-Lands, Delaying Vote Count

Absentee ballots 'lost' in Florida

October 28, 2004 09:28 IST

Nearly 58,000 absentee ballots for the US presidential election may never have reached Florida's Broward County voters, who had requested them more than two weeks ago, election officials said.

Scavenged ballot box lids haunt S.F. elections

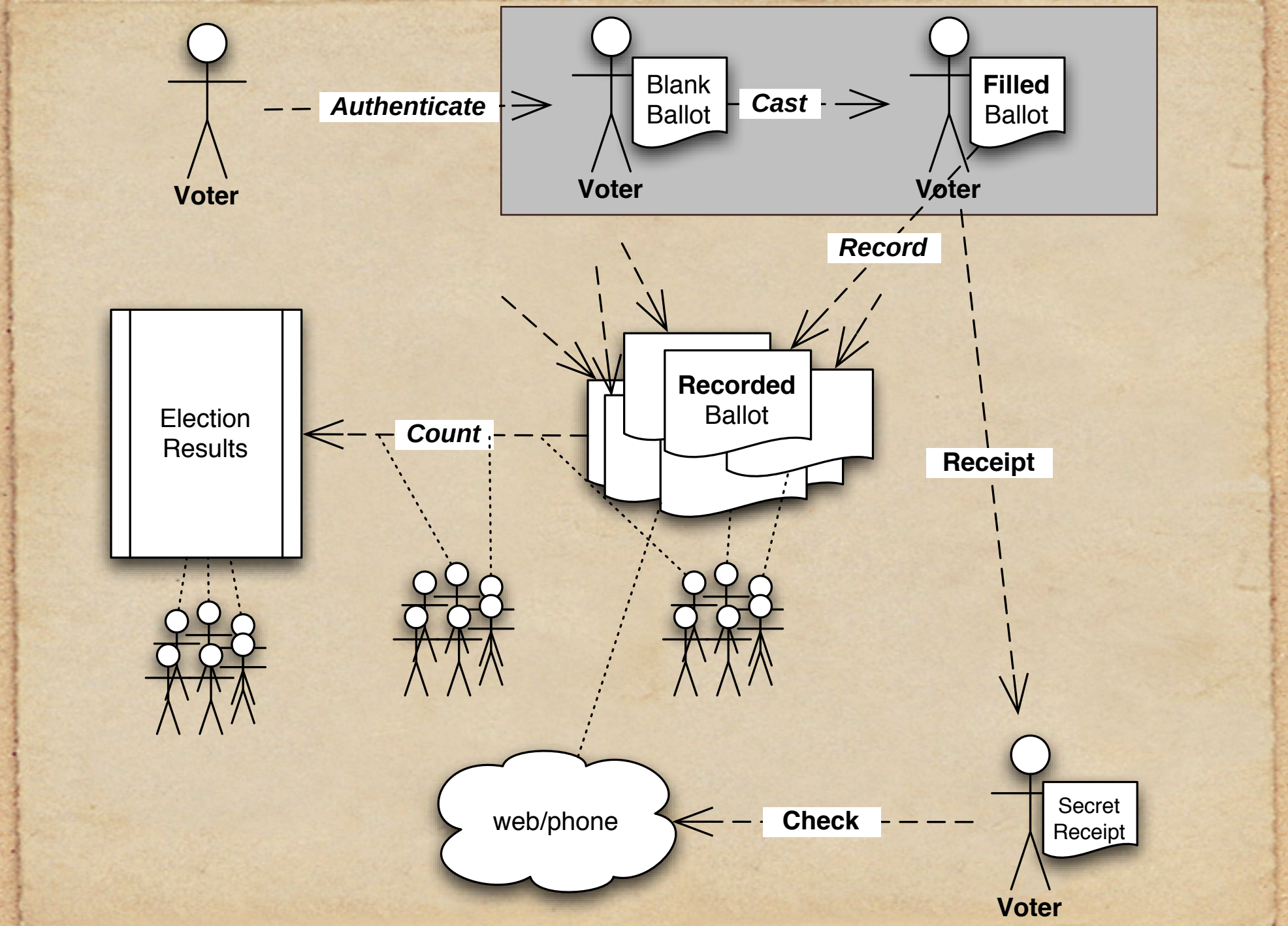
Erin McCormick, Chronicle Staff Writer

Monday, January 7, 2002

A Bright Future:
Cryptography and Universal Verifiability

Crypto “Bag of Tricks”

- Public-Key Encryption
- Secret Sharing
- ZK Proofs


Voter
Authenticate
Blank Ballot
Voter
Cast
Filled Ballot
Voter
Record
Recorded Ballot
Election Results
Count
Receipt
web/phone
Check
Secret Receipt
Voter

Do you need to be a cryptographer to trust the voting system?

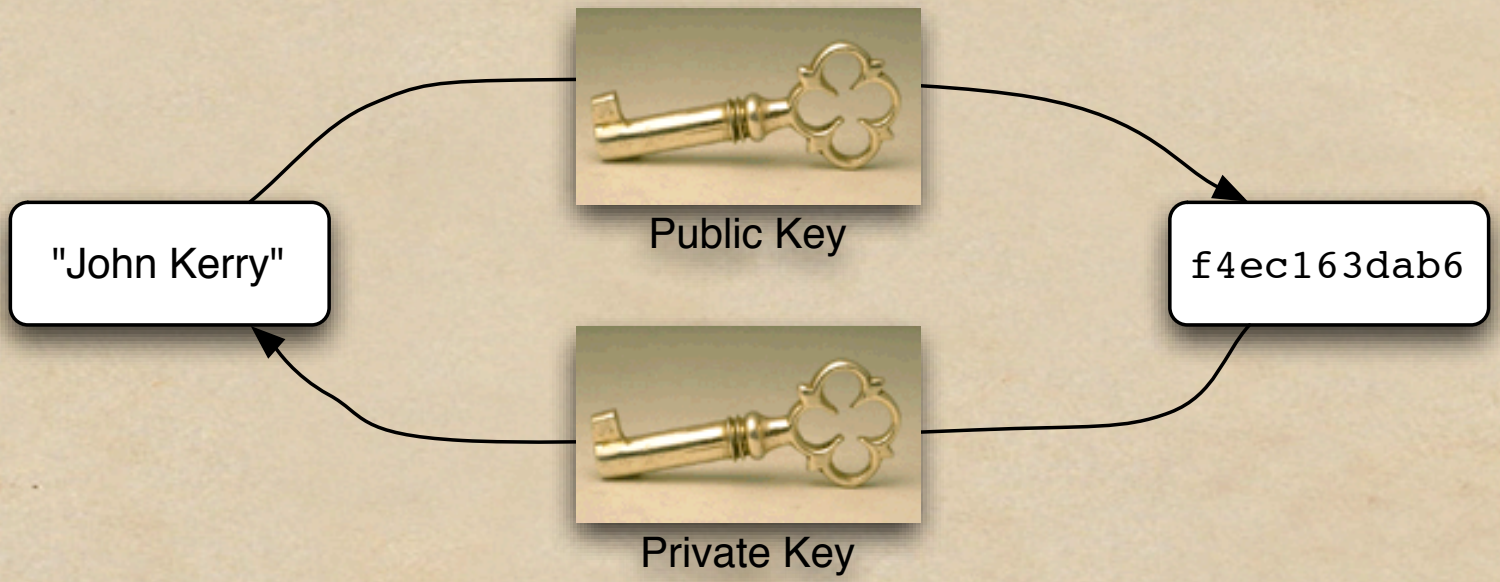
Summary

- Paper is a quick (but necessary?) fix
- Voting is Hard to do right
- The Voter is an Adversary
- Complex Schemes offer hope?

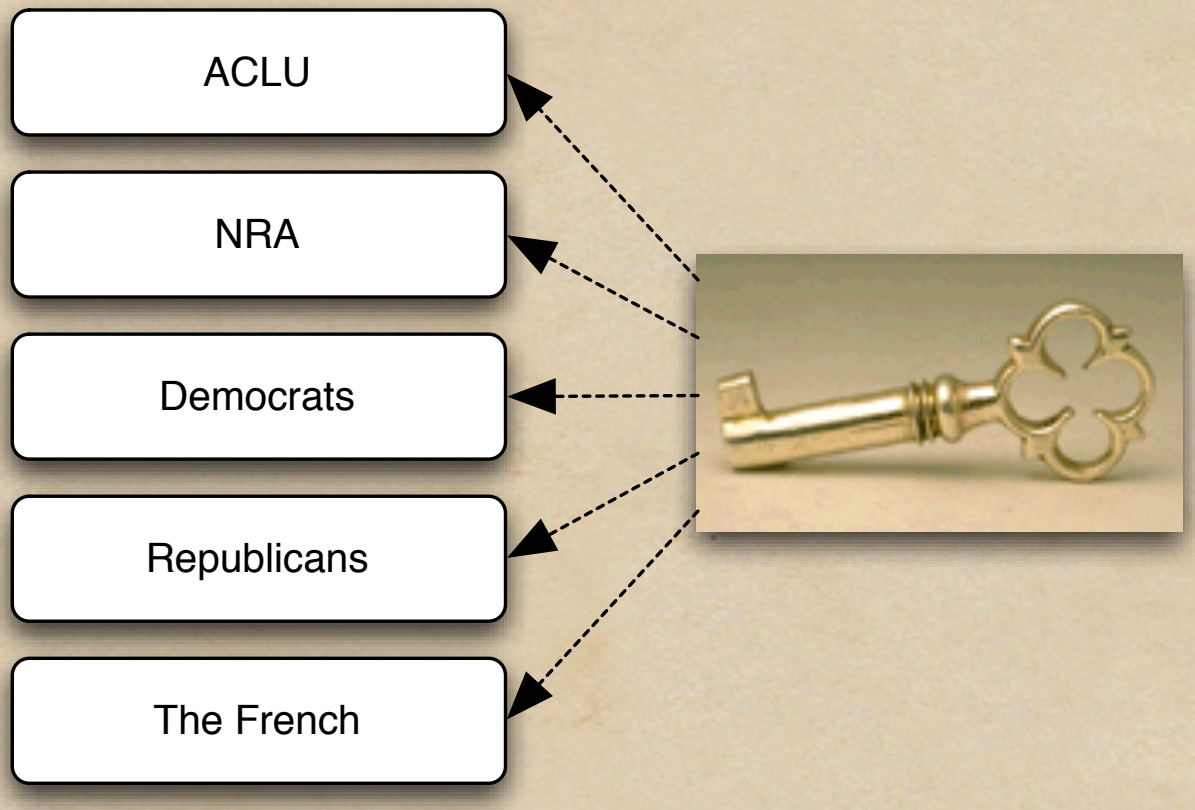
Questions?

Backup Slides

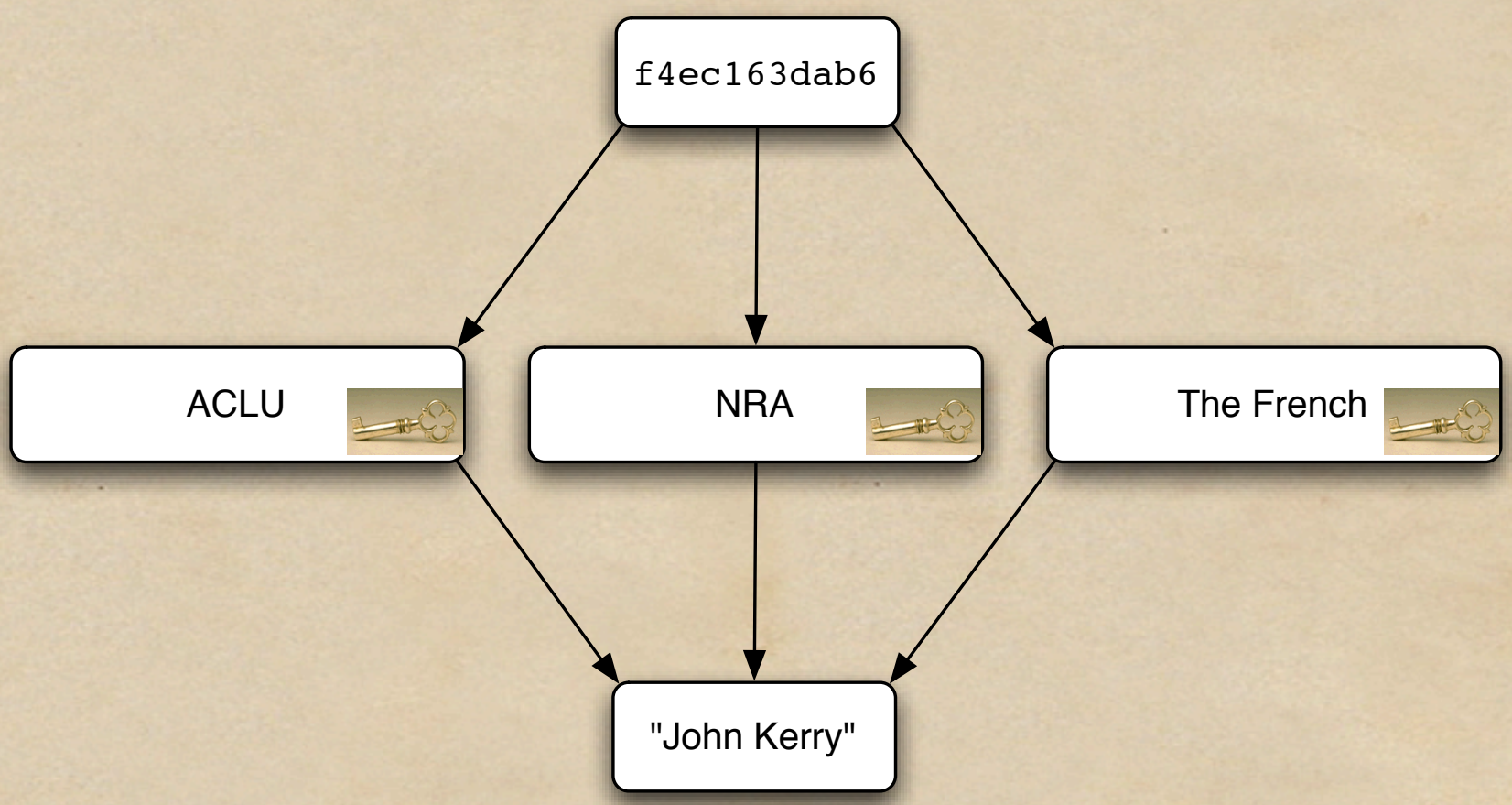
Public-Key Encryption



Secret Sharing



Threshold Decryption



Zero-Knowledge Proofs