Early Requirements for Mechanical Voting Systems

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Pre 19th Century Reforms

Viva vocce voting common
- too much transparency

No secret ballot
- partisan ballot printing
- problems with handwriting

In the US, complex elections
- Example: 1839 ballot from Iowa
- 9 races
- 3 multi-candidate offices
THE PEOPLE'S CHARTER.

1839.

THE PEOPLE'S CHARTER; BEING THE OUTLINE OF AN ACT TO PROVIDE FOR THE JUST REPRESENTATION OF THE PEOPLE OF GREAT BRITAIN IN THE COMMONS' HOUSE OF PARLIAMENT; EMBRACING THE PRINCIPLES OF UNIVERSAL SUFFRAGE, NO PROPERTY QUALIFICATION, ANNUAL PARLIaments, EQUAL REPRESENTATION, PAYMENT OF MEMBERS, AND VOTE BY BALLOT, PREPARED BY A COMMITTEE OF TWELVE PERSONS, SIX MEMBERS OF PARLIAMENT AND SIX MEMBERS OF THE LONDON WORKING MEN'S ASSOCIATION, AND ADDRESSED TO THE UNITED KINGDOM.
The Pattern

New requirement discovered
  Chartists discovered need for secret ballot.
  Insiders rarely pose new election requirements.
Reformers demand adoption of the requirement
  Rallies, petitions, lobbying, riot and revolution
Inventors produce mechanisms that meet it
  Reformers need proof that requirement can be met.
  Inventors frequently part of reform movement.
Secret Ballots

- First practical implementations in Australia
  - Eliminated machines, pure paper ballot
  - Details vary between Australian states
  - State of Victoria model widely exported

- Controversial
  - Where suffrage limited, secret ballot is bad
  - Egalitarian societies don't need it
    - Points made by John Stuart Mill in On Democracy
2. In the case of a poll at an election the votes shall be given by ballot. The ballot of each voter shall consist of a paper (in this Act called a ballot paper) showing the names and description of the candidates. Each ballot paper shall have a number printed on the back, and shall have attached a counterfoil with the same number printed on the face. At the time of voting, the ballot paper shall be marked on both sides with an official mark, and delivered to the voter within the polling station, and the number of such voter on the register of voters shall be marked on the counterfoil, and the voter having secretly marked his vote on the paper, and folded it up so as to conceal his vote, shall place it in a closed box in the presence of the officer pre-
Types of Ballot Secrecy

- **Conditional secrecy:** Ballot is secret if both
  - Voter does not disclose ballot ID
  - State does not unseal ballot ID data
    - Ballot act of 1872 is a perfect example

- **Absolute secrecy:**
  
  Article I Section 28: ... ballots without any distinguishing mark or symbol ...
  
  - Virginia constitution of 1902

- Many law codes vague about this
Voting machines – absolute secrecy

One register per candidate,

No ballot stored
Votes stored in registers

Examples:

Spratt, 1875 (shown)
  U.S. Patent 158,652

Roney, 1878
  U.S. Patent 211,056

Beeranek, 1881
  U.S. Patent 248,130
Machines – conditional secrecy

Registering ballot boxes

Serial number the ballots or
Store ballots in sequence voted

Examples

Bacon, 1878 (shown)
U.S. Patent 203,525

Williams, 1878
U.S. Patent 200,495
Machines – vague intent

Reel-to-reel vote records

Record votes on a paper roll

Examples

Rhines, 1890
U.S. Patent 422,891

McTammany, 1893
U.S. Patent 502,744 (shown)

"... it is possible to identify a man's vote, by counting voters as they go in and afterward counting the rows of marks on the sheet."
Transparent Ballot Boxes

Examples

Cummings, 1858
U.S. Patent 20,256

Jollie, 1858,
U.S. Patent 21,684 (shown)

"... the bystanders may

- see every ballot which is put in,
- see all the ballots that are in,
- and see them when taken out."

Jollie
Registering Ballot Boxes

Examples

Savage, 1873
U.S. Patent 142,124 (shown)

Davis, 1874
U.S. Patent 149,202

The bystanders may see that

- the counter is initially zero,
- the counter increments for each ballot voted, and
- the final count matches the count of ballots.
The Public Counter Requirement

Introduced with registering boxes

Included in voting machines

- Spratt, 1875
  - U.S. Patent 158,652
- Myers, 1890
  - U.S. Patent 424,332
- And all subsequent machines

Became a legal requirement

- Still required, 1990 FEC, 2002 EAC
- But visible to "designated officials" not public!
Voter Verification

Recognizing the problem:

"It seems to me that for a person to vote ... he must have some sensible evidence ... that he has performed some effectual act ... to indicate for whom he has voted. ... But a voter on this voting machine has no knowledge through his senses that he has accomplished a result. The most that can be said, is, if the machine worked as intended, then he has ... voted. It does not seem to me that that is enough."

– Horatio Rogers, In re Voting Machine dissent, 1897
Voter Verification

Indirect recording
   Machine emits a "frog"
   Voter can verify "frog"
   Count "frogs" at ballot box

Punched cards
   Iles, 1893
      U.S. Patent 500,001
   No use until rediscovery
   Harris (Votomatic), 1960
   Bruck, Jefferson, Rivest
Voter Verification

Direct Recording with VVPAT

Machine counts votes and creates human-readable paper

Paper record is secondary

Punched secondary record

Gray, 1899

U.S. Patent 620,767

No use until rediscovery

Mercuri, Chung (Avante)
Recountability/Redundancy

What if you suspect an error
Can recount paper ballots
But direct recording machines?
Possible with redundancy
Myers, 1889
U.S. Patent 415,548
token in slot like vending machine
No use until rediscovery
FEC 1990 Standards
Not voter verifiable!
Recountability/Redundancy

What if you suspect an error
  Can recount paper ballots
  But direct recording machines?
Possible with redundancy
  Rhines, 1890
    U.S. Patent 422,891 (shown)
  McTammany, 1893
    U.S. Patent 502,744
Not voter verifiable!
Reel-to-reel vote recording!
Ballot Validity – Vote for One

Sliding door to expose one knob
   Spratt, 1875
      U.S. Patent 158,652
Turn knob selects candidate
   Roney, 1878
      U.S. Patent 211,056
Drive wedge between spacers
   Beranek, 1881 (shown)
      U.S. Patent 248,130
Ballot Validity – Vote for $n$

Refined wedge and spacer
Spratt, 1894
U.S. Patent 526,668 (shown)

Programmable machines
Gillespie, 1899
U.S. Patent 628,905 (below)
Ballot Validity – Cross Endorsement

Link all registers for cross endorsed candidates

Gillespie, 1907

U.S. Patent 857,800 (shown)
The Law

1889 – Myers petition to legalize voting machines
1892 – New York legalizes Myers machine
1896 – New York legalizes Davis machine etc.
1897 – New York Voting Machine Commission
1898 – Report of the Commission for the Purpose of Investigating Voting Machines to the Senate and Assembly 33rd Session of the Legislature of the State of California
The Public Face of the Industry

1889-1892 – Newspaper reports identify voting machines with political reform movement

1900 – *Appleton's Cyclopaedia* article written by salesman for voting machine vendor

1911 – *Encyclopaedia Britannica* written by salesman for voting machine monopoly

The only stated requirements are those met by the vendor's own products.
The Outcome

1934 – “Laws authorizing the use of voting machines are practically identical in the several states, due, no doubt, to the fact that they were enacted at the instigation of the manufacturers.”

Joseph Harris,

*Election Administration in the United States*
Conclusion

- Some requirements come from officials
  - Multiple races in one election
  - Straight-party voting
  - Vote for N out of M
- Innovative requirements come from outsiders
  - Secret Ballot
  - Transparency
  - Voter verification
  - Validity enforcement mechanisms
- There is risk when outsiders become vendors