# Artificial Societies

In each society we define parties and preference orders, where a preference order is an order over all parties.

We define as the total number of voters in a given district.

## Polya Eggenberger (Urn) Model

We assume districts are independent.

In each district we sample preference orders, each representing a single voter, from the Polya Eggenberger distribution with parameter where represents the homogeneity of preferences in the district.

## Spatial Model

Our model has a parameter which is a vector representing the standard deviation in each dimension in the space of issues.

Where

As our model is unaffected by adding dimensions with zero variance, that is values of such that, it would still be possible to fit our model with an overestimate of, and for, there exists an equivalent model with , thus for the sake of convenience we define .

We have a parameter which represents the standard deviation of population means of districts as a portion of the standard deviation of voters.

We define a dimensional space called the space of issues. Each voter and each party are represented by a point in this space. Voters prefer parties with a lower distance between a voter’s point and a given party’s point.

In each party we select where represents the point in the space of issues of party.

We also consider the case in which two of the parties are instead represent the traditional major “left” and “right” parties.

Population means for voters in a district is selected

We assume districts are independent.

In each district, a voter is selected

### Parameter selection

#### Parameter z

We run PCA over the first preferences in each district of an election. It makes sense that the variance explained by each principal component would have some relationship with our parameter. We validate this hypothesis by simulating a large number of elections under our model for each of several different values of and comparing the variance explained by each principal component of the outcomes.

We select by running the PCA algorithm over the outcome of a real election, or set of elections, and varying to minimise the error defined as the distance between the variance explained by each principal component of the actual elections and the variance explained by each principal component of the simulated elections.

#### Parameter d

## Preference Swapping Model

The Preference Swapping Model takes a set of real world elections as a parameter and creates a cluster of similar elections around each real world election.

We define to be the probability that a voter switches a voter’s 1st and th

### Parameter selection