# ABM

The provided notebook contains a basic implementation of a model of political party competition in relation to alternative voting systems. The model consists of political parties and districts. Political parties have a policy position in a 2-D continuous space.

A political party runs candidates in all districts sampled from a 2-D normal distribution centered on its current policy position. Depending on how well the elections go, the party updates its policy position and runs new candidates in the districts it has lost. The party always keeps its successful candidates.

A district has a population of voters. There are three distinct subpopulations, each with its own mean policy position. The districts differ in how many population members are sampled from each subpopulation. Given the candidates run by each party in their district, the district members vote. In the current implementation, there is no change in the policy position of the population.

The model comes with 3 different voting systems:

1. First past the post (**plurality vote**)
2. **Majority vote** where the worst performing candidate is dropped each round until a candidate secures more than 50% of the vote
3. **Borda count**, rather than vote for a preferred single candidate, all population members rank order their candidate with 0 points for the most preferred candidate. Next, the total score for each candidate is calculated by summing the points across the population. The candidate with the lowest total score wins.

The model aims to explore the behaviour of political parties as expressed by how they move through policy space across these different voting systems. The model is inspired by ongoing discussions in the UK and various states of the US about changing their voting system.

The provided notebook contains the implementation of the complete model, but the default rule of how parties update their policy position is not interesting. In the provided version, parties follow a so-called Stickler rule. That is, political parties have a fixed policy position and never change this position. They only run new candidates in those districts they have lost, but these are sampled from the same 2-D normal distribution centered on a static policy position.

1. Change the behaviour of the party from the stickler rule to a combination of the aggregator rule and the vote seeker rule. The aggregator rule holds that the new policy position of the party is the mean of the policy positions of the candidates that have won for that party. The agents follow this rule if they have won any seats. If a party does not win any seats, it follows a vote-seeker rule. The vote-seeker rule states that a party updates its policy position by moving towards the policy position of the largest party. Assume that they do this by moving 5% towards the biggest party on both dimensions of the policy space.
   1. (20/100) Sketch a flowchart or provide in pseudo-code a conceptual description of the modified step method for the political party
   2. (30/100) Implement the step method. For validation purposes, the figure below gives you a sense of the dynamics the model produces. The necessary code to create this visual is included in the notebook.

Graphical user interface, application

Description automatically generated

Figure 1 Indicative results for seed 15, and plurality voting. The left-hand plot shows the movement of the political parties through policy space. The blue lines are a gaussian kernel density estimate of the policy position density of the population. The top right-hand plot shows the number of seats over time. The bottom left-hand plot shows the vote share.

1. (20/100) The current implementation of the model treats the population as static. There has been some work, however, that suggests that people are open to moving to different geographically neighbouring districts if this improves the alignment between their policy position and the policy position of the candidate typically selected in that other district. One example of this type of work is the so-called Tiebout model.

Provide a detailed conceptual description of how you would modify the provided model to bring in this additional dynamic of the population potentially moving to geographically neighbouring districts based on the kind of candidate being elected in these districts. Consider potential modifications to the agents in the model, the space, scheduling, or step methods.

1. The model aims to explore the impact of voting systems on the behaviour of political parties. Explore the behaviour of the model for the three provided voting systems.

If you struggled to answer question 1, continue with the originally provided model.

* 1. (15/100) Implement the code necessary for performing the described set of experiments
  2. (10/100) Provide a clear visualization of how the model's behaviour changes across the three voting systems.
  3. (5/100) Describe and explain the changes in behavior as shown in response to question 3B.