



# Electronic Voting

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# Edison's 1869 Voting Machine

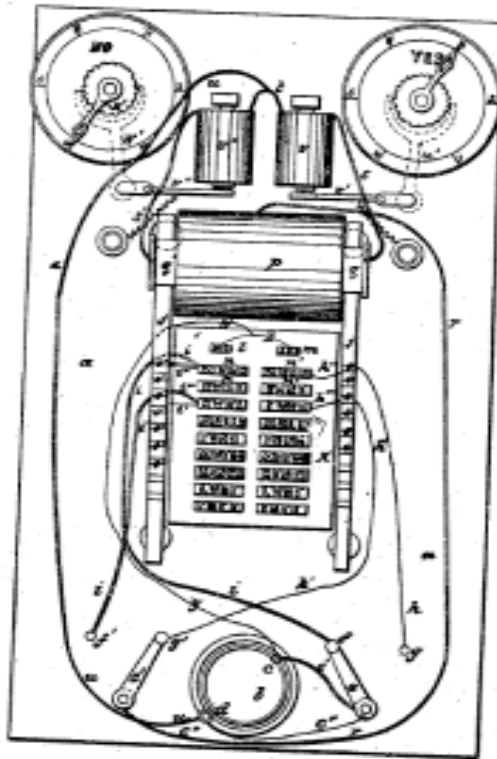
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T. A. EDISON.

Electric Vote-Recorder.

No. 90,646.

Patented June 1, 1869.



Intended for use  
in Congress;  
never adopted  
because it was  
"too fast" !

# The famous "butterfly ballot"

1 OFFICIAL BALLOT, GENERAL ELECTION  
PALM BEACH COUNTY, FLORIDA  
NOVEMBER 7, 2000

1-R OFFICIAL BALLOT, GENERAL ELECTION  
PALM BEACH COUNTY, FLORIDA  
NOVEMBER 7, 2000

ELECTORS FOR PRESIDENT AND VICE PRESIDENT	
(REPUBLICAN) GEORGE W. BUSH - PRESIDENT DICK CHENEY - VICE PRESIDENT	3 →
(DEMOCRATIC) AL GORE - PRESIDENT JOE LIEBERMAN - VICE PRESIDENT	5 →
(LIBERTARIAN) HARRY BROWNE - PRESIDENT ART OLIVIER - VICE PRESIDENT	7 →
(GREEN) RALPH NADER - PRESIDENT WINONA LaDUKE - VICE PRESIDENT	9 →
(SOCIALIST WORKERS) JAMES HARRIS - PRESIDENT MARGARET TROWE - VICE PRESIDENT	11 →
(NATURAL LAW) JOHN HAGELIN - PRESIDENT NAT GOLDHABER - VICE PRESIDENT	13 →

(A vote for the candidates will actually be a vote for their electors.)  
(Vote for Group)

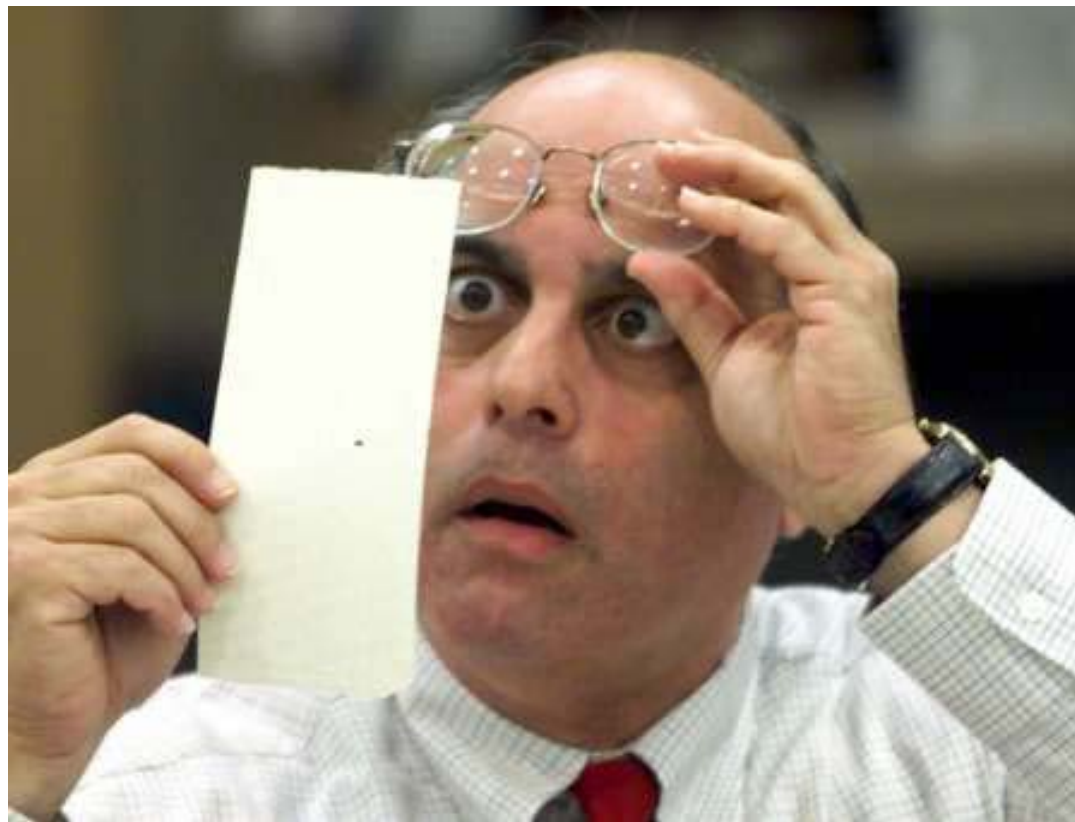
← 4	(REFORM) PAT BUCHANAN - PRESIDENT EZOLA FOSTER - VICE PRESIDENT
← 6	(SOCIALIST) DAVID McREYNOLDS - PRESIDENT MARY CAL HOLLIS - VICE PRESIDENT
← 8	(CONSTITUTION) HOWARD PHILLIPS - PRESIDENT J. CURTIS FRAZIER - VICE PRESIDENT
← 10	(WORKERS WORLD) MONICA MODREHEAD - PRESIDENT GLORIA La RIVA - VICE PRESIDENT

WRITE-IN CANDIDATE  
To vote for a write-in candidate, follow the directions on the long stub of your ballot card.

TURN PAGE TO CONTINUE VOTING →

# A “dimpled chad” ???

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# Voting Technology Study

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- ◆ **MIT** and **CalTech** have begun a joint study of alternative voting technologies.
- ◆ Companion to Carter/Ford commission on political issues in voting systems.
- ◆ Initial work funded by the Carnegie Foundation.

# Voting Technologies

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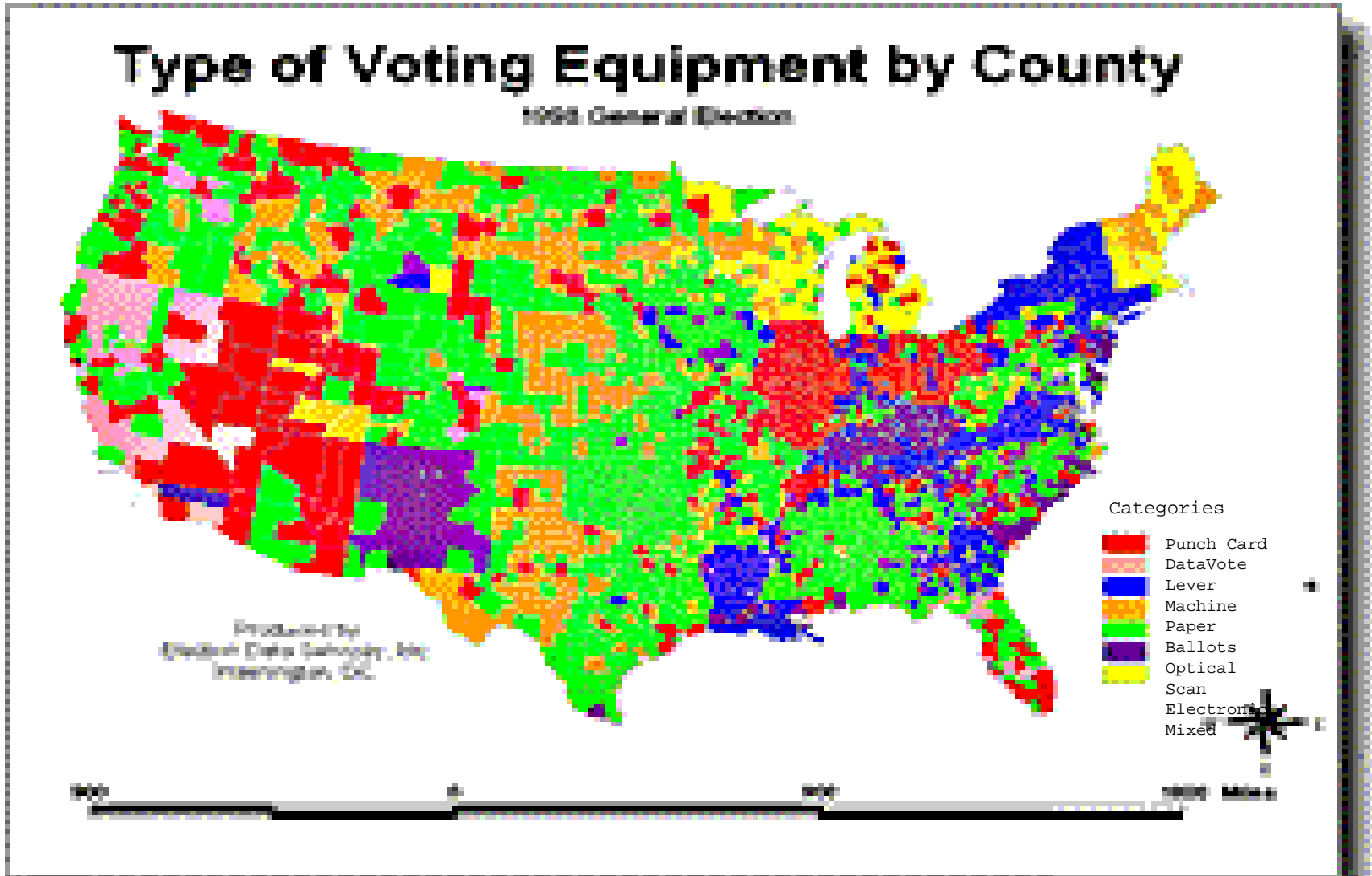
## ◆ Poll-site voting:

- Paper ballot (hand counted)
- Punched card (Votomatic; Datavote)
- Lever Machine
- Optical Scan
- Electronic (DRE)
- Mixed

## ◆ Remote voting:

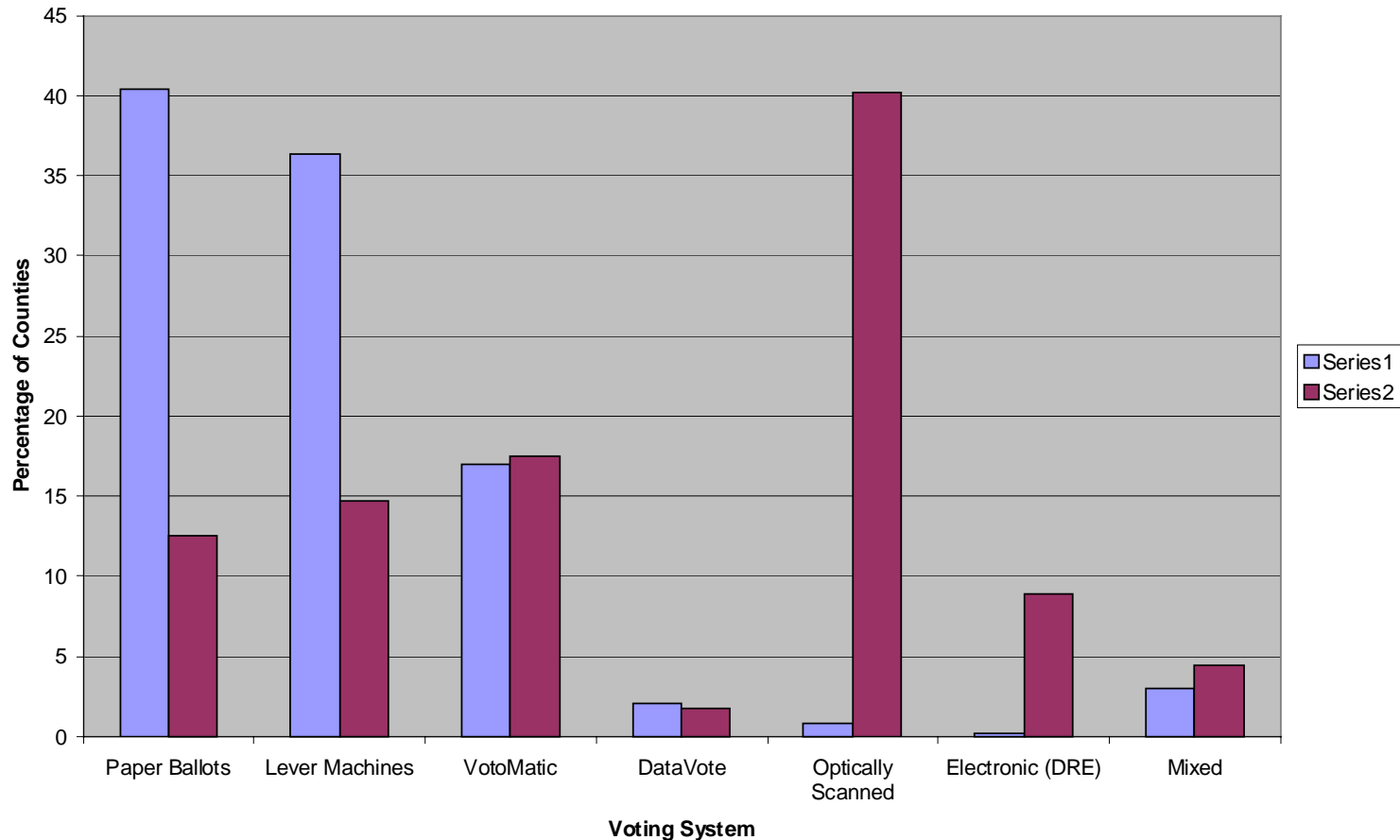
- Absentee
- Kiosk
- Internet voting

# Many kinds of equipment used



# Changes from 1980 to 2000

Percentage of Counties Using Different Voting Technologies

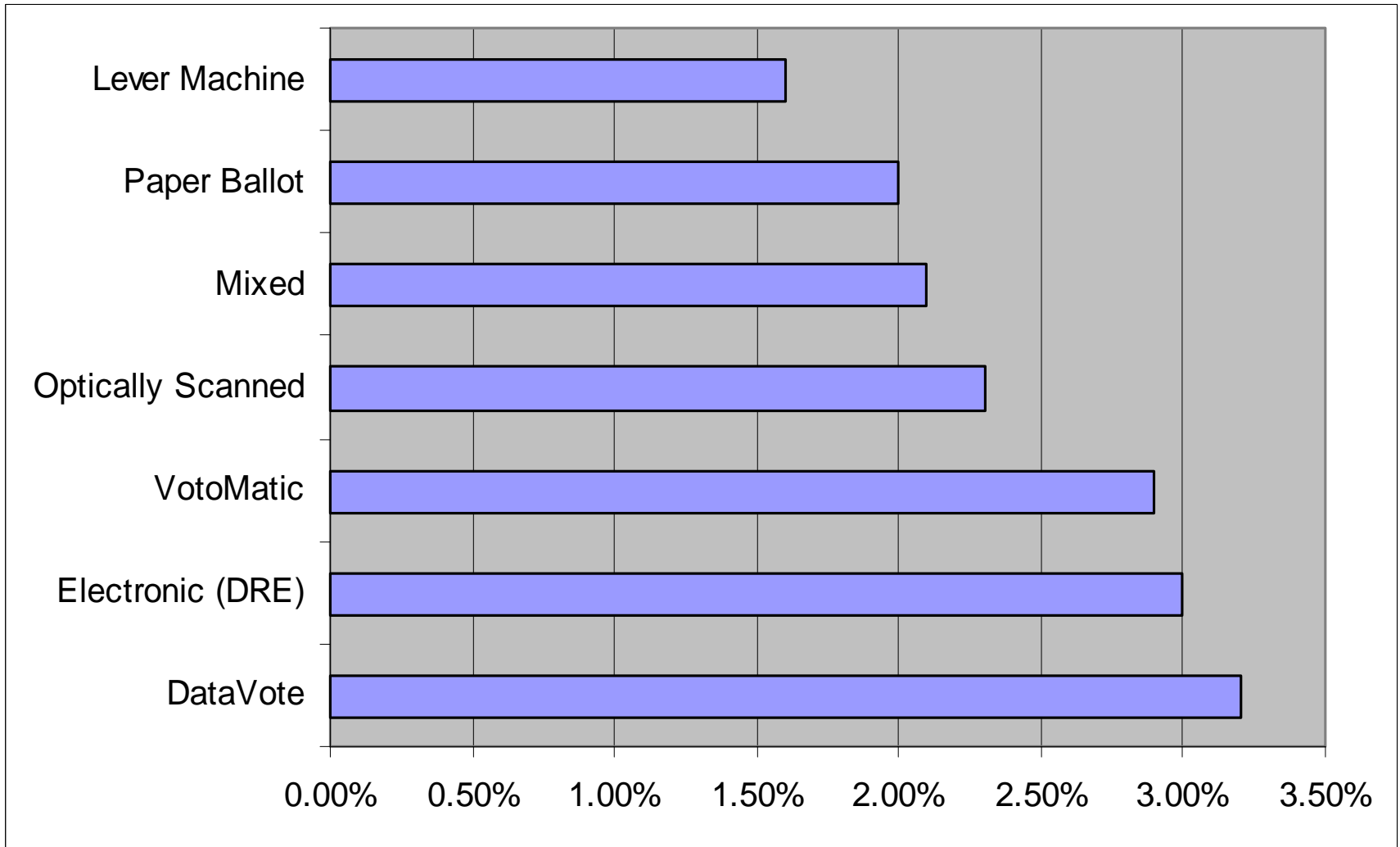


(Chart from Prof. Steve Ansolabehere, MI T PoliSci)



# Error Rates by Technology

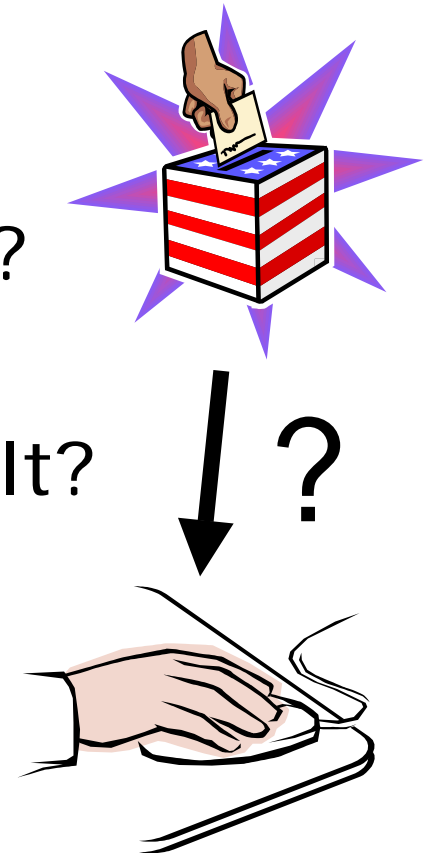
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# Electronic Voting

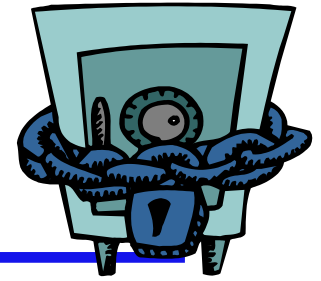
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- ◆ *Could the U.S. presidential elections be held on the Internet?*
- ◆ Why bother?
  - Increased voter convenience?
  - Increased voter turnout?
  - Increased confidence in result?
  - "Because we can"?



# Security Requirements

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- ◆ All eligible voters should be able to vote.
  - Therefore: can at best augment current system, not replace it.
  - May need to close electronic voting early.
- ◆ Votes should be private (anonymous).
  - May be difficult to ensure at home.
- ◆ Voters should not be able to sell their votes!
  - Voting should be private and “receipt-free”
- ◆ Integrity and verifiability of result; no vulnerability to large-scale fraud.

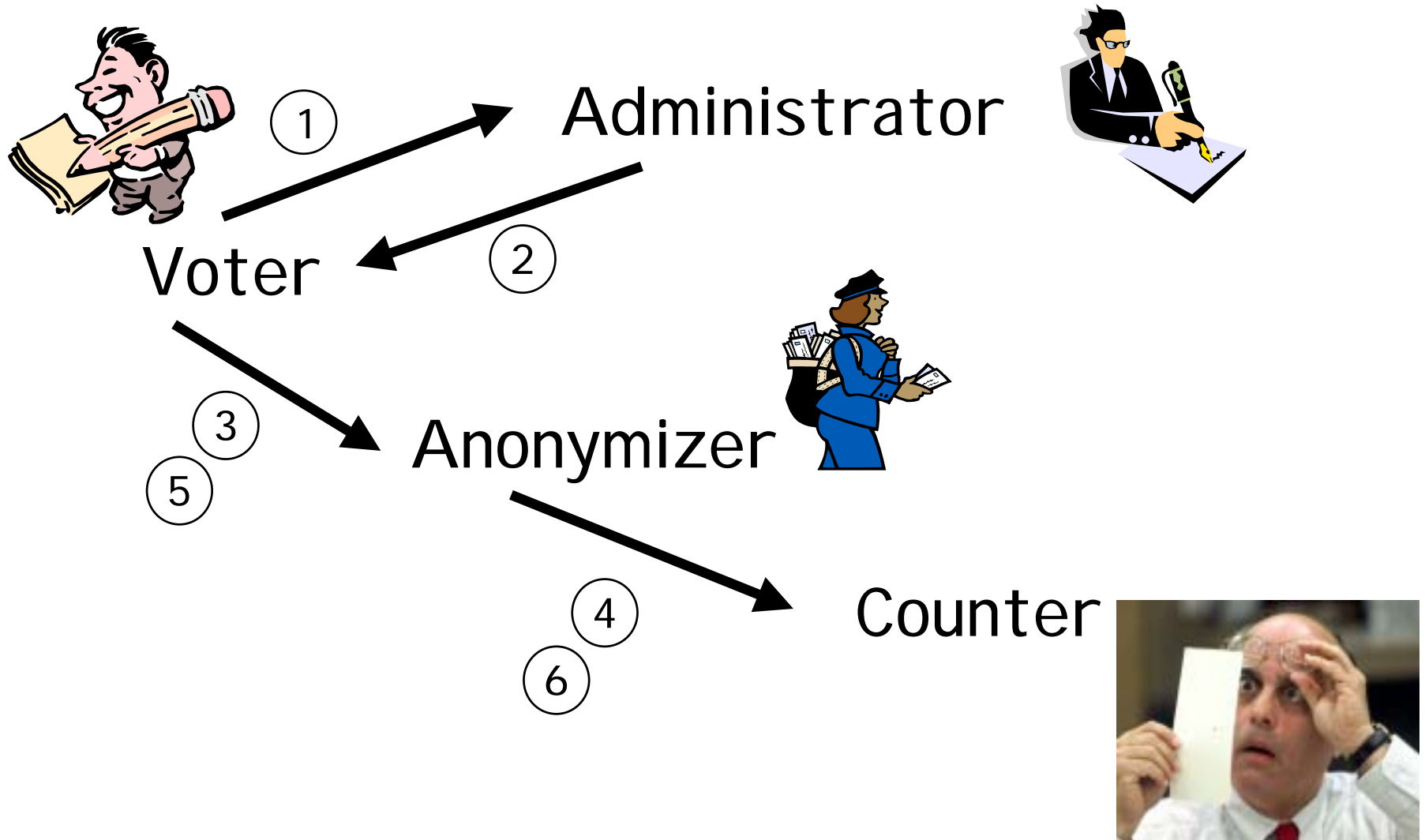
# The “**FOO**” Voting Scheme

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- ◆ **F**ujioka, **O**kamoto, and **O**hta  
AUSCRYPT '92, “A Practical Secret  
Voting Scheme for Large Scale  
Elections”
- ◆ The basis for the MIT/NTT  
collaborative research in electronic  
voting.



# Structure of Voting Scheme



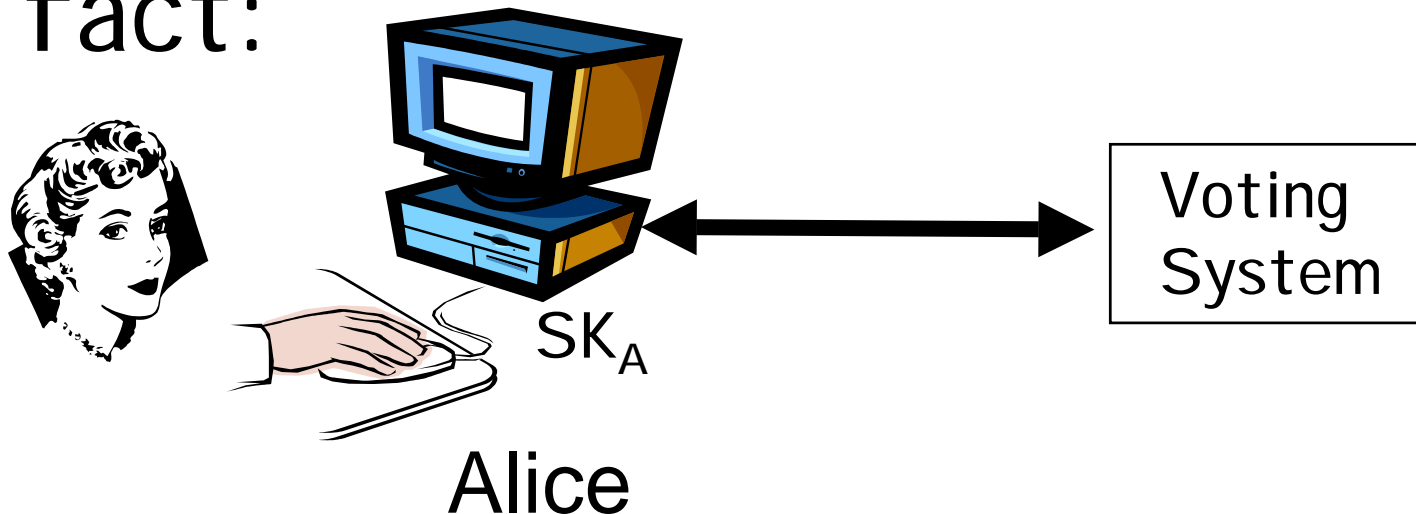
# The "Secure Platform Problem"

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In theory:



In fact:



# The Secure Platform Problem

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- ◆ Because of weaknesses in modern OS's (Windows, UNIX), including vulnerabilities to viruses and trojan horses, *we are not ready for Internet voting, and won't be for quite a while. As they say,*  
“ Don't try this at home !! ”

# Perhaps a smart phone?

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- ◆ Promising, but starting to look too much like a desktop PC in terms of complexity and consequent vulnerability...
- ◆ Maybe with a special SIM card just for voting...?
- ◆ Problems would remain: vote-selling (allow voting multiple times, where last one counts!)



# Some personal opinions

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- ◆ More important that *no one has their thumb on the scale* than having *scale easy to use or very accurate.*
- ◆ Can I convince my mom that system is trustworthy?
- ◆ Physical ballots (e.g. paper) can provide better audit trails than electronic systems.

# More personal opinions:

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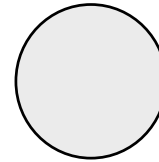
- ◆ Precinct-based decisions on voting technology has benefits: lack of uniformity allows for experimentation and makes large-scale fraud harder.
- ◆ Ability to handle disabled voters will become increasingly important.
- ◆ Biggest security problem has got to be the problem of *absentee ballots*. (Note that absentee ballots were 30% of vote in California, and about 20% overall.)

# My favorite technology (today)

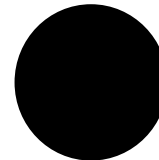
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- ◆ Fill-in bubbles on paper ballots.  
Optically scan ballots at polling site,  
before ballot is deposited.

Harvard



Yale



(THE END)

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