Livos

Liquid-Federated Voting System

# LIVOS : BACHELOR PROJECT PRESENTATION

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# SUMMARY:

- Introduction (what is livos, usefulness, goal, challenges)
- Implementation (structure, website, simulations)
- Simulation (Survey, Circle, Tyrant, Markov, Quadratic Voting)
- Results (Liquid accuracy impact)
- Conclusion

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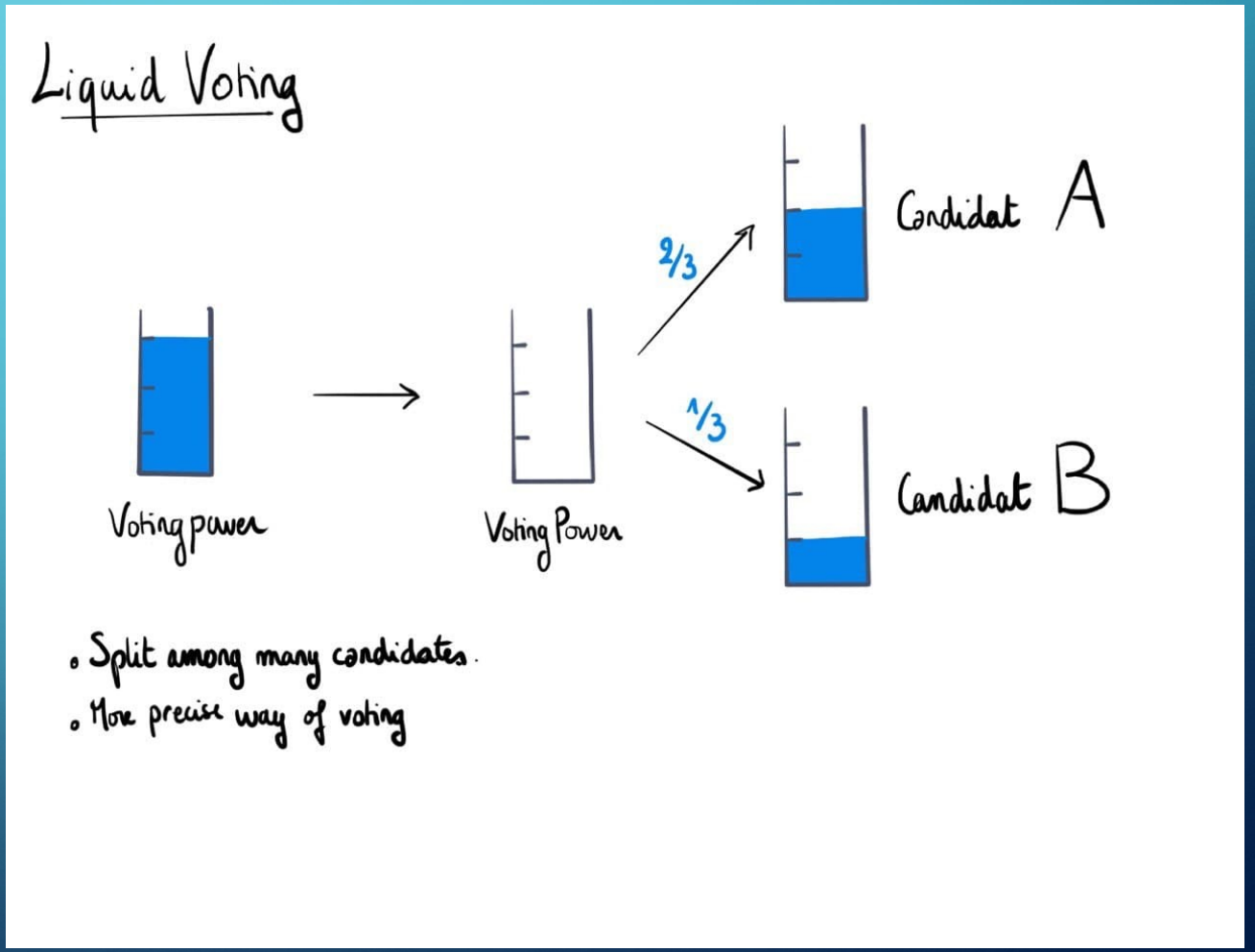
# INTRODUCTION : WHAT IS LIVOS ?

- Research project based upon Liquid Democracy
- Liquidity
- Delegation
- Proof of concept of E-voting system



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# USEFULNESS OF THE PROJECT

- Major problem : not yet applied in real systems. (Digital Liquid Democracy)
- Theory is ready.
- Missing part : to provide more effort into working on a realist implementation of a Liquid Democratic voting system.

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# GOAL OF THE PROJECT

- Proof of Concept of integration of a Liquid system in «real» simluations
- Does Liquid Democracy bring major changes to the results ?
- Basis for future studies

- Comes with interrogations:
  - Circle delegation, Tyrant problems
  - Minorities and the balance of voting power

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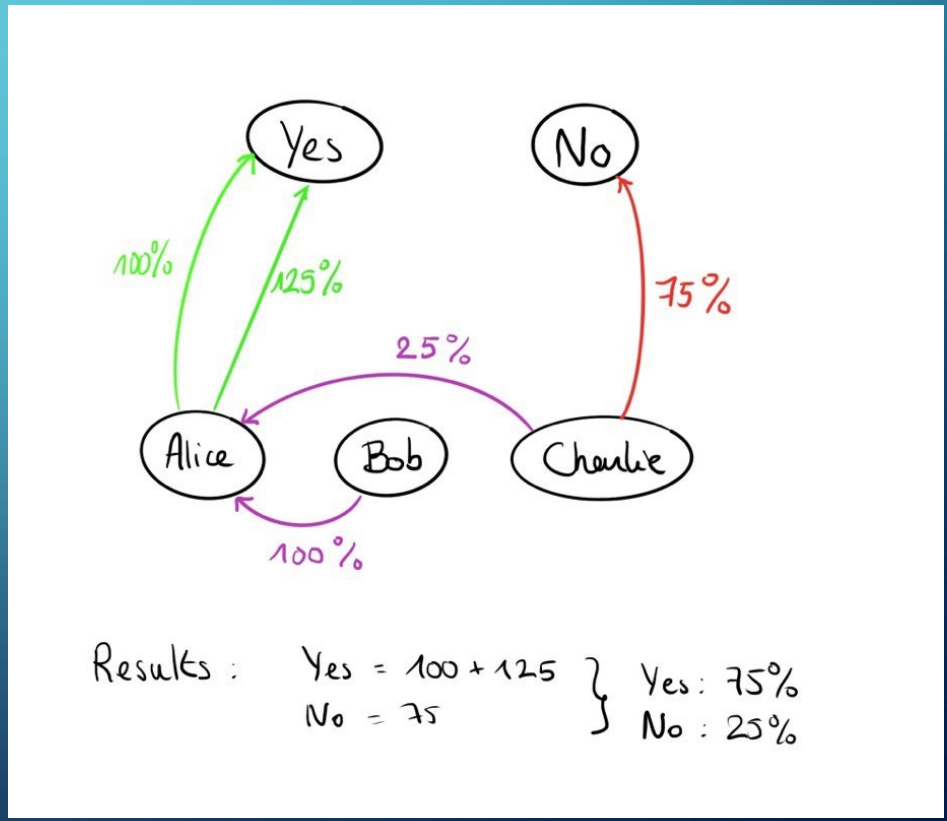
# CHALLENGES

- Drop Security and federated aspect to mainly focus on the Liquid/Delegation part. (First ideas were too ambitious)

- Implementation of the liquid democracy :
  - more complex than traditional
  - simulating the behavior of a voter



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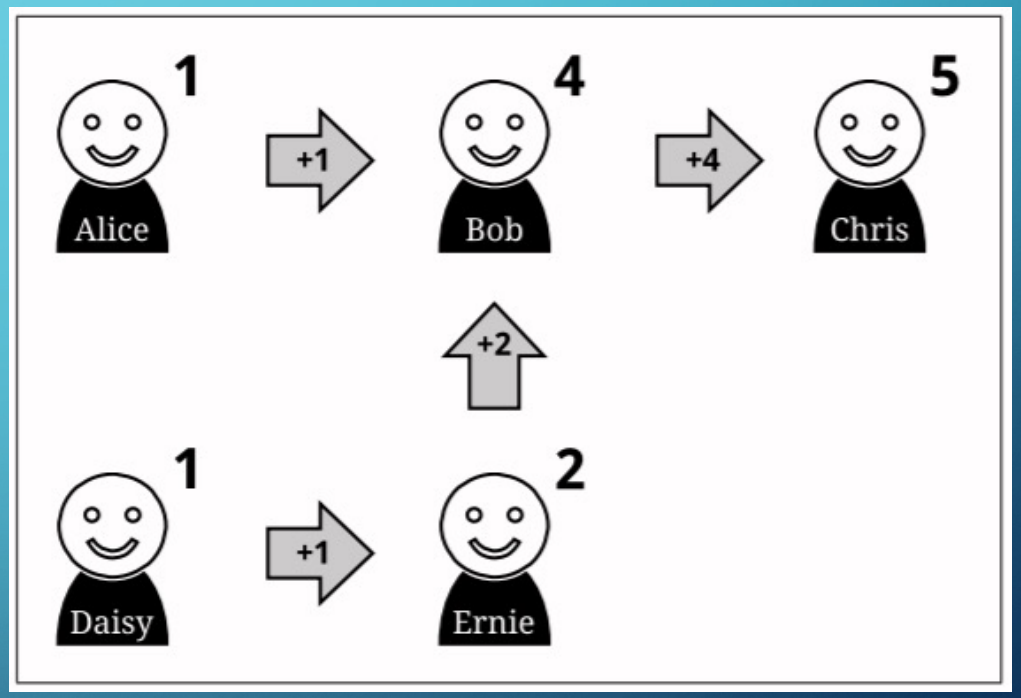
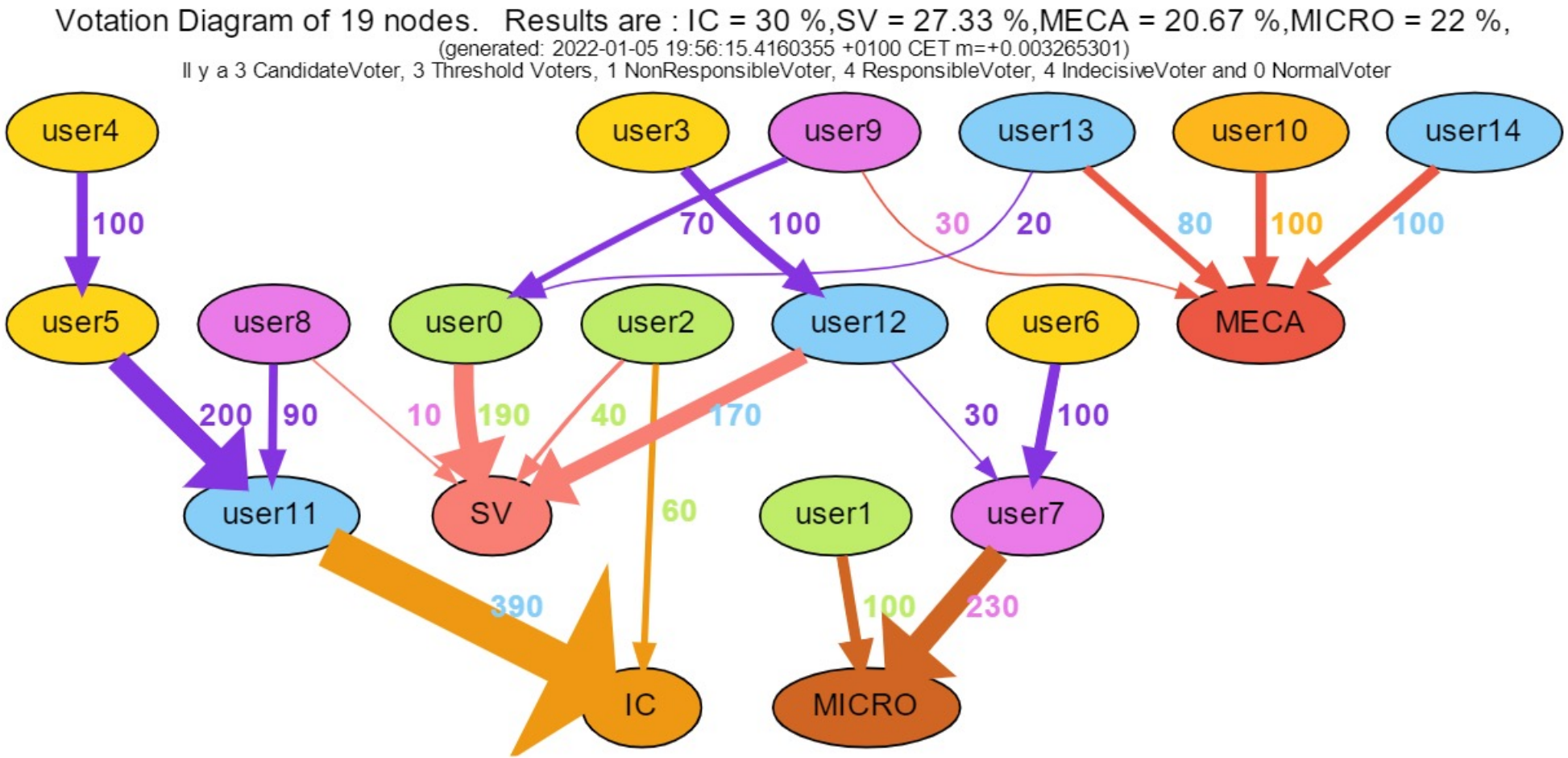
# SIMULATION DESIGN

- Blank vote and abstention-vote
- Maximum number of actions
- Simulation rounding problems
- Transitivity of delegation



# IMPLEMENTATION:

- Key words: VotingSystem, VotingInstance, VotingConfig, Users
- Server and web application : DEMONSTRATION
  - Tool that is implemented, ready to be used for a real (centralized) experiment.
- Simulations with the GraphViz library (see next slide)


Votation Diagram of 19 nodes. Results are : IC = 30 %,SV = 27.33 %,MECA = 20.67 %,MICRO = 22 %,
(generated: 2022-01-05 19:56:15.4160355 +0100 CET m=+0.003265301)
Il y a 3 CandidateVoter, 3 Threshold Voters, 1 NonResponsibleVoter, 4 ResponsibleVoter, 4 IndecisiveVoter and 0 NormalVoter
user4
user3
user9
user13
user10
user14
100
70
100
30
20
80
100
100
user5
user8
user0
user2
user12
user6
MECA
200
90
10
190
40
170
30
100
user11
SV
60
user1
user7
390
100
230
IC
MICRO

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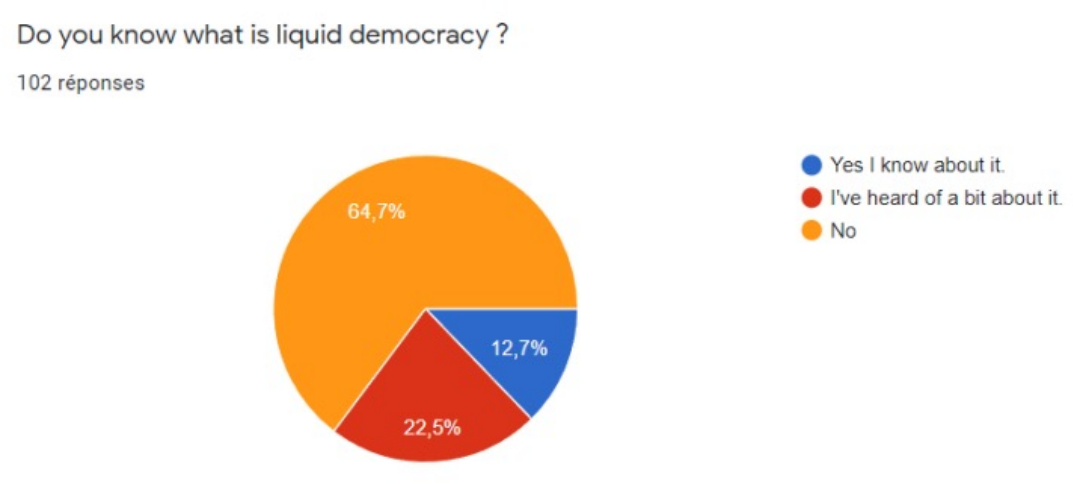
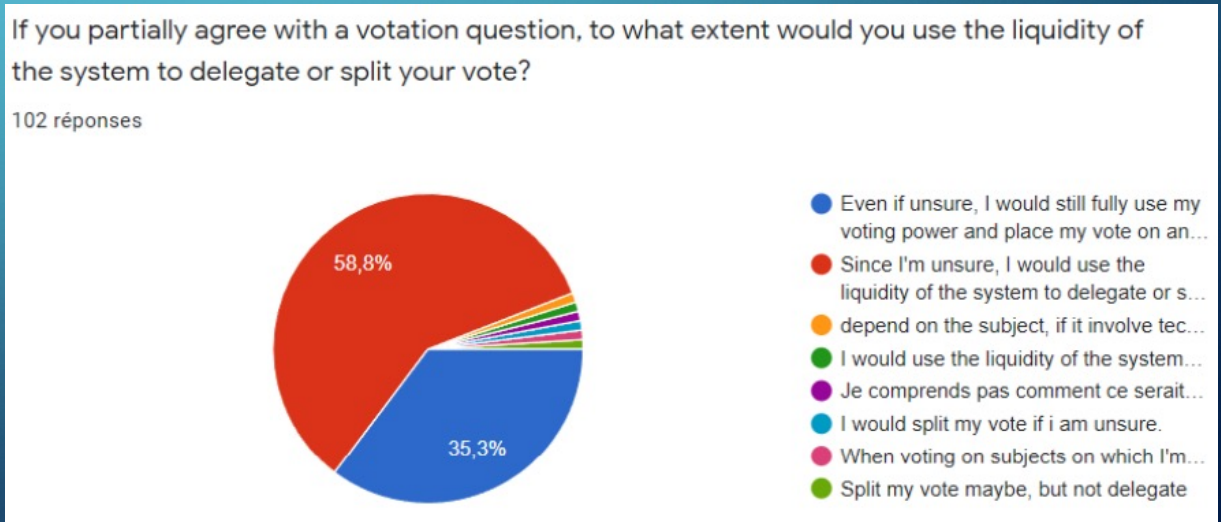
# SIMULATION: SURVEY

- Objective : Categorize voters specific behaviors




- Run simulation with (limited) set of datas closest to the reality
- Urge to make Liquid Democracy popular



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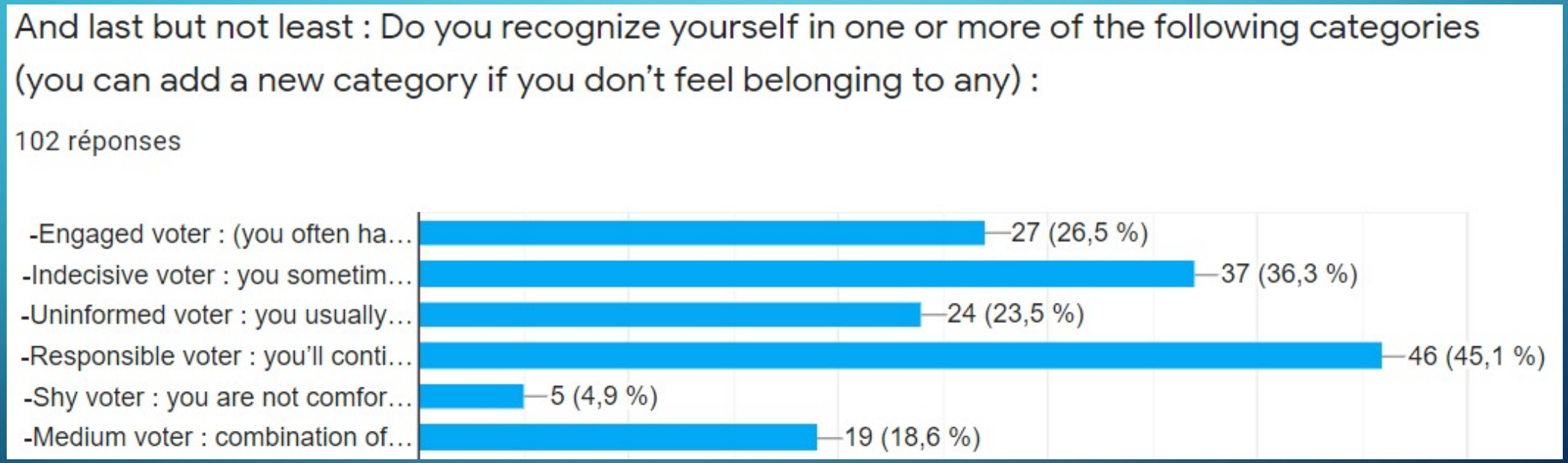
# DIFFERENT VOTER CATEGORIES



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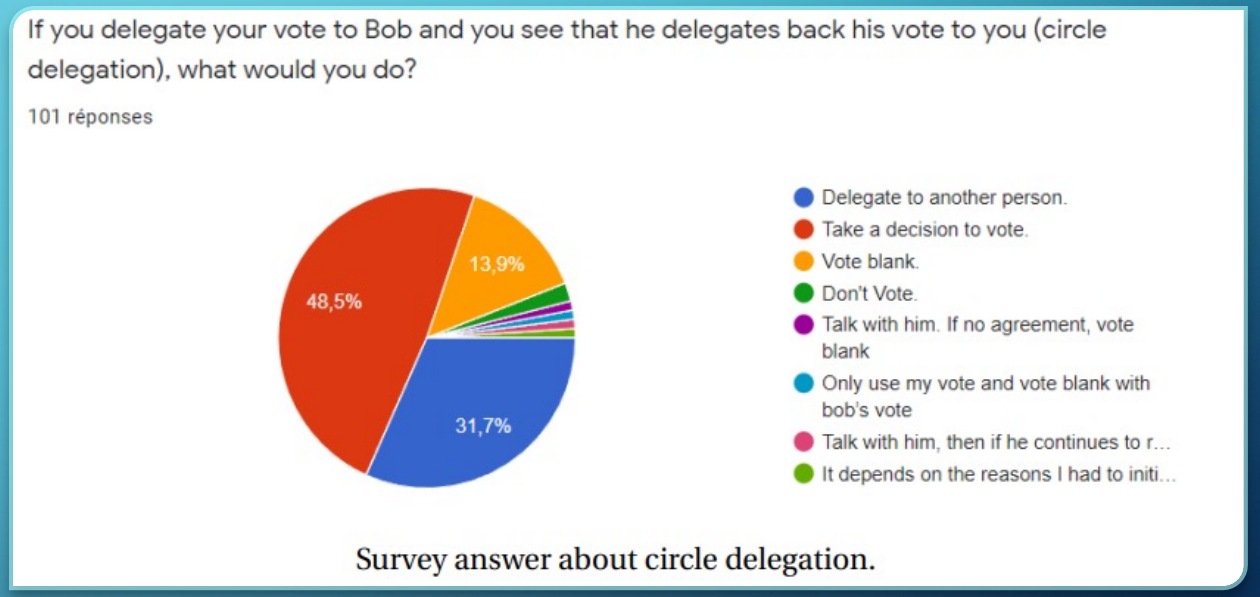
# CIRCULAR DELEGATION PROBLEM

- Awareness of a cycle then take a decision (to break it).
- How ? Notification system : come back to the website to vote again



Survey answer about circle delegation.

# COULD WE AUTOMATE THIS PROCESS TO BE MORE USER-FRIENDLY ?

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- Voters should fill in form to describe their behavior in various situations (situations, conditions, parameters change drastically the decisions)
- Fit people into categories doesn't always represent the reality and is in fact not more user-friendly
- Another path that : running simulations with preference lists

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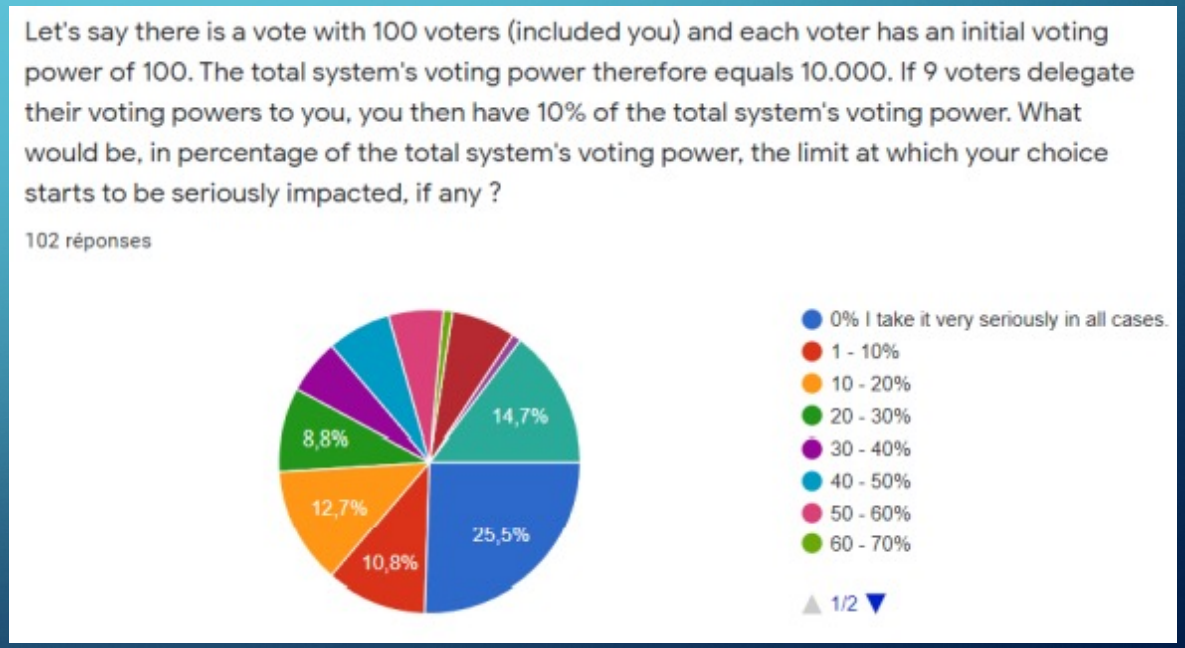
# TYRANT PROBLEMS

- We might think that with the delegation process some tyrant with too much voting power can be created.
- Either by a chain of delegation:
  - broken by responsible voters

  As they are as many chance to break the chain



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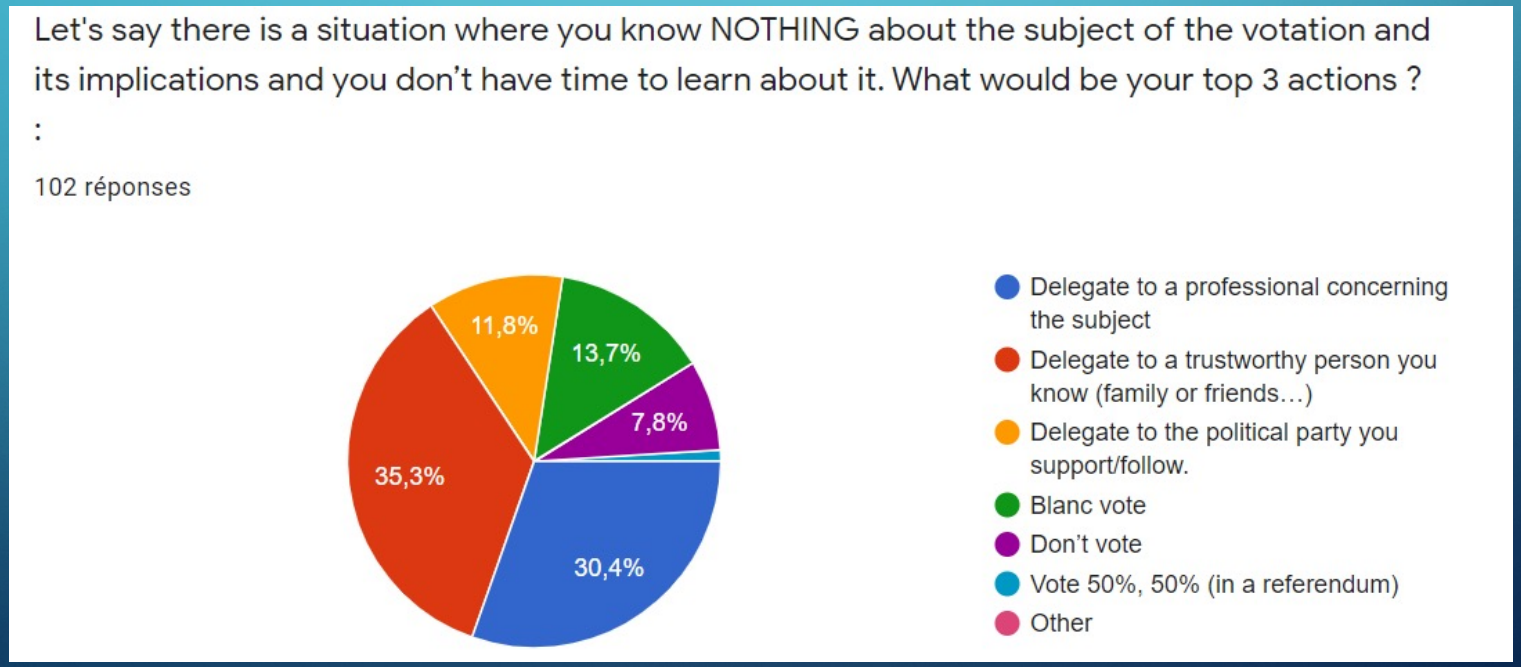
# TYRANT PROBLEMS

- If everyone delegates to one person :
  - seems unrealistic as you often delegates to someone different.



# MARKOV CHAINS

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- New result counting method:

  Elect not the most voted candidate but the one that best suits the most people.

  The liquidity = tool to count differently the results

- Example : Voter1 voted for 60% to A, 30% to B and 10% to C.

- Mathematical tool of Markov to solve this and get that B should be the winner.

- Vote 1: A,B,C
- Vote 2: A,B,C
- Vote 3: B,C,A
- Vote 4: C,B,A

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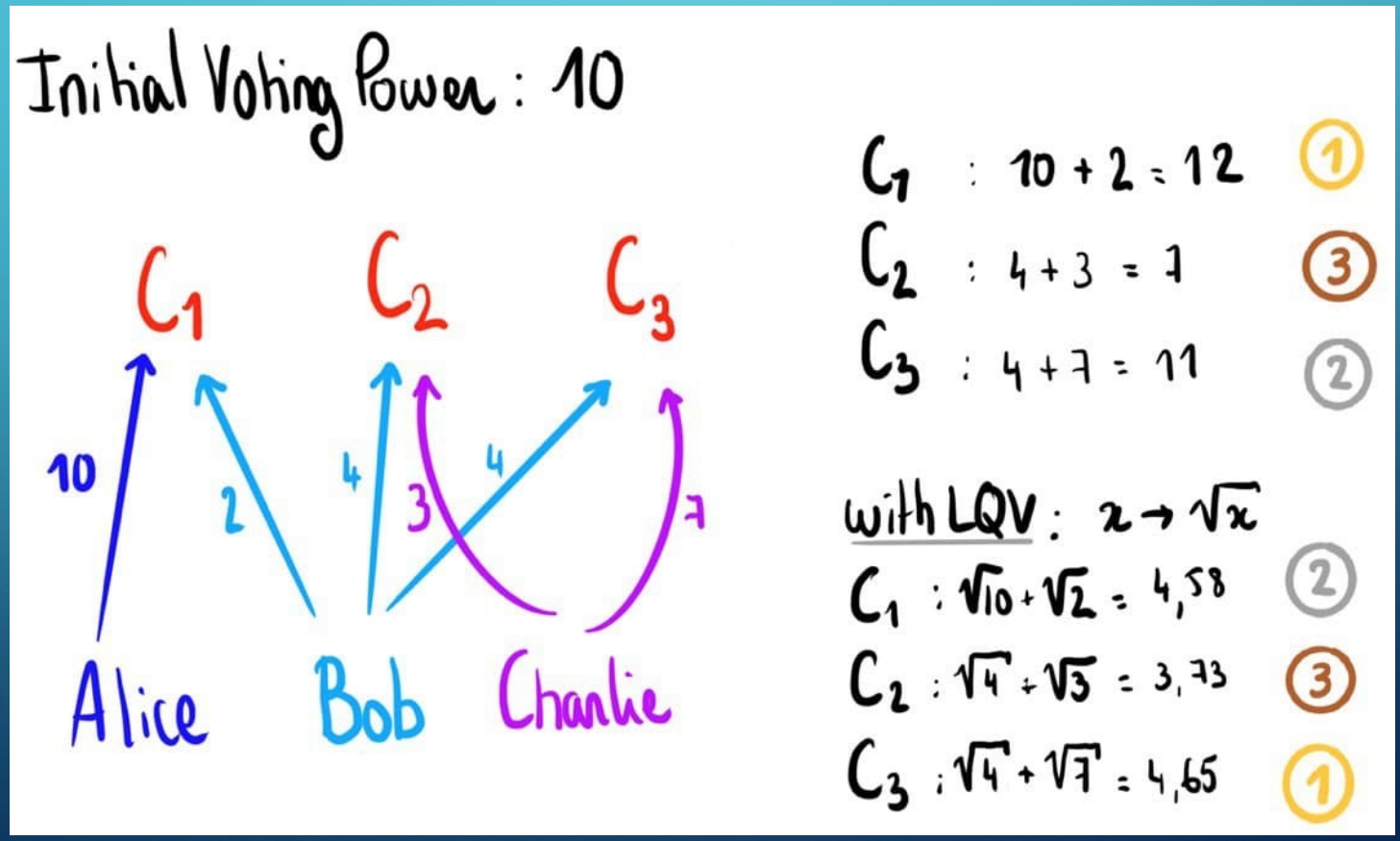
# LIQUID QUADRATIC VOTING:

- Another way of counting the results.
- Favors vote spliting and thus encourage liquidity.



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# RESULTS :

- Liquid accuracy impact measured with :
  - Election with candidates
  - Referendums (yes/no)
  - Survey data (with and without Indecisive voters : blank vote)
  - Number of voters
  - Balanced / Unbalanced votes

# LIQUID ACCURACY (ELECTIONS)

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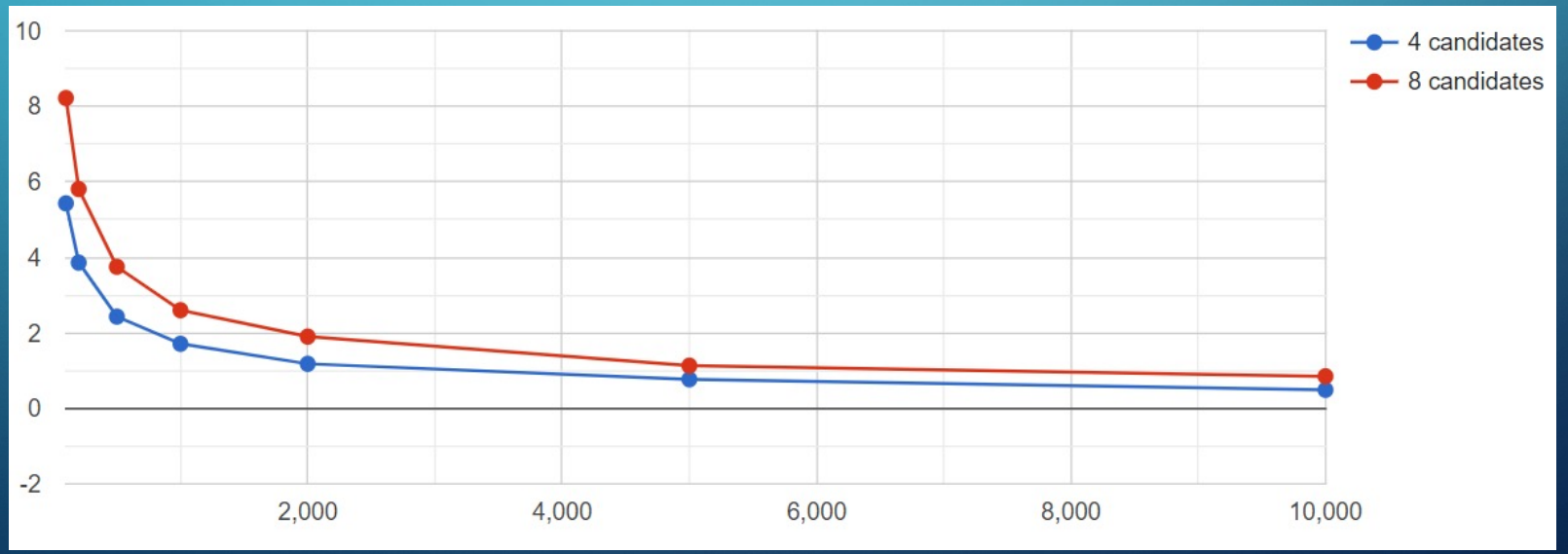
- Up to 20% precision loss when using a traditional system (stays almost constant due to indecisive voters : ~19.5%)
- Without indecisive voters : 5%- 8% then drop of the accuracy (when adding voters)
- No difference between balanced and unbalanced elections



# LIQUID ACCURACY (REFERENDUMS)

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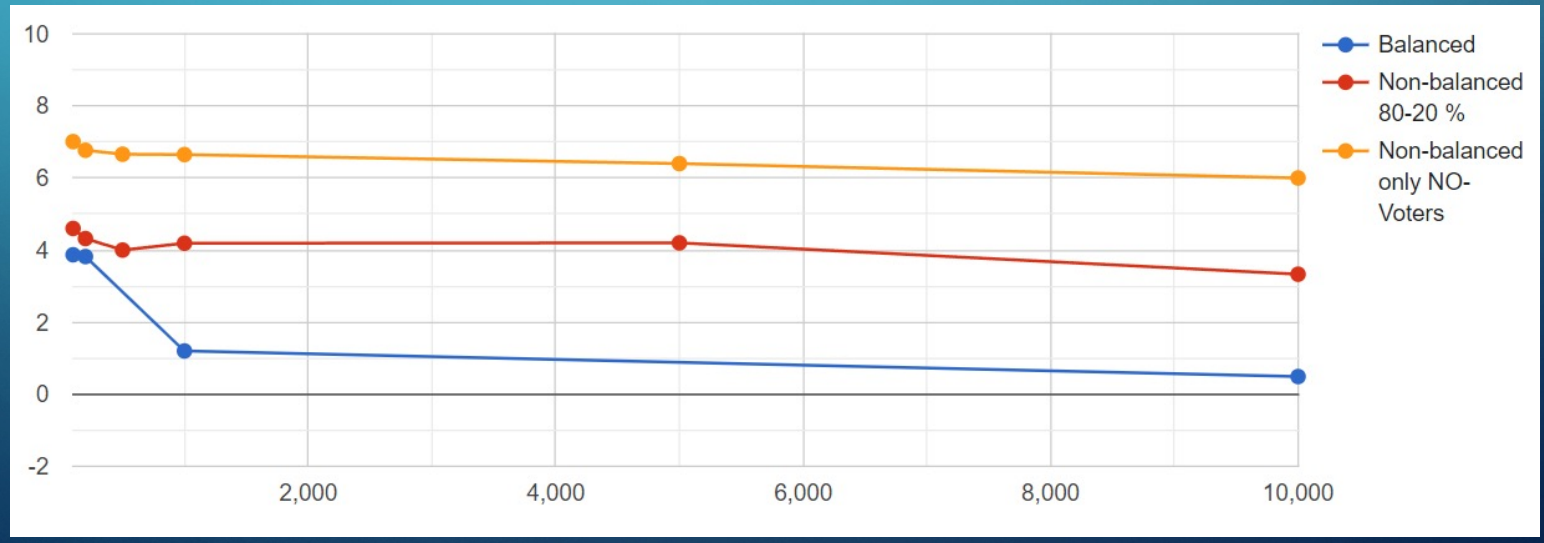
- Up to 18% precision loss when using a traditional system (stays almost constant due to indecisive voters)
- Without indecisive voters Balanced : 4% then drop of the accuracy (when adding voters)
- Non-balanced (2 sorts) : impact of accuracy stays constant (slight decrease ~1% loss from 100 to 10.000 voters



# LIQUID QUADRATIC VOTING

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- Without indecisive voters : 2.7% then quick drop of the accuracy (when adding voters)
- With indecisive voters : 4.2% then quick drop of the accuracy.

| Quadratic Impact **4** Candidates | **Realist Data** | **Realist Data without Indecisive** |
|---|---|---|
| **Balanced** (50 % each, and equal number of YesVoter and NoVoter) | 100 voters : **4.27 %** (1.000 simulations)<br>1000 voters : **1.40 %** (100 simulations)<br>10.000 voters : **0.41%** (4 simulations) | 100 voters : **2.74 %** (1.000 simulations)<br>1000 voters : **0.86 %** (200 simulations) |

- Strongly relative to the design of the system and our data.

# CONCLUSION

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- Liquid Democracy can be used in every democratic systems.
- People are more involved, the results can be up to 20% more accurate (under specific conditions)
- This project provides a system that implements Liquid Voting and provides different ways to interact with it as the website or the simulations.
- For the future, LIVOS project can be improved in many ways:
  - User-friendliness of the e-voting system, keep the balance between automation of the process and precision of the result with few solicitation of the user.
  - A Federated architecture
  - Security and usability of the web application thought proper authentication and remote access.
  - Display more information and give more options in the website to diverse the system.
  - More parameters to the simulations (such as the age of the participant...)

# THANK YOU !

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