



Electronic and Athenian Democracy

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Weakness of conventional systems

- Power in hands of politicians not ordinary folk
- Parliaments unrepresentative in terms of sex, race and class when compared to population
- Major issues like taxation, war and peace, are decided without reference to public opinion
- Model of democracy has been the US constitution

Rome or Athens

- US constitution framed by slave owning gentlemen like Washington. They wanted a Roman style *Republic* not an Athenian *Democracy*.
- The Roman republic appealed to them as the form best suited to the collective rule of a slaveholding aristocracy.
- But there is another ancient model Athens, not republicanism but direct democracy.

The Greeks, after long experience, developed mechanisms to prevent aristocratic domination :

- All major political decisions had to be taken by the people as a whole in a plebiscite.
- The executive functions of the state were implemented in a randomly selected council. This randomly selected council had among its duties the selection of issues that were to be put to plebiscite.
- Note : random selection is, as every polling organisation knows, the only scientific way of getting a representative sample of the population.

Athenian voting machine



Bronze id card to be used with Kleroterion

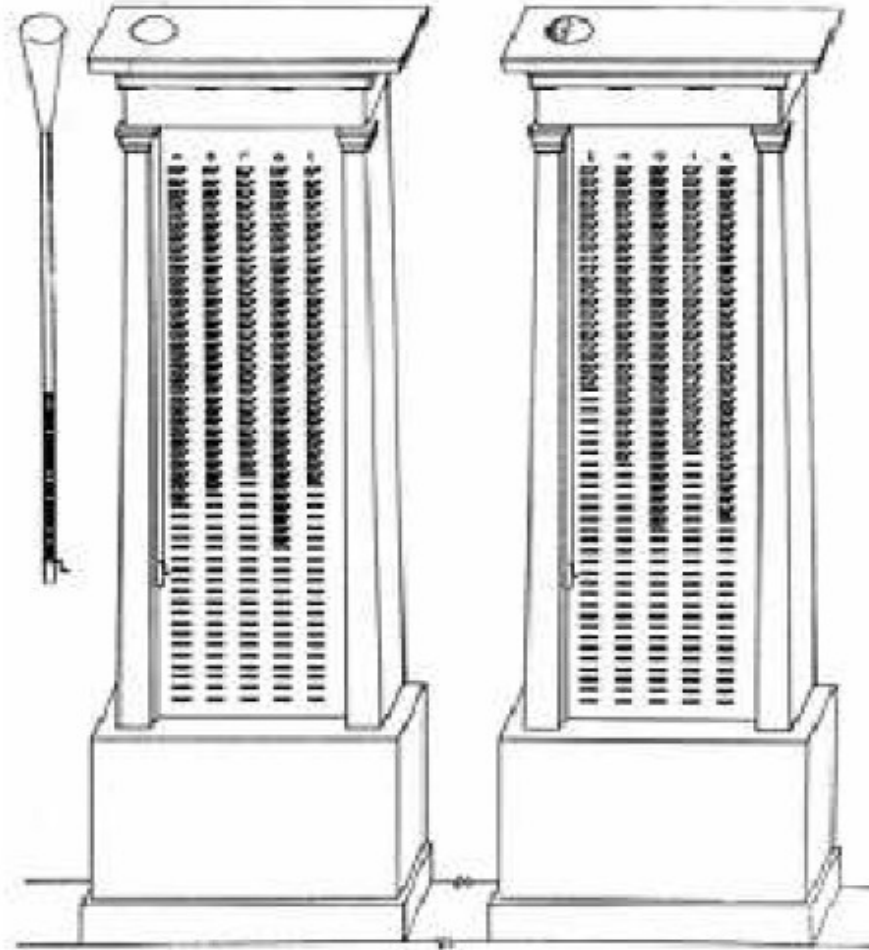


FIGURE 1. A reconstruction of the *kleroterion*

Aristotle

- He argued that the essence of democracy was direct voting or selection by lot.
- This system introduced by Solon ensured that in Athens the big slave owners never acquired the power that they did in Rome

Principle of a Republic

- In a republic like Rome or USA, political power is held by a 'senatorial class' drawn from the wealthy sections of society.
- To be elected senator you need money.
- The senatorial class claim to rule in the name of the people, but their social position and social ties mean that their policies favour the rich not the poor.

21st century democracy

- In 6th Century BC democracy meant entire population gathering in town square to vote.
- In 21st Century it will mean the entire population voting electronically on important questions.
- Technology is here with Mobile Phones and Internet

The internet and communications revolution has brought us lots of new ways of doing things

- e-Commerce.
- Democratic access to information.
- Democratic expression of opinion via blogging.
- New collaborative work practices in the open-source community
- Undermining of monopoly via P2P networks

Stefan Meretz and the Keimform theorists argue that these are the germ of a whole new social order. But as yet it has had little impact on the political system.

Can we use modern communications technology to democratise complex social decisions like, for instance, the Budget?

Existing applications required appropriate protocols and practices

What protocols would be required for participatory budgeting?

- 1) We present a basic e-voting protocol suitable for yes/no plebiscites**
- 2) Show how to extend this protocol to multidimensional votes on taxation and expenditure.**

Honest voting system

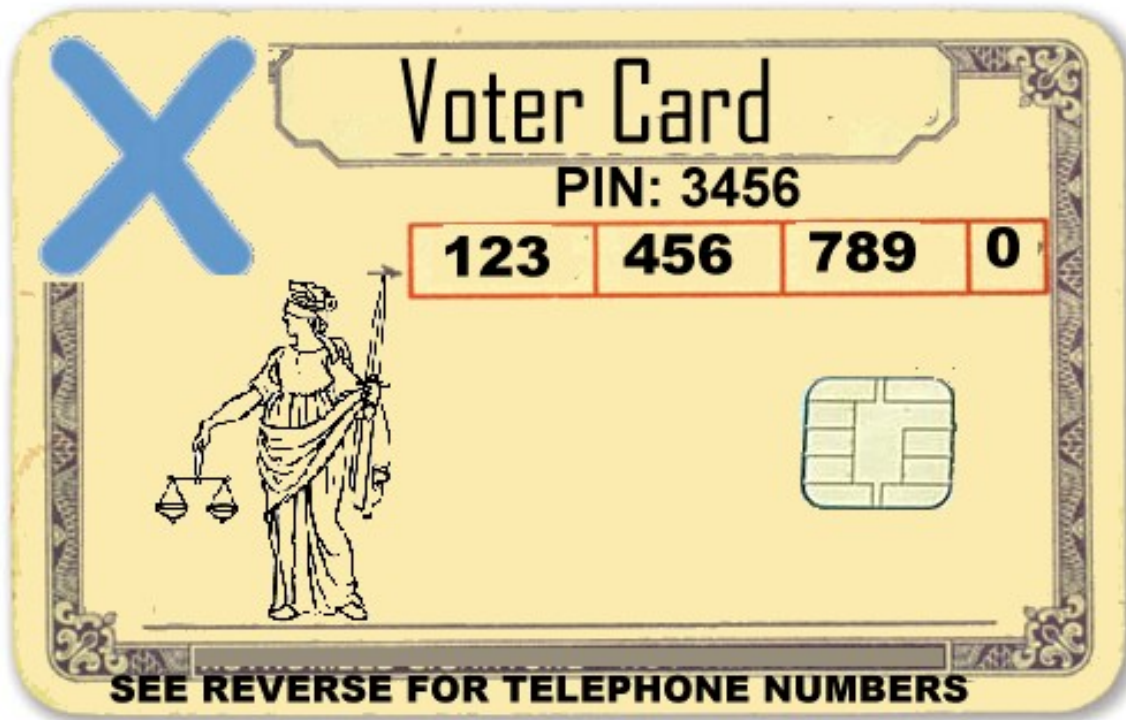
- **Anonymity** – voters should not be linked to their vote
- **Privacy** – vote should not be observed
- **Coercian resistance** .
- **Verifiability** – a transparent and open process
- **Atomicity** – one person, one vote
- **Integrity** – the person's vote must be recorded correctly and the votes must be counted correctly

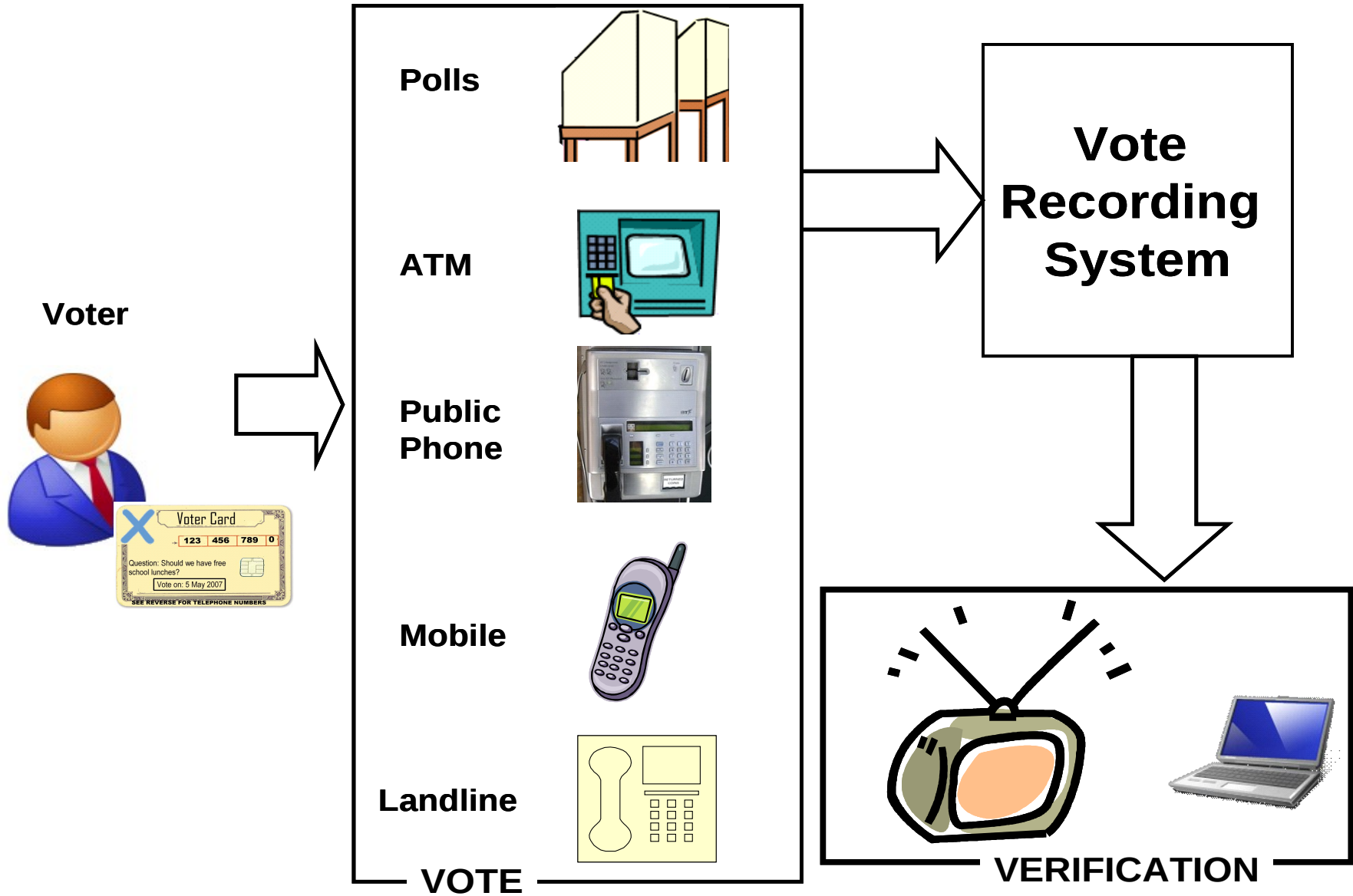
Registration

- At registration you put hand in jar and pull out an envelope with a voters card.
- Nobody but you knows which card you chose

The voter's card

- Each card has different number and PIN





Verification

- At end of vote, complete list of yes and no votes is published on the internet and the newspapers.
- Each person can check that their vote is correctly recorded,
- The total yes and no votes can be checked independently



Anonymous

- You know that your vote was recorded ok
- But nobody else knows your voter's number
- So nobody else knows how you voted.



← Real Time Count of Votes Cast



TV Camera

- At end of vote, complete list of yes and no votes with the PINs elided is published on the internet and the newspapers.
- Each person can check that their vote is correctly recorded,
- The total yes and no votes can be checked independently
- The published voter numbers can not be used by 3rd parties who do not have the PIN.

- You know that your vote was recorded ok
- But nobody else knows your voter's number
- So nobody else knows how you voted.



Politics involves more than yes no decisions

- We have decisions that involve ranges – how much should health expenditure change by
- We have interdependencies between decisions – spending more requires raising more revenue, cutting taxes implies cutting expenditure

How can a fundamentally discrete voting process be extended to handle this?

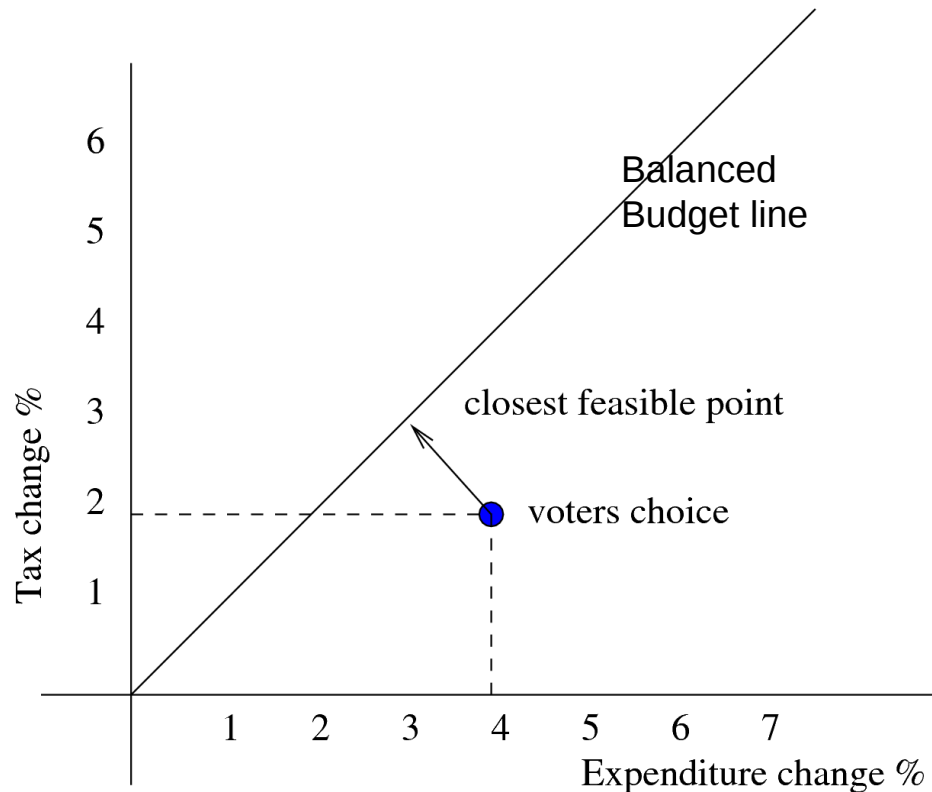
- **Suppose you give three choices: raise base rate of income tax by 5%, reduce by 5% or abstain if you are happy with the current rate.**
- **Suppose 40% abstain, 40% say cut by 5% and 20% say raise by 5%**

choice	shift	Voter %	weighted vote
abstain	0.00%	40.00%	0.00%
up	5.00%	20.00%	1.00%
down	-5.00%	40.00%	-2.00%
Consensus as weighted sum			-1.00%

- You can potentially vote on several taxes going up or down: VAT, Base rate Income tax, High rate income tax,...
- In addition there are multiple headings of expenditure that could go up or down : Health, Education, Transport, Defence,...
- If people can cast a vote on each that concerns them you end up with a Vector Vote of tax and expenditure changes eg: [0,-1,+5,+3,+1,-1,-2]
- This stage exists even for the Chancellor now, he is choosing a point in a vector space even if he does not think of it that way.

- **But would not that just result in taxes being voted down and expenditure up?**
- **Well there would have to be a pre-given constraint in terms of the incremental budget deficit.**
- **If there is then we can resolve the vector vote to a feasible vote.**
- **In what follows we assume a balanced budget constraint, but one could assume a fixed budget deficit constraint without altering the argument.**

- If we have an n dimensional vote vector, this implies an n dimensional decision space.
- A budget deficit constraint, along with the current shares of each tax and expenditure heading in total revenue defines an $(n-1)$ dimensional hyperplane in the decision space : the feasible set.
- There are well established algorithms to find the closest point on an $(n-1)$ dimensional hyperplane to an n dimensional point.



- **Suppose voters want 4% increase in expenditure but only 2% increase in tax.**
- **Move from the vote position to the closest point on the balanced budget line.**
- **In this case 3% increase in both tax and expenditure**

- **The vector maths used in the algorithm could not be understood by the general public.**
- **But simple diagrams like the previous slide explain it clearly.**
- **Even more simple explanation :**
 - 4% spending vote, 2% tax vote
 - Split the difference means
 - 3% increase in each