

# Voting systems and democracy

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LORIA

PhD Pizza time, March 2023

In France, 2 important elections every 5 years.

Abstention rate in legislative 2022

Round	Abstention rate
1 <sup>st</sup> round	52,49%
2 <sup>nd</sup> round	53,77%

Abstention rate in presidential 2022

Round	Abstention rate
1 <sup>st</sup> round	26,31%
2 <sup>nd</sup> round	28,01%

- 1 Diagnosis of the situation
- 2 District voting, a threat to democracy
- 3 Proportional repartition for more democracy
- 4 Two rounds elections, the majority dictatorship
- 5 Can we improve the presidential?
- 6 Conclusion

# A huge variety of ballots

In practice, democracy is ensured thanks to elections.

In France, several types of elections.

The municipal elections	
Scale	Town
Who?	Mayor and councilors
When?	Every 6 years
Ballot	2-rounds plurinominal proportional repartition

The departmental elections	
Scale	Department
Who?	Departmental board
When?	Every 6 years
Ballot	2-rounds binominal two councilors per canton

The regional elections	
Scale	Region
Who?	Regional councilors
When?	Every 6 years
Ballot	2-rounds plurinominal majority bonus system

The legislative elections	
Scale	Country
Who?	Parliament members
When?	Every 5 years
Ballot	2-rounds uninominal one deputy per district

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The European elections	
Scale	Country
Who?	European parliament
When?	Every 5 years
Ballot	1-rounds plurinominal a few deputies per region

The presidential elections	
Scale	Country
Who?	President
When?	Every 5 years
Ballot	2-rounds uninominal

# A huge variety of ballots

In practice, democracy is ensured thanks to elections.

In France, several types of elections. They all use a different ballot!

Election	Scale	Ballot
Municipal	Town	2-rounds plurinominal, proportional
Departmental	Department	2-rounds binominal, two per canton
Regional	Region	2-rounds plurinominal, majority bonus
Legislative	Country	2-rounds uninominal, one per district
European	Country	1-round plurinominal, several per region
Presidential	Country	2-rounds uninominal, one president

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In France, several types of elections. They all use a different ballot!

Already, we notice **irregularities**, some of which are [explained](#). (Are they?)

We also notice a **strange rule**.

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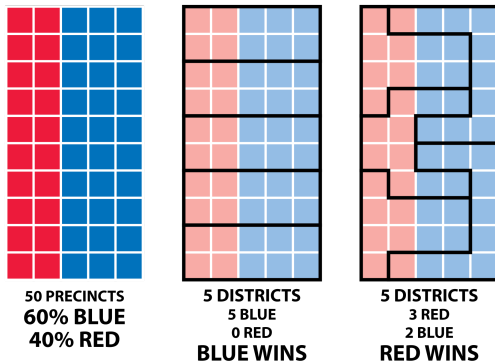
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# Divide and conquer, a strategy that never gets old

A common case: one deputy per “geographic” division.  
But district boundaries are made by politicians!

## HOW TO STEAL AN ELECTION



fairvote.org, September 2017

# Divide and conquer, a strategy that never gets old

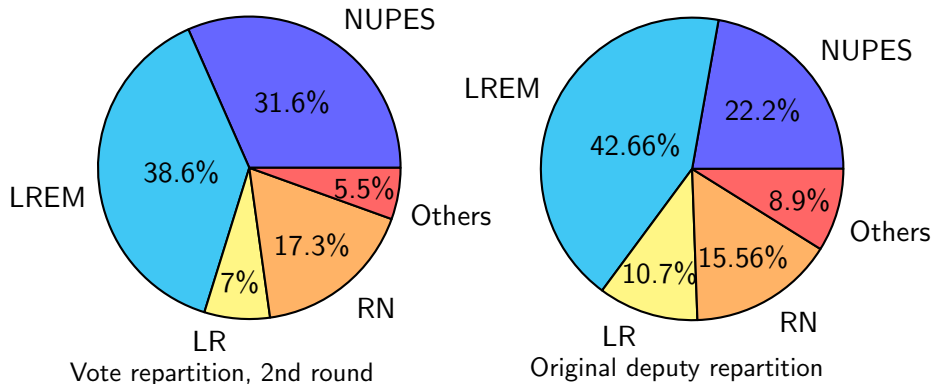
This strategy is called gerrymandering



Political cartoon, March 1812

# Divide and conquer, a strategy that never gets old

Impact on France's legislative election, 2022 (governmental data):



Note: the districts did not change recently; this was not premeditated.

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# Rounding in a proportional repartition

In France, 577 seats in the assembly.

Party	% voices	# deputies
LREM	38.6%	222.7
NUPES	31.6%	182.3
RN	17.3%	99.8
LR	7%	40.4
Others	5.5%	31.7

We need a rule to do the rounding!



# The D'Hondt method

This rule is used in Belgium.

**Step 1.** Successively divide the number of votes by  $1, 2, 3, \dots$

**Step 2.** Get the 577 highest values of the obtained list

**Step 3.** The corresponding parties get the seat

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Example

divisors	LREM	NUPES	RN	LR	Others
1	38.6	31.6	17.3	7.0	5.5
2	19.3	15.8	8.65	3.5	2.75
3	12.87	10.53	5.77	2.33	1.83
4	9.65	7.9	4.33	1.75	1.38
5	7.72	6.32	3.46	1.4	1.1
6	6.43	5.27	2.88	1.17	0.92
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Result for the 2022 French legislative

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slightly favors  
large parties

# Many other methods

There are many other methods to achieve proportional voting:

- Highest averages methods (ex: the D'Hondt method)
- Largest remainder methods
- Single Transferable Vote
- $\vdots$

They may favor small or large parties.

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Example: the **majority bonus** (used for regional elections)

- Gives 25% of the seats to the winner
- Use proportional repartition for the others

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- Highest averages methods (ex: the D'Hondt method)
- Largest remainder methods
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- $\vdots$

They may favor small or large parties.

Example: the **majority bonus** (used for regional elections)

- Gives 25% of the seats to the winner
- Use proportional repartition for the others
- You only need 33% of the voices to get the majority!

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# The second round promotes useful and strategical voting

Results of the first round of the presidential 2022, by political alignment

Candidate	1 <sup>st</sup> round score	
Nathalie ARTHAUD	0, 56%	} Extreme left (1, 33%)
Philippe POUTOU	0, 77%	
Fabien ROUSSEL	2, 28%	} Left (30, 61%)
Jean-Luc MÉLENCHON	21, 95%	
Yannick JADOT	4, 63%	
Anne HIDALGO	1, 75%	} Right (34, 69%)
Jean LASSALLE	3, 13%	
Emmanuel MACRON	27, 85%	
Valérie PÉCRESSE	4, 78%	
Nicolas DUPONT-AIGNAN	2, 06%	} Extreme right (30, 22%)
Marine LE PEN	23, 15%	
Éric ZEMMOUR	7, 07%	

# The second round kills representativity

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Consequence: the minorities cannot **express** their opinion.

# Using only one round does not solve all problems

Number of seats per party after the legislative election, 2022

Nuances de Candidats	Nb Sieges
Divers extrême gauche	0
Parti radical de gauche	0
NUPES	131
Divers gauche	22
Ecologistes	0
Divers	1
Régionalistes	10
Ensemble !	245
Divers centre	7
Les Républicains	61
Divers droite	11
Reconquête !	0
Rassemblement National	89
Divers extrême droite	0



# Single transferable vote (STV)

STV is a voting system used in Australia, Canada, the USA and the UK.

1. Each voter order (some of) the candidates:

Elise's ballot

Choice
Gandalf the White
Santa Clauss
Capybara
Agent Smith
Zarathoustra
Dora the explorer

Maiwenn's ballot

Choice
Capybara
Santa Clauss
Gandalf the White
Zarathoustra
Agent Smith
Dora the explorer

# Single transferable vote (STV)

2. A quota is set to get a seat
3. The first candidate on each ballot gets one vote

Elise's ballot

Choice	Value
Gandalf	1
Santa Clauss	0
Capybara	0
Agent Smith	0
Zarathoustra	0
Dora	0

Maiwenn's ballot

Choice	Value
Capybara	1
Santa Clauss	0
Gandalf	0
Zarathoustra	0
Agent Smith	0
Dora	0

Overall score

Candidate	Score
Agent Smith	7
Capybara	1000
Dora	25
Gandalf	16
Santa Clauss	36
Zarathoustra	21

Example with 6 candidates, 3 seats and 1105 voters. The quota is 277.

# Single transferable vote (STV)

- Those who reach the quota are selected.
- The voices are transferred!

Elise's ballot

Choice	Value
Gandalf	1
Santa Clauss	0
Capybara	0
Agent Smith	0
Zarathoustra	0
Dora	0

Maiwenn's ballot

Choice	Value
Capybara	0,277
Santa Clauss	0,723
Gandalf	0
Zarathoustra	0
Agent Smith	0
Dora	0

Overall score

Candidate	Score
Agent Smith	49
Capybara	277
Dora	34
Gandalf	58
Santa Clauss	489
Zarathoustra	198

Example with 6 candidates, 3 seats and 1105 voters. The quota is 277.

# Single transferable vote (STV)

- Those who reach the quota are selected.
- The voices are transferred!

Elise's ballot

Choice	Value
Gandalf	1
Santa Clauss	0
Capybara	0
Agent Smith	0
Zarathoustra	0
Dora	0

Maiwenn's ballot

Choice	Value
Capybara	0,277
Santa Clauss	0.410
Gandalf	0.313
Zarathoustra	0
Agent Smith	0
Dora	0

Overall score

Candidate	Score
Agent Smith	53
Capybara	277
Dora	44
Gandalf	256
Santa Clauss	277
Zarathoustra	198

Example with 6 candidates, 3 seats and 1105 voters. The quota is 277.

# Single transferable vote (STV)

- If no one reaches the quota, the least popular candidate is eliminated.
- The voices are transferred!

Elise's ballot

Choice	Value
Gandalf	1
Santa Clauss	0
Capybara	0
Agent Smith	0
Zarathoustra	0
Dora	0

Maiwenn's ballot

Choice	Value
Capybara	0,277
Santa Clauss	0.410
Gandalf	0.313
Zarathoustra	0
Agent Smith	0
Dora	0

Overall score

Candidate	Score
Agent Smith	94
Capybara	277
Dora	0
Gandalf	259
Santa Clauss	277
Zarathoustra	198

Example with 6 candidates, 3 seats and 1105 voters. The quota is 277.

# Single transferable vote (STV)

8. The process is repeated until someone reaches the quota or enough candidates have been eliminated

Elise's ballot

Choice	Value
Gandalf	1
Santa Clauss	0
Capybara	0
Agent Smith	0
Zarathoustra	0
Dora	0

Maiwenn's ballot

Choice	Value
Capybara	0,277
Santa Clauss	0.410
Gandalf	0.313
Zarathoustra	0
Agent Smith	0
Dora	0

Overall score

Candidate	Score
Agent Smith	0
Capybara	277
Dora	0
Gandalf	311
Santa Clauss	277
Zarathoustra	240

Example with 6 candidates, 3 seats and 1105 voters. The quota is 277.

# Single transferable vote (STV)

Winners of the election:



Note: the progress of the example was not decided by Elise and Maiwenn.

# Single transferable vote (STV)

## Advantages

Proportional repartition

Less strategical voting:

- One vote, many rounds
- Your vote is never lost

Visibility of small parties

Representativity for the minorities

## Disadvantages

Hard to undersand

Hard to use:

- Rank (some of) the candidates
- Strict ordering

Hard to display the result

Hard to tally



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# STV still works: Instant Runoff Voting



See the full comics at [chickennation.com/voting](http://chickennation.com/voting)

The Condorcet methods find the most “rightful” candidate

**Condorcet winner:** is preferred from all the others by a majority

Condorcet’s strategy:

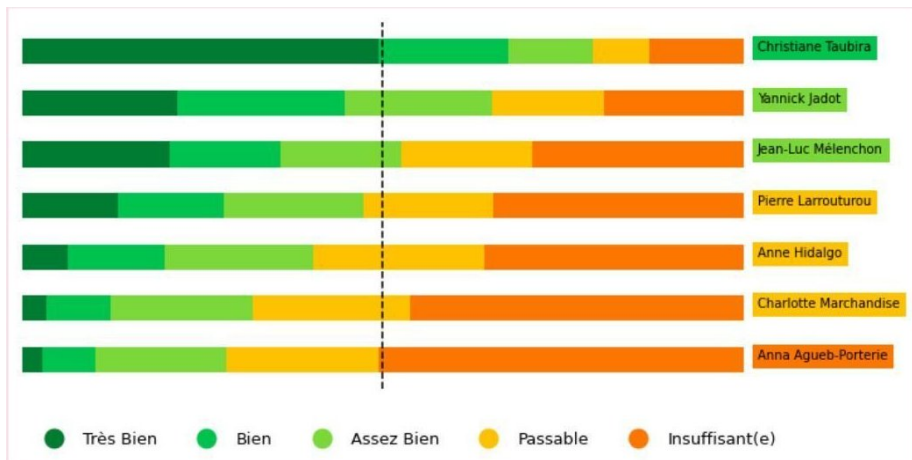
- Rank all candidates (you can give the same rank to several candidates)
- The Condorcet winner wins!

**Condorcet paradox:** There is not always a Condorcet winner...

A lot of Condorcet-compliant methods exist to solve this: Schulze method, ranked pairs, minimax... it is also possible to use IRV as a tie-break rule.

# Majority judgment

The majority judgment is the choice of the “collective intelligence”



Results of the left-wing primary election, 2022 (europe1.fr)

The simplest solution would be to switch to approval voting

Who would you like as a PhD advisor?	
Niels Henrik Abel	<input type="checkbox"/>
Véronique Cortier	<input checked="" type="checkbox"/>
Sigmund Freud	<input type="checkbox"/>
Pierrick Gaudry	<input checked="" type="checkbox"/>
Victor Hugo	<input type="checkbox"/>
Adi Shamir	<input type="checkbox"/>
Zinedine Zidane	<input type="checkbox"/>

# Conclusion

There are plenty of alternatives to improve the current situation!

Voting system	Advantages	Disadvantages
STV	Expressive Addresses strategical voting	Very complex Strict ordering <b>Not</b> Condorcet-compliant
Condorcet methods	Fair, expressive Addresses strategical voting Simpler than STV	Complex Must rank all candidates
Majority judgment	Approved by very smart people Relatively simple	Must grade all candidates <b>Not</b> Condorcet-compliant
Approval voting	Simple Close to the current system	Does <b>not</b> prevent strategical voting! <b>Not</b> Condorcet-compliant