

Design Your Own Democracy accompanies the Introduction to the Modeling Cycle chapter of the book ***Mathematical Modeling: Teaching the Open-ended Application of Mathematics***. To find out more about this modeling curriculum, please visit www.meaningfulmath.org. You can contact Joshua Abrams at meaningfulmath@meaningfulmath.org

The “*Design Your Own Democracy*” program may not be altered, distributed for a fee, or distributed without this document, the Democracy Program Guide file.

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Thanks to Jeffrey Westall for his help with this documentation and for testing the software. Special thanks to Jacob Gagnon for creating the PC version of the program.

This documentation describes each of the features of the program and suggests connections between the features and the class discussion of the political parties model. If you are using Vying Vendors (intended for middle school students), the commands have new names, but the program functions identically.

The Menu Commands

File Commands

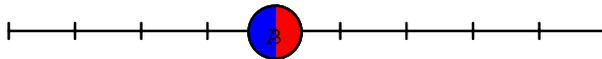
- New This command returns you to the original one-dimensional view with the initial settings. The new document is titled “untitled”.
- Open... Opens a previously saved Democracy file.
- Save This allows you to save the current settings and the current positions of the parties.
- Save As... This command is the same as save but you are allowed to specify a new file name.
- Print... This command prints the current window view.
- Quit The program quits.

Edit Commands (Macintosh version only)

Most of these commands are disabled when the program window is active.

- Copy A picture of the current political situation is copied into the clipboard.
Example:

Party	Vote
A	5.000
B	5.000



Length Commands

- 4 - 14 This list of numbers allows you to select the length of the political spectrum. This length is equivalent to the number of different positions that a party can take on a given issue. The length affects the number of voters and is equal to the number of voters in the one-dimensional, even distribution set-up. The length determines both dimensions in the two-dimensional set-up.

Parties Commands

- 2 - 8 This list allows you to select the number of parties that will compete in the democracy. Students can explore how many parties are needed under different versions of the simulation before the parties spread out along the political spectrum.

Dimension Commands

- 1 - 2 This menu allows you to choose a one- or two-dimensional political universe. It is recommended that the user understand the dynamics of the one-dimensional setting before moving to the two-dimensional grid. All two-dimensional grids are square. The two-dimensional grid is one possible approach to incorporating multiple political issues. Each axis can represent a different issue or set of issues. There is no natural origin or special point of intersection between the axes. The grid produces the $(\text{length})^2$ different combinations of the two positions that voters and parties might have on each issue. With the even distribution setting, there is one voter at each point of intersection of the grid. Parties in the two-dimensional model will consider their four neighboring positions (due north, south, east, and west) before moving. They do not move diagonally in a single turn.

Run Commands (In the PC version, the first four items appear as buttons on the main screen)

NOTE: At any time, the location of parties can be changed by positioning the cursor over a party, clicking, and dragging. If two parties are in the same place, the hand will grab the party whose label is later in the alphabet. The hand cursor can be used to change the initial configuration of the parties prior to running the simulation. It can be used to move a party in the middle of a simulation. It is also interesting to move a party once the parties have settled down into a stable or periodic configuration. Do slight shifts lead to an upheaval or are the parties quickly drawn back to their prior stable positions? In order to understand why a party chose a particular spot, stop the simulation and then move the party to each of its neighboring positions. If Display Election Totals is on then you can observe the effect that each move has on the party's vote total.

Go - The voters begin to vote (as fast as your processor can run the simulation).

Step - A party takes its turn and then the simulation stops. If All Parties at Once is checked, then one round of voting occurs and the simulation stops. Since the simulation runs rather quickly, a better understanding of the development of the parties' positions can be had by using the keyboard commands (open-apple-T for the Macintosh or "t" (once the simulation has been run once) for PCs) repeatedly to watch the parties take their turns.

Stop - If the simulation is running, this command halts the democratic process enabling you to study the current state of affairs or to adjust the conditions (menu settings can be changed and parties can be moved).

Reset - This commands returns the parties to their initial positions.

One at a Time- The parties take turns moving.

All Parties at Once - The parties plot their strategies and move simultaneously.

Vote Commands

Display Election Totals – A chart displays how much of the vote each party receives in the current arrangement.

Show How They Voted - Each intersection on the grid is colored to show which party the voter at that intersection voted for. The intersection will be colored black in case of a tie and left blank if the voter abstained from voting.

Metric - A 'metric' is a function for assigning distances to a space. It must satisfy the following properties:

$d(a, b)$ = the distance between points a and b.

$d(a, b) = d(b, a) \geq 0$.

$d(a, b) + d(b, c) \geq d(a, c)$ {the triangle inequality}

Different metrics give a space different geometric behaviors. The two metrics below are interchangeable in one dimension. However, in the two-dimensional simulation, they lead to different results. They reflect voter perception of a party's disagreement with their own views. Is a separation by one step for two separate issues better, equal to, or worse than matching on one issue and differing by two steps for the other issue?

Euclidean - Distance is measured along the diagonal. $\sqrt{(x_b - x_a)^2 + (y_b - y_a)^2}$

Taxicab - Distance is measured only along horizontal and vertical lines.

$$|x_b - x_a| + |y_b - y_a|$$

Tie Votes

Are Split - If more than one party is closest to a given voter then the voter will evenly split their vote (e.g., 1/3 of a vote each to three parties each two units away).

Go to the "Older" Party - If more than one party is closest to a given voter, the voter will cast their vote for the party whose label is earliest in the alphabet. Alphabetically earlier labels correspond to better-known, more influential parties.

Voter Distribution:

Even - Each intersection of the grid is home to one voter.

Central - More voters reside in the center of the grid than in the middle. The outermost positions are assigned one voter and then each position closer to the center receives one additional voter. For example, a nine position linear (one-dimensional) spectrum will have positions with the following numbers of voters: 1, 2, 3, 4, 5, 4, 3, 2, 1. Can students determine the pattern?

Vote If Within - Voters will only consider a party within a set number of units from them. This setting is affected by the prevailing metric. Voters with no party within this range remain neutral. This option allows voters to "punish" parties who stray too far from a given position. It simulates principled voting. It is not a good simulation of low voter turnout, which may not always be based on principles.

1 unit - 10 units - Voters will only vote for a party within this range.

Any Distance - Voters will vote for the nearest party regardless of its distance. This option is the initial setting.