Integrated Behavioral Model of Elections, Version 1.0

David A Siegel[1]
1/30/11
dsiegel@fsu.edu
URL: http://myweb.fsu.edu/dsiegel/BDSTBook

Overview

The integrated behavioral model of elections allows for the probing of outcomes that arise when two types of actors—voters and parties—interact within the setting of an electoral system. Within the model, voters make decisions via aspiration-based adjustment, retrospectively responding to payoffs that arose during the incumbent's most recent term in office. Both turnout and the choice of for which party to vote (voter choice) are modeled explicitly. Voters' payoffs depend stochastically on the policies enacted by the incumbent, and include a cost term should a voter choose to turn out. If a voter's payoff exceeds her (endogenously changing) aspiration level she becomes more likely both to vote and to vote for the incumbent party, and vice versa.

Parties make decisions via a simple satisficing dynamic. When a party wins office, it keeps its present platform. When a party fails to win office, it searches for a new platform; the model specifies several search options. Party choice—the policies each party would enact if in office—is thus modeled explicitly. The electoral system modeled is plurality rule: the party with the most votes wins the election, and the policy implemented during the period is that party's platform.[2]

A graphical interface based on RePAST 3 makes it easy to experiment with different parameter values (a helpful tutorial on using the interface can be found here: http://repast.sourceforge.net/repast_3/tutorials.html), and assorted graphs relevant to each model appear and update in real-time as a particular history unfolds. (Minimizing these will increase the speed of the program.) Simulation data are also taken as the program runs, and at the end of each history. A complete description of the different parameters and the program's operation follows. To cut down on parameters, some act in different ways depending on which combination of settings is used. To avoid confusion, please read this document carefully.

Framework of Program

Order of Events:

1. Election occurs (voter choice and turnout decisions)
2. Payoffs are given
3. Propensities are adjusted
4. Aspirations are adjusted
5. Parties search
6. Data for that period are taken. Data collection begins at period 1.

General model parameters:

(Note: unchecking “In Alpha Order” under the RePAST actions tab will order parameters by category rather than alphabetically.)

ExtraHist: Check this box to show histograms of aspirations and payoffs. Default is unchecked.

Inertia: The probability that all updating decisions (aspiration, propensity, and turnout decision adjustment, as well as party search) do not occur that period, regardless of payoff outcome. Checked independently at each opportunity for updating.

ElectionsEnd: If set to greater than zero, ends the run at this election number. Default is zero (user controlled).

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[2] A far fuller description of the integrated model can be found in Chapter 6 of Bendor, Diermeier, Siegel, and Ting 2011.

Voter-specific parameters:

N: The number of voters. Default is 1000.

bliss1mean, bliss1stdev, bliss2mean, bliss2stdev: Used in the following ideal point distributions. Individual voters receive 2-D bliss points (bliss1, bliss2).

VoterDistribution: A vector containing different options for the initial distribution of voters' ideal points. In all cases, extra voters that don't fit are placed in the center, at (0,0). Note that payoffs only derive from these; ideal points need not be known to voters. At present, the options are:

- "Evenly placed in 1-D": Range of [-3**bliss1stdev*, 3**bliss1stdev*] is populated by *N* evenly spaced voters.
- "Evenly placed in 2-D": Area of [-3**bliss1stdev*, 3**bliss1stdev*]X[-3**bliss2stdev*, 3**bliss2stdev*] is populated by *N* evenly spaced voters.
- "Uniform in 1-D": *N* voters are uniformly distributed over [-3**bliss1stdev+bliss1mean*, 3**bliss1stdev+bliss1mean*].
- "Uniform in 2-D": *N* voters are uniformly distributed over [-3**bliss1stdev+bliss1mean*, 3**bliss1stdev+bliss1mean*]X[-3**bliss2stdev+bliss2mean*,3**bliss2stdev+bliss2mean*].
- "Normal in 1-D, One Maximum": *N* voters are normally distributed with mean *bliss1mean* and standard deviation *bliss1stdev*.
- "Normal in 2-D, One Maximum": *N* voters are normally distributed in 2-D with *bliss1mean*, *bliss1stdev*, *bliss2mean*, and *bliss2stdev*.
- "Normal, 5 Maxima": *N* voters are split up into five equal groups, each normally distributed with means (-1,-1), (-1,1), (1,-1), (1,1), and (0,0) and standard deviations given by *bliss1stdev* in the x-direction and *bliss2stdev* in the y-direction.
- "Bimodal in 1-D": Half the voters are at (-1,0), the other half at (1,0).
- "Left, Middle, Right in 1-D": Skewed distribution; *bliss1mean* fraction of the voters are located at (*bliss2stdev*,0), *bliss2mean* fraction of the voters at (0,0), and the rest at (*bliss1stdev*,0).
- "Triangle": Skewed distribution in 2-D; *bliss1mean* fraction of the voters are located at (0,-1), *bliss2mean* fraction of the voters at (0,*bliss2stdev*), and the rest at (*bliss1stdev*,0).

Lambda: Rate of adjustment for both vote- and turnout-propensities; higher values correspond to faster adjustment to previous successes or failures.

StrategyAdjustment: A vector containing different options for how voters attribute their payoff signals. "Update on Incumbent Performance Only"' follows the retrospective (or economic) voting model of Chapter 5, in which voters know who the incumbent was and attribute their payoffs to him or her. "Update on Incumbent Performance and Last Vote" implies that they also attribute their payoffs to their own last vote, and adjust propensities to vote for both the incumbent and for the party to which they voted last, assuming they are different. "Update on Last Vote Only" implies that all voters attribute payoffs only to their own vote, and they do not adjust based on who is the incumbent. The last option only makes sense in multi-party competition, and should not be used in two-party competition. As an example, assume that there are parties A, B, and C, and that a voter voted for party B in the previous election. Further assume that the voter was satisfied with party A's performance as the incumbent. A voter can increase her likelihood to vote for party A (first option), A and B (second option), or B (third option). The default is option one.

VoterUtility: A vector containing different options for the utility functions of voters. The setting "Quadratic Loss" uses a quadratic loss function for the portion of the voter's utility function corresponding to the divergence of the enacted policy from the voter's ideal point: $-0.5*((\text{Inc1}-\text{bliss1})^2+(\text{Inc2}-\text{bliss2})^2)$, where Inc1 and Inc2 are the (endogenously chosen) x- and y-positions of the incumbent. "Piecewise Linear (Abs Value) Loss" uses absolute values rather than squared terms: $-0.5*(|\text{Inc1}-\text{bliss1}|+|\text{Inc2}-\text{bliss2}|)$. Default is option one.

PropensityInitDist: A vector containing different options for the way the propensities are initially distributed across the population. Accompanying parameters are *Propinitmean* and *Propinitstdev*. To get a neutral start, choose the first option and set the former to .5 and the latter to 0.

- "Distributed Normally with given Parameters": For two-party competition, each voter's propensity to vote for a Democrat is drawn from a normal distribution with stated parameters. In multi-party competition, propensities for all parties are so drawn, and then the vector of propensities normalized to one.
- "Distributed Uniformly": Same as previous description, save all propensities are drawn from a uniform distribution on [0,1].
- "All Republican (party 0)": Propensities are set to 0 for all parties other than R/party 0.
- "All Democratic (party 1)": Propensities are set to 0 for all parties other than D/party 1.

PropensityAdjustment: A vector containing different options for the way propensities are adjusted. Some options obviate other program settings, rendering them inoperable. For all but the first option, voters vote stochastically via their propensity to vote for a particular party. All ties are decided via a fair die with number of sides equal to the number of parties tied. If the model is in the two-party competition regime, only the propensity to vote Democratic is saved and updated. (The propensity to vote Republican is kept at one minus this number.) Under more than two parties, each voter maintains a propensity to vote for each party; these add up to 1. The propensity corresponding to the incumbent (and/or possibly to the party for whom the voter last voted as well; see *StrategyAdjustment*) is updated as under two-party competition. The vector of propensities is the renormalized to one. The options are:

- "No Adjustment—Downsian Voters": Propensities are not adjusted, and no data on them are taken. Voters vote deterministically according to whichever party is closer; any payoffs they receive are ignored, as are aspirations and initial propensities. Ties for closeness are broken by a fair die.
- "Symmetric Bush-Mosteller (*lambda*)": propensity = (1 - *lambda*) * propensity + *lambda* if success, propensity = (1 - *lambda*) * propensity if failure.
- "Symmetric Equal Adjustment (*lambda*)": propensity = Min (propensity + *lambda*,1) if success, Max (propensity - *lambda*,0) if failure.
- "No Adjustment—Stick with Initial Values": Propensities remain at their initial values forever, but, unlike Downsian voting, these propensities are used in determining the winner of the election.

TurnoutInitDist: A vector containing different options for the way the propensities are initially distributed across the population. Accompanying parameters are *Turninitmean* and *Turninitstdev*. To get equal chances of voting and not voting at the start, choose the first option and set the former to .5 and the latter to 0. Some of these options, as well as some of the output measures below, make use of a measure of “extremism” of voters. This measure is a normalized distance of the voter's bliss point from the mean of the voter distribution. For bounded voter distributions, this distance is constrained to lie in [0,1] by dividing by the maximum distance from the mean of the distribution attainable in the distribution. For unbounded voter distributions, the maximum distance used is that corresponding to a bliss point three standard deviations away from the mean in all dimensions. More distant bliss points are set to the maximum distance measure, 1. Values of this measure lying closer to 1 represent voters with more extreme underlying interests, while values closer to 0 represent more moderate voters, within any distribution of voter ideal points.

- "Distributed Normally with given Parameters": The chance of voting is drawn from a normal distribution with stated parameters.
- "Distributed Uniformly": Same as previous description, save from a uniform distribution on [0,1].
- "Everyone Votes": All probabilities of voting set to 1.
- "No One Votes": All probabilities of voting set to 0.
- "Extremists Vote More": The chance of voting is set equal to the measure of extremism. Thus the more extreme the voter's interests, the more she starts likely to turn out.
- "Moderates Vote More": The chance of voting is set equal to one minus the measure of extremism. Thus the more moderate the voter's interests, the more she starts likely to turn out.

TurnoutAdjustment: A vector containing different options for the way the likelihood to turn out is adjusted. Some options obviate other program settings, rendering them inoperable. For all but the first option, voters turn out stochastically via their likelihood to turn out. The options are:

- "Full Turnout": Likelihoods to vote do not vary, and no data is taken on them. Everyone votes in every election.
- The following options are the same as for vote choice propensities, and are described there. Note that each may be set independently.
- "Symmetric Bush-Mosteller (*lambda*)"
- "Symmetric Equal Adjustment (*lambda*)"
- "No Adjustment—Stick with Initial Values"

votingCost: The cost incurred for choosing to turn out.

Nu: The rate of aspiration adjustment; higher rates indicate faster adjustment.

shockUniform: When checked, indicates that the shock variable is distributed uniformly in the range [*-3*shockstdev+shockmean,3*shockstdev+shockmean*]. When unchekced (the default) it is distributed normally according to mean *shockmean*, and standard deviation *shockstdev*.

AspirationsInitDist: A vector containing different options for the way voters' aspirations are initially distributed across the population. Accompanying parameters are *Aspinitmean* and *Aspinitstdev*. Voters' aspirations are adjusted from these initial values endogenously in response to success (payoffs meeting or exceeding aspirations) and failures (payoffs not meeting aspirations). Aspirations adjust via Cyert-March (1963): aspiration = (1-*nu*)*aspiration + *nu**payoff. Payoffs are given by the sum of a spatial payoff, a shock term, and a cost of voting. See the parameters *VoterUtility*, *shockUniform*, and *votingCost* for details of each element in the sum.

Some of the options of the initial aspiration distribution, as well as some of the output measures below, make use of a measure of “extremism” of voters. This measure is a normalized distance of the voter's bliss point from the mean of the voter distribution. For bounded voter distributions, this distance is constrained to lie in [0,1] by dividing by the maximum distance from the mean of the distribution attainable in the distribution. For unbounded voter distributions, the maximum distance used is that corresponding to a bliss point three standard deviations away from the mean in all dimensions. More distant bliss points are set to the maximum distance measure, 1. Values of this measure lying closer to 1 represent voters with more extreme underlying interests, while values closer to 0 represent more moderate voters, within any distribution of voter ideal points.

- "Default (Near Center of Payoff Dist)": Aspirations are set at the average payoff arising from each party in two-party competition, and at that arising from the mean of the party distribution in multi-party competition. Specifically, initial aspirations are the sum of *shockmean*, - *votingCost*/2 if turnout propensities are adjusted, and a spatial loss term dependent on other model choices. For two-party competition and quadratic loss (other spatial loss choices are similar), this term averages the quadratic loss under the bliss points of each party: $-0.25*[(Dpos1-bliss1)^2 + (Dpos2-bliss2)^2 + (Rpos1-bliss1)^2 + (Rpos2- bliss2)^2]$. For citizen candidates this term is the loss from the mean of the voter distribution: $-0.5*[(bliss1mean – bliss1)^2 + (bliss2mean – bliss2)^2]$. For other cases, this term is the loss from the mean of the party distribution: $-0.5*[(partyPosition0a – bliss1)^2 + (partyPosition1a - bliss2)^2]$.
- "Distributed Normally with given Parameters": The chance of voting is drawn from a normal distribution with stated parameters.
- "Distributed Uniformly": Same as previous description, save from a uniform distribution on [-3**aspinitstdev+aspinitmean*, 3**aspinitstdev+aspinitmean*].
- "Very High (100)": All aspirations are set to 100.
- "Very Low (-100)": All aspirations are set to -100.
- "Extremists Higher": Aspirations range from -3***aspinitstdev+aspinitmean* to 3***aspinitstdev+aspinitmean*, with increasingly extreme voters receiving increasingly high initial aspirations.

- "Moderates Higher": Aspirations range from -3*_aspinitstdev+aspinitmean_ to 3*_aspinitstdev+aspinitmean_, with increasingly moderate voters receiving increasingly high initial aspirations.

Party-specific parameters:

NumParties: The number of parties present. Not used if the *PartyDistribution* vector is set to "Two-Party Competition".

PartyPosition0a, PartyPosition0b, PartyPosition1a, PartyPosition1b: These parameterize the distribution of parties. Under "Two Party Competition" they correspond to the x- and y-coordinates of the initial policies of the R and the D party, respectively. Under multi-party competition they are distributional parameters, as detailed below. Note that whenever voters are set to a one-dimensional distribution, the program overrides settings in the second dimension and sets parties to be one-dimensional as well.

PartyDistribution: A vector containing different options for the way parties' initial policy positions are distributed. Some options obviate other program settings, rendering them inoperable. The options at present are:

- "Two Party Competition": *NumParties* is ignored (there are always two). *PartyPosition0a* and *PartyPosition0b* correspond to the Republican's bliss points in the x- and y-direction, respectively, and similarly for *PartyPosition1a* and *PartyPosition1b* and the Democrats. This is the default choice.
- "Evenly placed in 1-D": Range of [-3*_PartyPosition0b_,3*_PartyPosition0b_] is populated by *NumParties* evenly spaced parties.
- "Evenly placed in 2-D": Area of [-3*_PartyPosition0b_, 3*_PartyPosition0b_]X[-3*_PartyPosition1b_, 3*_PartyPosition1b_] is populated by *NumParties* evenly spaced parties. Extra parties that don't fit are placed in the center at (0,0).
- "Uniform in 1-D": *NumParties* parties are uniformly distributed over [-3*_PartyPosition0b_ + _PartyPosition0a_, 3*_PartyPosition0b_+_PartyPosition0a_].
- "Uniform in 2-D": *NumParties* parties are uniformly distributed over [-3*_PartyPosition0b_ + _PartyPosition0a_, 3*_PartyPosition0b_+_PartyPosition0a_] X [-3*_PartyPosition1b_+_PartyPosition1a_, 3*_PartyPosition1b_+_PartyPosition1a_].
- "Normal in 1-D, One Maximum": *NumParties* parties are normally distributed with mean *PartyPosition0a* and standard deviation *PartyPosition0b*.
- "Normal in 2-D, One Maximum": *NumParties* parties are normally distributed in 2-D with *PartyPosition0a*, *PartyPosition0b*, *PartyPosition1a*, and *PartyPosition1b*.
- "Citizen Candidates": *NumParties* parties have their bliss points chosen to match random citizens' ideal points.
- “Nader, Gore, Bush”: Three parties are set up, a far left one at (-2,-2), a left one at (-1, -1), and a right one at (1,1). All distributional parameters are ignored.
- “Triangle”: Places three parties at (0,-1), (0,*bliss2stdev*), and (*bliss1stdev*,0). Designed for use with “Triangle” voter distribution.

PartySearchMean1, PartySearchStdev1, PartySearchMean2, PartySearchStdev2: Parameters that affect the method of search, described in the party search vector below.

PartySophisticationLevel: This parameter dictates how “sophisticated” a party is. A challenger's new policy will be a linear combination of the policy chosen by the search rule, described below, and the mean of the voter distribution, according to the formulae under PartySearchRule. This results in sophisticated parties' choosing positions closer to the mean of the voters' ideal point distribution. (Note the means of the voter distribution used here are always the true means for that distribution, not the value of the parameters bliss1mean and so on. This is relevant mostly for 1-D and specialized distributions, where not all parameters translate directly.)

PartySearchRule: A vector containing different options for the way challengers search for new positions. Only challengers search within the model. Some options obviate other program settings, rendering them inoperable. Initial party positions are given as described under *PartyDistribution*. Searches are constrained to keep policy in the region [-3**bliss1stdev+bliss1mean*, 3**bliss1stdev+bliss1mean*] X [-3**bliss2stdev+bliss2mean*,3**bliss2stdev+bliss2mean*]. The options are:

- "No Search": Parties do not change positions.
- "Local (Incremental) Uniform Search": Parties search around their present position, possibly biased, which is: **Z** = (polLoc1 + *PartySearchMean1*, polLoc2 + *PartySearchMean2*), where (polLoc1, polLoc2) is the party's present position. They search uniformly within the range: [-[3**PartySearchStdev1* + Z_X, 3**PartySearchStdev1*+Z_X] X [-3**PartySearchStdev2* + Z_Y, 3**PartySearchStdev2* + Z_Y]. This point is then transformed according to: polLoc1 = *PartySophisticationLevel**bliss1mean + (1- P*artySophisticationLevel*)*polLoc1; polLoc2 = *PartySophisticationLevel**bliss2mean + (1-*PartySophisticationLevel*)*polLoc2.
- "Global Uniform Search": Same as Local Search, but with **Z** = (*PartySearchMean1*, *PartySearchMean2*), so positions do not change incrementally.
- "Local (Incremental) Normal Search": Same as Local Uniform, but the search around **Z** is according to a bivariate normal with parameters Z_X, *PartySearchStdev1*, Z_Y, and *PartySearchStdev2*.
- "Global Normal Search": Same as Local (Incremental) Normal Search, but with **Z** from Global Uniform Search.

Output

Charts: The program outputs and updates in real-time a number of charts. These may safely be minimized to increase program speed. The charts include:

1. Incumbent: displays (in red) the graph of which party is presently in office and (in blue) the average number of elections up to that point won by D. The latter only appears in two party competition.
2. D's Vote Share: Displays D's vote share in each period. Only appears in two party competition.
3. Propensity Descriptors: displays (in red) the mean across the population of the propensities to vote D, (in blue) the standard deviation of the propensities, (in green) the number of individuals who voted "correctly" for the party whose platform was closest to their bliss points, and (in black) the point biserial correlation coefficient of realized correct voting totals (the dichotomous variable) to the extremism measure described earlier under both *PropensityInitDist* and *TurnoutInitDist*, each at a point in time. Only appears in two-party competition if voters are not Downsian.
4. Propensity Distribution: An 11-bin histogram of the propensity to vote for D at a given time. Only appears in two-party competition if voters are not Downsian.
5. Vote Count: the percentage of the voting electorate that goes to each party. Only appears when not in two-party competition.
6. Turnout Descriptors: displays (in red) the mean of the propensities to vote, (in blue) the standard deviation of the propensities, and (in green) the point biserial correlation coefficient of realized turnout (the dichotomous variable) to the extremism measure described earlier under both *PropensityInitDist* and T*urnoutInitDist*, each at a point in time. Only appears if not Full Turnout.
7. Turnout Distribution: An 11-bin histogram of the probability of turning out at a given time. Only appears if not Full Turnout.
8. Payoff Distribution: Displays a histogram of payoffs, if *ExtraHist* is checked.
9. Aspiration Distribution: Displays a histogram of aspirations, if *ExtraHist* is checked.

The main display consists of colored rectangles, larger colored circles, and one small black dot. The progress of the simulation can be observed within the main display, but this too can be minimized to speed up the program. Each rectangle collects voters who have bliss points in that region of policy space. The window covers a range of 6**bliss1stdev* in the x-direction, centered on *bliss1mean*, and the same for the y-direction. More extreme voters get collected with the rectangles on the borders. The colors signify several things. Transparent voters of any color did not vote in the last period. If they have never voted, they show up as light green. The last party for which they voted shows up as red or blue. In two-party competition, red signifies a Republican vote, and blue a Democratic one. In multi-party competition, blue signifies a vote for

one of the challengers, and red for the incumbent. Mixtures of red and blue signify more than one voter at that spot, and the proportion of red and blue there signifies how that spot leaned in its last vote.

The circles are parties, and all are shades of green. Transparent parties are out of office; opaque ones are in office. In two party competition, the darker circle is the Republican; with more than two parties the colors are in order of party number. The circles move with the parties' positions. The small black dot corresponds to the implemented policy, and is always attached to one of the circles under elections not using PR.

Both rectangles and circles (their centers) make be left-clicked, which brings up a window with all the parameters for all voters in that rectangle. Warning: this may bring up many windows, so click with care. There is an option under the RePAST options tab that lets you update probes. If this is checked, then these parameters will change as the simulation runs.

The program writes to a file ibm_data.csv each run. If such a file already exists, it is copied to a backup data file, and the new file writes over the old. Backups are labeled sequentially from 1. Each data file consists of the following data taken at each period:

- "tick": Period number
- "Number of Voters"
- "X- and Y-Coordinates": the party locations in order, Republican first in the case of two-party competition.
- "Incumbent": Who won the election that period.
- “X- and Y-Position of Incumbent”: Position of the incumbent in that period.
- "Percent of Votes Captured by D": D's vote share that period. Only in two-party competition.
- "Percent of Elections Won by D": Running % of elections won by D. Only in two-party competition.
- “Vote Share”: The vote share for each party. Only when not in two-party competition.
- "Number Times Winner": The number of times each party has won an election to that point. Only when not in two-party competition.
- “Effective Number of Parties”: The effective number of parties as per the Laakso-Taagepera (1979) measure.
- "Mean Aspiration Level"
- "Mean Payoff"

All of the following appear only if not in Full Turnout:

- "Mean Turnout Level"
- "Standard Deviation of Turnout"
- "Correlation of Turnout with Interests": The point biserial correlation coefficient of realized turnout (the dichotomous variable) to the extremism measure described earlier under *TurnoutInitDist*.
- "0-10%","10-20%","20-30%","30-40%","40-50%","50-60%","60-70%","70-80%","80-90%","90-100%": Number of voters in each decile of turnout.

All of the following appear only if propensities update (i.e. voting is not Downsian) within two-party competition:

- "Mean Propensity": Mean value of the propensity to vote D that period
- "Standard Deviation of Propensities": Standard deviation of the propensity to vote D that period.
- "Correct Voting Percent": The number of individuals who would have voted “correctly” in a Downsian sense; that is, for the party whose platform was closest to their bliss points. Note that this includes all individuals, whether or not they voted in the last period. As long as one’s last vote was correct, one is considered to have voted correctly, even if one did not vote at all. Those who have never voted are never considered to have voted correctly.
- "Correlation of Correct Voting with Interests": The point biserial correlation coefficient of realized correct voting totals (the dichotomous variable) to the extremism measure described earlier under *TurnoutInitDist*.
- "0-10%","10-20%","20-30%","30-40%","40-50%","50-60%","60-70%","70-80%","80-90%","90-100%": Number of voters in each decile of Democratic-vote-propensity.