Voting maps

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Voteshire

▶ Voteshire has 25 voters who live on a square grid.

▶ Voters either vote for the $\square$ or $\triangle$ parties.

▶ Voteshire returns 5 MPs.

▶ How should the voting results here be used to assign 5 MPs.

 ▶ How many MPs does each party get?

 ▶ Which voters are represented by which MP?

$\square$	$\square$	$\square$	$\square$	$\square$
$\square$	$\square$	$\square$	$\square$	$\square$
$\square$	$\triangle$	$\triangle$	$\square$	$\square$
$\square$	$\triangle$	$\triangle$	$\triangle$	$\triangle$
$\square$	$\triangle$	$\triangle$	$\triangle$	$\triangle$

Uneven boroughs

► In England, after the Magna Carta of 1215, each parliamentary borough could send two representatives to Parliament.

► The population grew in some areas and shrank in others, and by the 18th C. some constituencies, known as rotten boroughs, were so small that wealthy landowners could control the vote.

► Meanwhile, some new large cities had very many people with little representation.

► For example, in the early nineteenth century, the city of Manchester had a population of 100,000, while Old Sarum in Wiltshire had just a handful.

► The 1832 Reform Act changed this.

(Rowińska, 2024)

Electoral maps

- ▶ So it is important to change electoral boundaries from time to time.
- ▶ But who gets to choose?

Gerrymandering

▶ The process where the party in power chooses electoral boundaries to suit themselves is known as Gerrymandering.

▶ The term comes from a US state senate district drawn by Elbridge Gerry in 1812, which was said to look like a salamander.
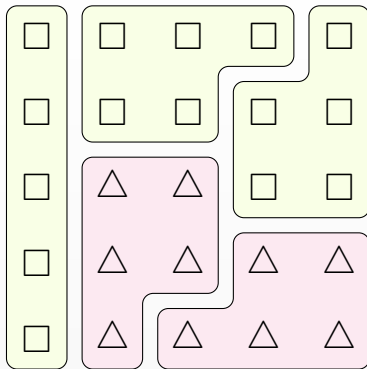
(Rowińska, 2024)

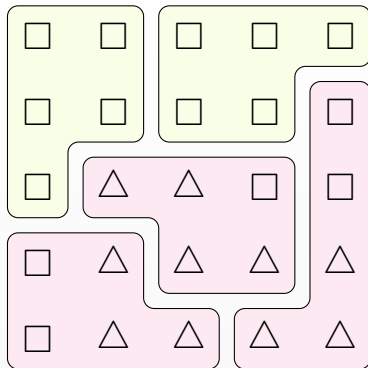CC0 National Museum of American History

- ▶ How about this?
  □ Party: 3;
  △ Party: 2.
- ▶ Two □ voters are represented by a △, and two △ voters by a □. But that's democracy for you.
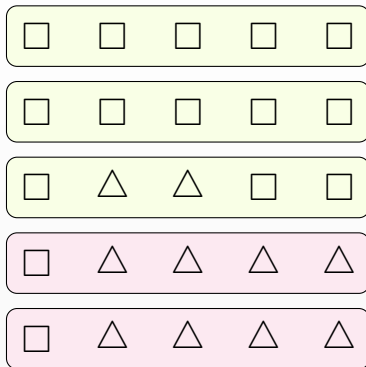
- ▶ How about this?
  ☐ Party: 3;
  △ Party: 2.
- ▶ Everyone is represented by a candidate they voted for.

- ▶ How about this?
  □ Party: 2;
  △ Party: 3.
- ▶ △ Party is the winner!
- ▶ Is this fair?

Judging fairness

▶ In any election, each party 'wastes' some votes: all votes in losing constituencies, and any excess votes in winning ones.

▶ The efficiency gap is the difference between the votes wasted by two parties, expressed as a percentage of the total number of votes.

▶ In a fair election, both parties waste a similar number of votes, which translates to a small efficiency gap.

Judging fairness

- ▶ What is the efficiency gap in this election?
- ▶ Wasted votes: all votes in a losing district, any votes > 50 in a winning one.
- ▶ For example, in District 1, Party A 'wasted' 20 votes and Party B 'wasted' 30.
- ▶ The efficiency gap is the difference between the votes wasted by both parties as a percentage of the total number of votes.

District	A	B
1	70	30
2	70	30
3	70	30
4	54	46
5	54	46
6	54	46
7	54	46
8	54	46
9	35	65
10	35	65

Judging fairness

- ▶ There were 1000 votes.
- ▶ Party A 'wasted' $3 \times 20 + 5 \times 4 + 2 \times 35 = 150$.
- ▶ Party B 'wasted' $3 \times 30 + 5 \times 46 + 2 \times 15 = 350$.
- ▶ The difference is $200 = 20\%$ in favour of Party A.
- ▶ But something may be wrong in this constituency because the efficiency gap is quite large!

References

Rowińska, P. (2024). *Mapmatics: How we navigate the world through numbers*. Picador.