Building Trust for Sample Voting

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IRIF, RSVP, POPSpEC
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Plan of the talk

1. Randomness in Politics
2. Random Sample Voting
3. Building Trust
4. The Public Opinion Platform
5. The Future
Believing Monty Hall
The Monty Hall Problem
The Monty Hall Problem

[Diagram of three doors, one circled]
The Monty Hall Problem

![Monty Hall Problem Diagram]

THIS IS A SHEEP, NOT A GOAT...
The Monty Hall Problem
The Monty Hall Problem
The Monty Hall Problem

Switching is very counter-intuitive

- More than 10000 complaints from readers
- Close to 1000 from people with PhDs
The Monty Hall Problem

Switching is very counter-intuitive

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- Close to 1000 from people with PhDs

Theorem (Gardner, 1959)

In no other branch of mathematics is it so easy for experts to blunder as in probability theory.
The Monty Hall Problem

People don’t agree with Monty Hall

- Minimal and no consequence on real world
- People still refuse to believe the solution
The Monty Hall Problem

People don’t agree with Monty Hall

- Minimal and no consequence on real world
- People still refuse to believe the solution

Politics based on probabilities

- Huge consequences and risks
- Higher trust threshold
- No reason to believe it’s easier than Monty Hall
Sortition and the Athenians
The Boulê

Citizen’s Assembly

- Uses randomly selected citizens (serving one year each)
- Takes decisions on a diversity of subjects
The Boulê

Citizen’s Assembly
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Voting
- Influence peddling possible
- Votes are not secret
The Heliaia

Justice Court

- Used for most trials
- Jury of random citizens selected in the morning
The Heliaia

Justice Court

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Trial conditions

- No interaction with outside world until the end
- Trials last 6 hours at most
Sortition today

Sortition not directly usable in our societies

- Logistical problems
Sortition today

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- Logistical problems
- Privacy problems
Sortition today

Sortition not directly usable in our societies

- Logistical problems
- Privacy problems
- Trials last more than a day
Sortition today

Sortition not directly usable in our societies

- Logistical problems
- Privacy problems
- Trials last more than a day

Fact

Giving power to a limited set of people is dangerous.
Random Sample Voting
The Random Sample Voting Project Team

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Tomasz M. Wlisłocki
Christopher Nguyen
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### Simplified Protocol

1. Register on the voting lists
2. Get chosen at random in the population
3. Receive a ballot with a unique ID and two vote codes
4. Log in and cast your vote
5. Check that the other code hasn’t been used
Constraints

Three constraints to satisfy

1. The sampling is demonstrably fair
2. The voting is provably secure
3. The protocol actively prevents corruption
Three constraints to satisfy

1: The sampling is demonstrably fair
Constraints

Three constraints to satisfy

1: The sampling is demonstrably fair

2: The voting is provably secure
Three constraints to satisfy

1 : The sampling is demonstrably fair

2 : The voting is provably secure

3 : The protocol actively prevents corruption
Fair sampling

Public Roster

- Publish list of citizen-number pairs
Fair sampling

Public Roster

- Publish list of citizen-number pairs
- Use Public Random Beacon Bits (NYSE) for the seed
## Fair sampling

### Public Roster

- Publish list of citizen-number pairs
- Use Public Random Beacon Bits (NYSE) for the seed
- Random Number generator outputs the sample
Fair sampling

Public Roster

- Publish list of citizen-number pairs
- Use Public Random Beacon Bits (NYSE) for the seed
- Random Number generator outputs the sample
- Everyone can check the fairness
Randomness in Politics

Random Sample Voting

Building Trust

The Public Opinion Platform

The Future

Fair anonymous sampling

Encrypted Roster

- Random permutation is initially applied
Fair anonymous sampling

Encrypted Roster

- Random permutation is initially applied
- Encrypted table is published
Fair anonymous sampling

**Encrypted Roster**

- Random permutation is initially applied
- Encrypted table is published
- Random bits are used to create the sample
Fair anonymous sampling

**Encrypted Roster**

- Random permutation is initially applied
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- Random bits are used to create the sample
- Key is released after voting
Fair anonymous sampling

Encrypted Roster

- Random permutation is initially applied
- Encrypted table is published
- Random bits are used to create the sample
- Key is released after voting
- Members are kept anonymous during the vote
Secure voting

Theorem (J. Stalin, 1923, origin disputed)

*It’s not the people who vote that count, but those who count the vote.*
Secure voting

**End-to-End verifiability**

- Voters can’t prove what they voted for
- Voters can be sure that their vote was correctly counted
- No ballots can be added, modified or removed
Secure voting

End-to-End verifiability

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Multiple step process

- Create permuted versions of the enriched roster
- Encrypt them with different keys
- Selectively reveal certain columns of certain tables
- The (table-column) couple depends on public coins
YES/NO BALLOTS

Instructions: Choose one of upper or lower ballot to vote online by entering vote code. Please destroy voted ballot but check online that ballot not voted was correctly printed.

Serial #100a vote code: 9343 NO
1134 YES

Serial #100b vote code: 8584 YES 7653 NO

double-ballot form mailed to the voter address at position 7777 in voter roll

7777: Cleo Polis, 222 W. 23rd St, NY, NY

voter roster (with positions from 0000 through 9999)

#100: 2222
#999: 3460

list of third summands from initial draw to be added to each respective sum of first and second summands (unencrypted)

250 copies of whole table, with a different row order and summand split for each copy of table, and each column of each table separately encrypted

serial #5's & vote codes

print check
possible votes
voted or not voted
pre-draw summands
final summands

50 copies of table are chosen as a "batch," by draw out of all 250 copies, and their underlined columns are publicly decrypted

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underlined columns of the 50 remaining tables are publicly decrypted and anyone can then sum the green rows and corresponding purple rows to find voter indices in the voter roll and check with voters

* batch 1
* batch 2
* batch 3
* batch 4
* batch 5
The problem of corruption

Traditional corruption & coercion

- Give money or advantages to some voters
- Check who votes and threaten them
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With RSV

- Anonymous sample, so hard to target people to bribe
- Secret secure ballot so threatening is hard
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Traditional corruption & coercion

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- Check who votes and threaten them

With RSV

- Anonymous sample, so hard to target people to bribe
- Secret secure ballot so threatening is hard
- Changes the market from buyer-focused to seller-focused
## Decoy ballots

### Additional decoy ballots

- Looks in all ways identical to real ballot
- Provably a decoy (impossible to prove authenticity of ballots)
- Is not counted in the final tally
Decoy ballots

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Effects

- Market saturated in decoys
- People with decoys will try to trick buyers
- Huge risk, smaller reward: low incentive to buy votes
Distributing the decoys

Random distributions

- Uniform is fair, but no real advantage if people are corrupt
- Biased distribution can protect against massive buyer budget
- Even a small proportion of decoys are enough
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Civic duty defense

- Anyone can request a decoy
- Extremely close to optimal defense
- Good for large populations
Advantages of RSV

Technical advantages

- Mathematically secure
- Easy to use
- Inexpensive
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Probable social advantages

- Increased participation
- More informed voters
- Can form the basis for real modern direct democracy

N.K. Blanchard
Building Trust for Sample Voting

IRIF, RSVP, POPSpEC
Building Trust for Sample Voting
RSV In Practice

Expert trials

- Tested at Crypto 2015 and Real World Crypto 2016
- Data and audits publicly available
- No vulnerabilities found
- Publicity within the field

Problem

We still needed a real public trial
Global Forum on Modern Direct Democracy

GFMDD ’16 in San Sebastian

- Around 200 participants from more than 30 countries for four days
- Journalists, political scientists, politicians, local activists
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RSV at the forum

- Two parallel votes, around 120 ballots total:
  - Should voting be mandatory?
  - Should negative campaigning be authorized?
Murphy’s Law

Technical problems

- Printing ballots
- HTML on certain devices
Murphy’s Law

Technical problems

- Printing ballots
- HTML on certain devices

Design issues

- Font problems
- Voting timeline
Results from GFMDD

Participation

- Around 25-30% average
- Highly dependent on the question
Results from GFMDD

Participation
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Feedback from voters
- Found easy to use and trustworthy (from a security standpoint)
- Not as legitimate as general elections, but would increase engagement
- Mixed opinions about corruption prevention
Creating Familiarity

Trust vicious cycle

- Without successful large scale trials, system isn’t seen as trustworthy or legitimate
- Without legitimacy, people won’t use the system
- If people don’t use it, no large scale trials are possible
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Improving intuition

- Best method is experimentally (as with betting)
- RSV Simulator
RSV Simulator

Features

- Past elections to confirm correctness
- Simple and advanced modes
- Security and authenticity by having all code run on the machine
- Viewable temporarily at www.koliaza.com/rsvp
The Public Opinion Platform
What is POP

A Platform and a Party

- Integrate deliberation and voting
- Single promise from representants: follow the will of the people
- International in scope
What is POP

A Platform and a Party

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Real-time democracy

- Give people back permanent control
- Doesn't need support from governments
- Can progressively transform the political scene
Establishing legitimacy

- Secure voting system
- Avoid self-selection and represent the whole people
- Also improves visibility
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Making it accessible

- Increasing local and global participation
- Bridging the digital gap through third party voting
The Future
Improving RSV

Design

- Central voting site to simplify parallel votes
- Simpler crypto-system
- User-friendly scratch-off ballots
Improving RSV

Design

- Central voting site to simplify parallel votes
- Simpler crypto-system
- User-friendly scratch-off ballots

Public appeal

- Larger scale trials
- Improved simulator
- Free-to-use voting website for people to try
Fighting for POP

Improving POP

- System still being implemented
- Reflexions on best access methods and evolution
- Platform/RSV balance to be found
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Improving POP

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Making it POPular

- Reluctance from political class
- Thanks to RSV, grassroots is possible
- About to go public
Collaborations

**RSV**

- Council of Europe for major vote at WFD
- Efforts to study impact on abstention with Herrade Igersheim
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**RSV**

- Council of Europe for major vote at WFD
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**POP**

- Appeal to politicians in multiple countries
- Work with Council of Europe
- Technology exchange with vTaiwan and Pol.is