Complex Systems 270 - Fall 2014, Project 1

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Extending the Party Model
Going Above the 90 Points Mark

To extend the party model even further, our group created several variations on the three group model implemented in the previous section. Since the three groups implemented were labeled as "Liberals", "Conservatives, and "Moderates" we thought it would be interesting to model certain real world variables that are observable during a political race or campaign.

For the first variation, we wanted to model political conformity. To model this, we added a function that may "swing" a moderate turtle to join either the liberal or conservative parties. Given below is a major part of the code:

```
to update-color
    let conservative_proportion count turtles-here with [color = red]
    let liberal_proportion count turtles-here with [color = blue]
    let moderate_population count turtles-here with [color = green]
    let rand random-float 1
    let if rand > threshold and conservative_proportion > liberal_proportion
and moderate_population = 1 [set color = red]
    let if rand > threshold and conservative_proportion < liberal_proportion
and moderate_population = 1 [set color = blue]
end
```

A moderate turtle may change its political party if it is the only moderate in its group, and if a randomly generated number is greater than a slider parameter named 'threshold'. If these two conditions are true, then the moderate turtle in question will update its color to match the color of the political party that has the majority in it's individual group. The new 'threshold' parameter is used to model how likely a moderate turtle is to conform to the majority side when singled out in a group. The higher this threshold, the less likely they are to conform, while the lower the threshold, the moderate turtles are more likely to conform.

For the second variation, we expanded upon the previous model by adding "multipliers" to determine the most influential political party. Given below is a major part of the code:

```
to update-color
    let conservative_proportion count turtles-here with [color = red]
    let liberal_proportion count turtles-here with [color = blue]
    let moderate_population count turtles-here with [color = green]
    let conservative_pull conservative_proportion*conservative_influence
    let liberal_pull liberal_proportion*liberal_influence
    let rand random-float 1
    let if rand > threshold and conservative_pull > liberal_pull and moder-
ate_population = 1 [set color = red]
    let if rand > threshold and conservative_pull < liberal_pull and moder-
ate_population = 1 [set color = blue]
end
```

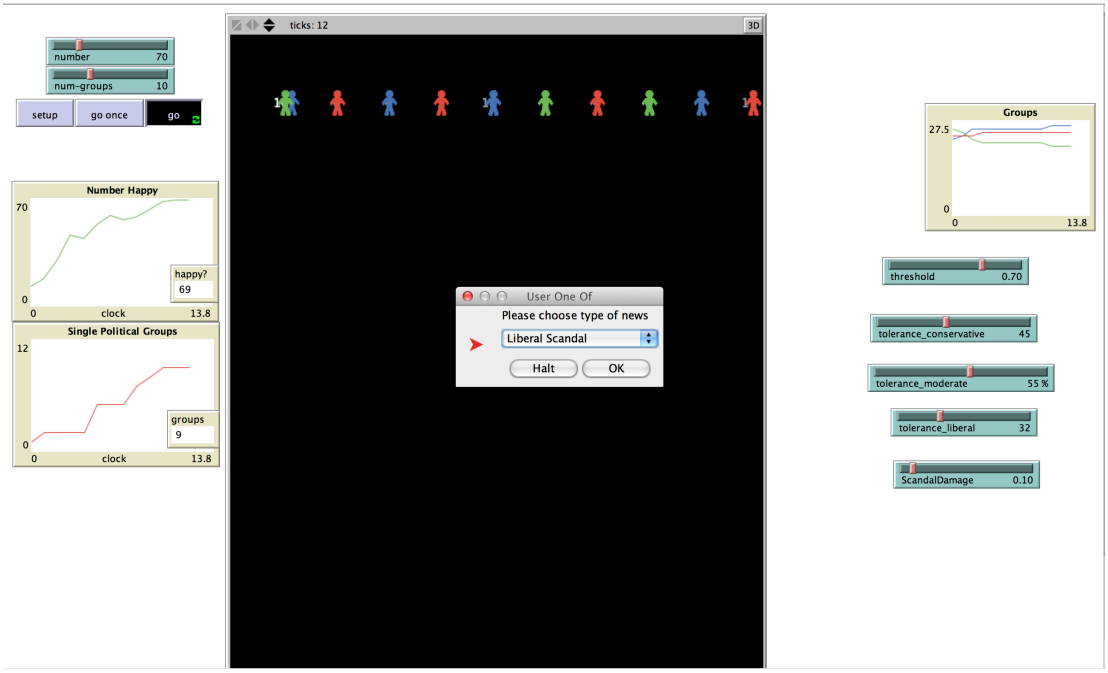
In contrast with the previous model, a singled out moderate will choose its new party based on which party has the largest political pull. The political pull is based on the political party's proportion of population in a group, multiplied by the party's political influence slider value, which is set by the user. This way a lone moderate turtle will side with the party that is relatively 'louder' and represents a large percentage of a group.

For the last variation, we added scandal events to the simulation. Every 3 ticks a scandal happens and the simulation asks the user whether the scandal involved the liberal side or the conservative side. The scandal affects the political influence of the chosen party negatively, with the magnitude of the effect being a value set by the user, 'ScandalDamage'. This change makes the political influence of both groups subject to change, adding another variable to the simulation. This is the major part of the code implementation:

```
if ticks mod 3 = 0
[
  ifelse "Liberal Scandal" = user-one-of "Please choose type of news"
  [
    "Liberal Scandal" "Conservative Scandal"
  ]
  [
    set liberal_influence liberal_influence - ScandalDamage
  ]
  [
    set conservative_influence conservative_influence - ScandalDamage
  ]
]
if liberal_influence < 0 [ set liberal_influence 0 ]
if conservative_influence < 0 [ set conservative_influence 0 ]
```

On the following page, an image of the user screen for this model is given.

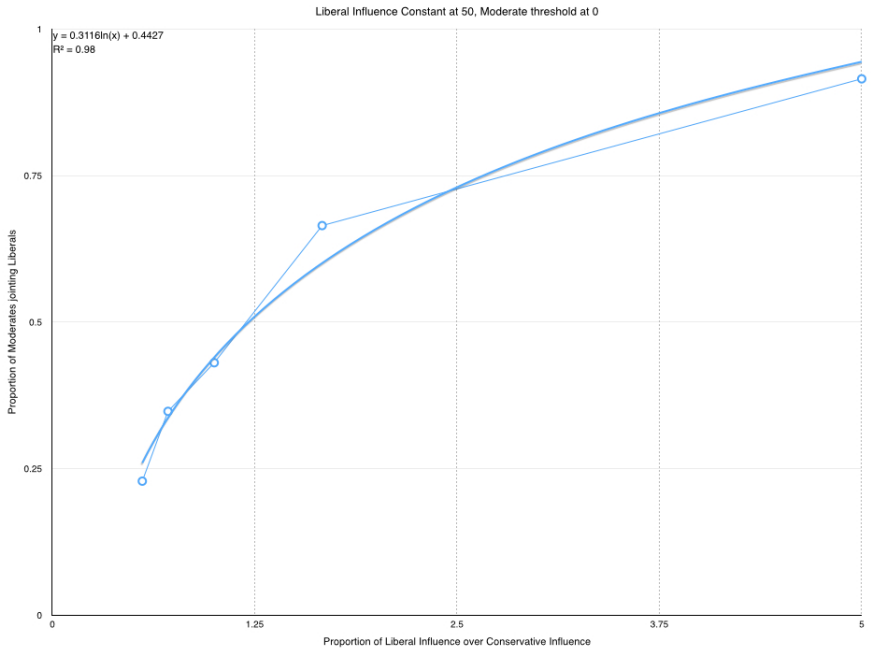
Here is an image of the user prompt and screen:



Through many simulations done by Behavior Space on NetLogo, we were able to obtain large amounts of data. It in fact turned out to be a problem that we had too much data for a few of the simulations, over 800,000 data points. So, we narrowed the scope of the variables and kept some variables constant to observe specific behaviors.

The particular model that was studied extensively was the second model where pulls of the Liberals and Conservatives affected how moderates changed their political views. The simulations were done by keeping the tolerances of all the groups constant at around 25. This is to model the fact that it has been scientifically proved many times that people generally prefer to be around people like themselves and also to neglect these variables as in these simulations, the focus is really on the influence of the Liberals and Conservatives and how that affects the group dynamics. The Liberal Influence was kept constant at some value in each set of simulations, while the Conservative Influence was set to vary from 10 to 100 at 20 point intervals. The reason 10 was chosen as a starting point is that if 0 were chosen, we seemed to get divide by zero errors in our equations. Finally, the moderates' threshold was varied from 0 to 0.8 in 0.2 point intervals. Again, the reason we use 0.8 as the max. value is that 1 produces divide by zero errors in calculations (at a threshold of 1, no moderates "convert").

Initially, using a Liberal Influence of 50, we got the following graph after some data collection and representation:



As can be seen above, we plotted the Proportion of Moderates joining the Liberals Vs. the Proportion of Liberal Influence over Conservative Influence. To do this, we opened the Table Style data produced by Behavior Space after the 300 simulations in a Spreadsheet software (Numbers). The table data itself contained only information about the tolerances for each group, the Liberal and Conservative Influence values, the threshold of the moderates and the initial and final numbers of people in each political ideology/group. So, we first calculated the number of moderates that converted and the number of people the liberals "gained" on average. Then, the proportion of the influences was calculated. Finally, graphs like the above were produced. The above graph is for, as the title states, "Liberal Influence Constant at 50, Moderate Threshold at 0." Similarly may other graphs were produced, all of these can be found in the Appendix.

Though the above graph and the ones in the Appendix appear quite normal, it is very important to understand what the graphs represent.

Some Intuitive Results

Firstly, there is always a clear increase in the Proportion of Moderates joining the Liberals when the Proportion of Liberal Influence over Conservative Influence rises. This is an intuitive result that one would expect. Secondly, there appears to be this flattening of the graphs as the moderate threshold rises. This is presumably because as the moderates become less likely to join any group (the liberals or the Conservatives), an increase in the influence of either party will not cause much (or any) change in the number of moderates they "gain." In fact at a threshold of 1, not a single moderate changes to any other political group.

Some general mathematical/algebraic observations

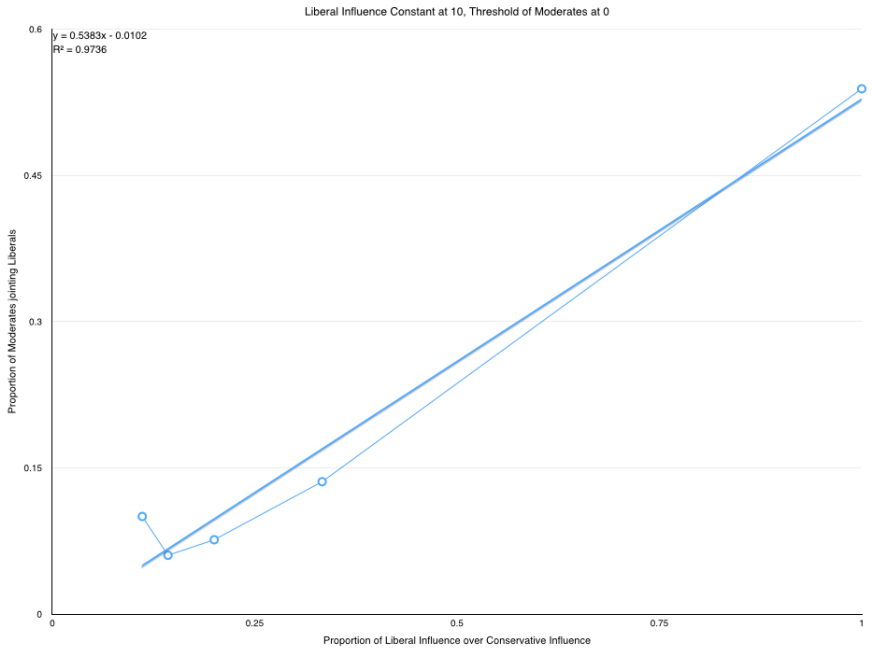
For any data set where there is some "guessing" involved as it not known how the variables relate to each other, plotting trend-lines and regression becomes a problem. There is a problem of under-fitting and over-fitting. However, after trying many possible regression (linear, polynomial, power, logarithmic), we chose the one that seems to best fit the data. Though this may seem like an arbitrary process, looking at the Coefficient of Determination value, R^2, and the possible logic behind the graph, the process becomes much more concrete. As an example, a cubic trend-line seemed to work very well for all the graphs (R^2 very nearly one), however; these trend-lines seemed to show strange behavior like sharp rising and falling when logically the graph should be monotonically increasing.

The trend-lines chosen for the Liberal Influence at 50 graphs were Logarithmic graphs showing that there is a sharp increase initially in the Proportion of Moderates joining the Liberals as the Proportion of Liberal Influence to the Conservative Influence rises. However, as you move along the x-axis to the right, this effect reduces. This is the typical characteristic of Logarithmic functions.

Even at a Liberal Influence of 90 Logarithmic functions seem to best represent the data. However, importantly, the graphs appear to be more horizontal or "flatter." This shows that an increase of the Conservative Influence will lead to a shallow decrease in the Proportion of Moderates joining Liberals. This fact, joined with the fact stated in the previous section about the "flattening" of graphs caused by an increase in the Moderate Threshold leads to the very near horizontal line like graph titled "Liberal Influence Constant at 90, Threshold of Moderates at 0.8"

A few Unintuitive results

Finally, and very interestingly there are some very revealing results in the graphs for the Liberal Influence Constant at 10. Given below is the graph for the Liberal Influence Constant at 10, Threshold of Moderates at 0:



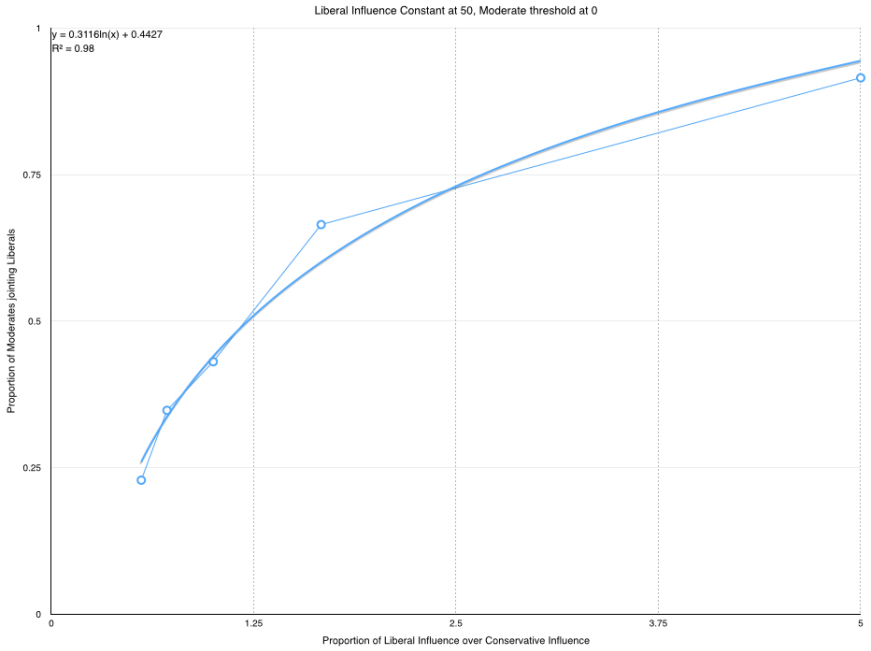
The key points are:

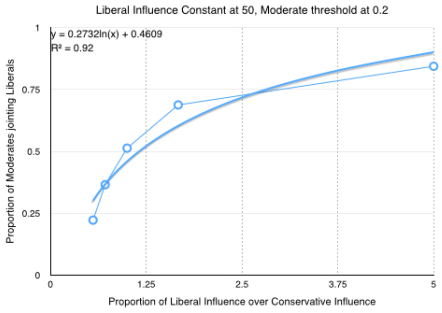
A linear trend-line seems to be the best fit. This shows that an increase in the Conservative Influence will only lead to a small (almost "equal") change in the Proportion of Moderates joining Liberals. So, the more general conclusion is that when a group has a very small influence, groups with more influence will not affect the group with less influence much. Also, something very unintuitive is the tipping point. This tipping point is explained on the following page.

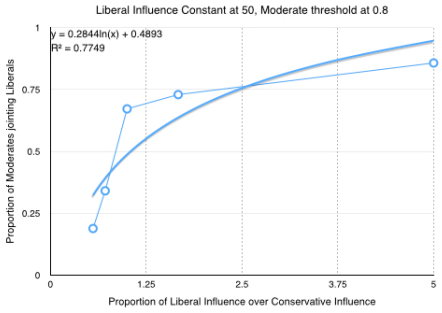
The "tipping" point is the point where there appears to be an increase in Proportion of Moderates joining Liberals near 0. As one goes across the x-axis to the right, the general monotonous increasing behavior is seen, except for a small decreasing part. Thus, a slight "v" is seen. What this behavior says is that there is a point before which an increase in the Conservative Influence actually causes an increase in the proportion of Moderates joining Liberals. So, taking a more general sense of this observation, this is really saying that when a group has a very low influence, if other groups rise in influence, it will actually "help" the group that has a low influence. This is indeed counter-intuitive and there aren't many possible explanations, especially given that this was a pretty consistent. One possibility is that this could be happening because moderates change as set by our model only if they are lone in a group. Nevertheless, in real life too, sometimes is does seem that an "over-influencing" group can cause other groups to gain popularity/get known by the community simply because people presumably get "annoyed" by the group and leave/get disinterested in joining it. There also appears to be some research on advertising that points to a similar idea, as cited from a website attached in the Bibliography, "No one likes to think they are easily influenced." Thus, the results indeed seem to match with some real-life phenomenon.

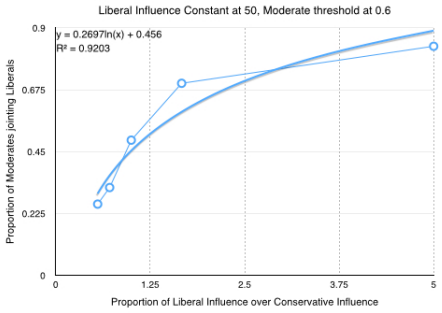
In conclusion, we have taken the basic model that concerns with how members of opposite sexes group in a party and made small modifications like the colors of the turtles, and made more substantial changes like adding sliders. Finally, using Behavior Space and expanding on the model, we also realized some rather unintuitive results from particularly the political models we built using three rather than two types of people.

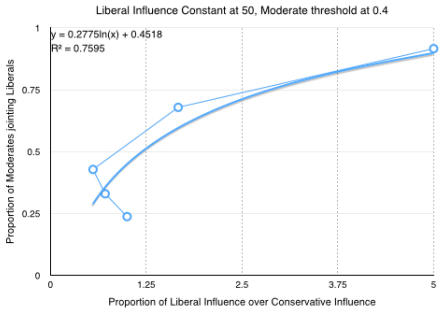
Appendix

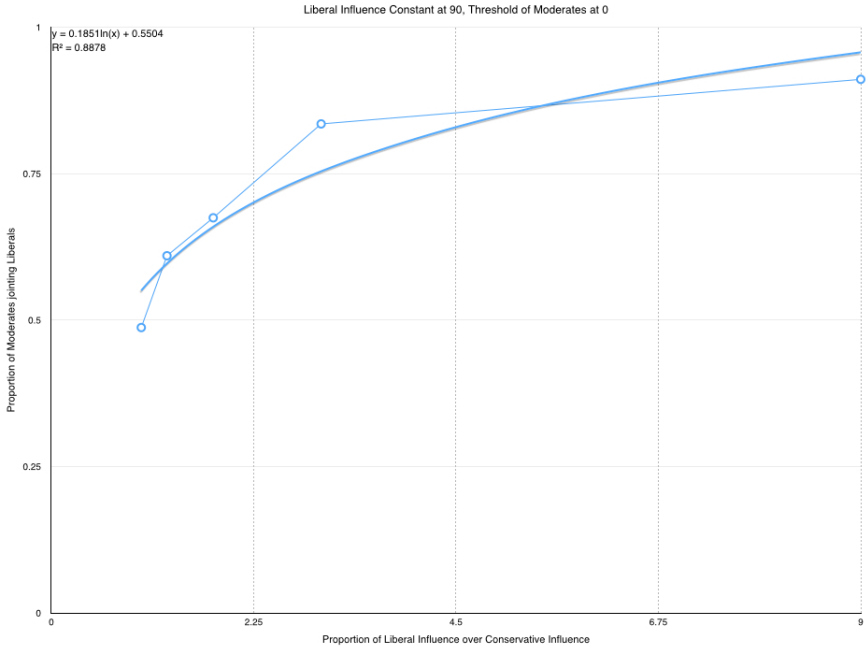

Liberal Influence Constant at 50, Moderate threshold at 0
y = 0.3116ln(x) + 0.4427
R² = 0.98
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence
0
0.25
0.5
0.75
1
0
1.25
2.5
3.75
5

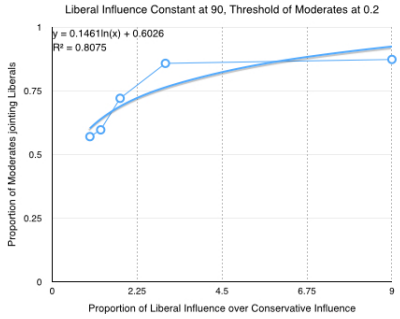

Liberal Influence Constant at 50, Moderate threshold at 0.2
y = 0.2732ln(x) + 0.4609
R² = 0.92
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence

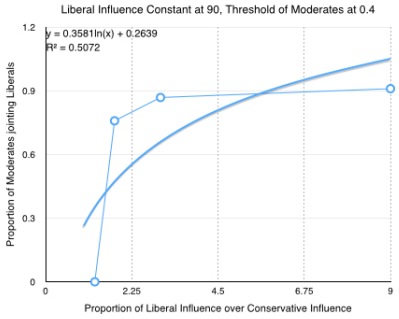

Liberal Influence Constant at 50, Moderate threshold at 0.8
y = 0.2844ln(x) + 0.4893
R² = 0.7749
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence

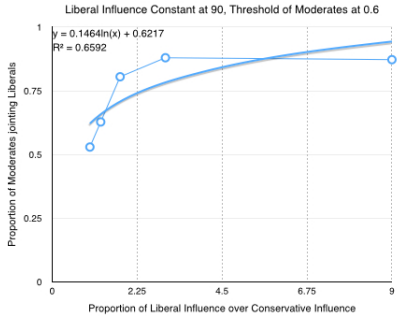

Liberal Influence Constant at 50, Moderate threshold at 0.6
y = 0.2697ln(x) + 0.456
R² = 0.9203
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence

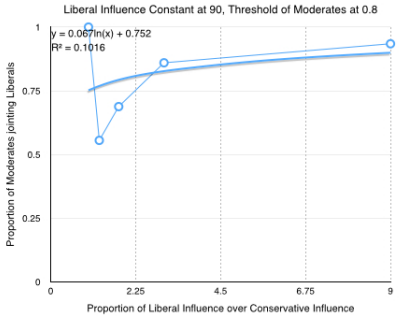

Liberal Influence Constant at 50, Moderate threshold at 0.4
y = 0.2775ln(x) + 0.4518
R² = 0.7595
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence

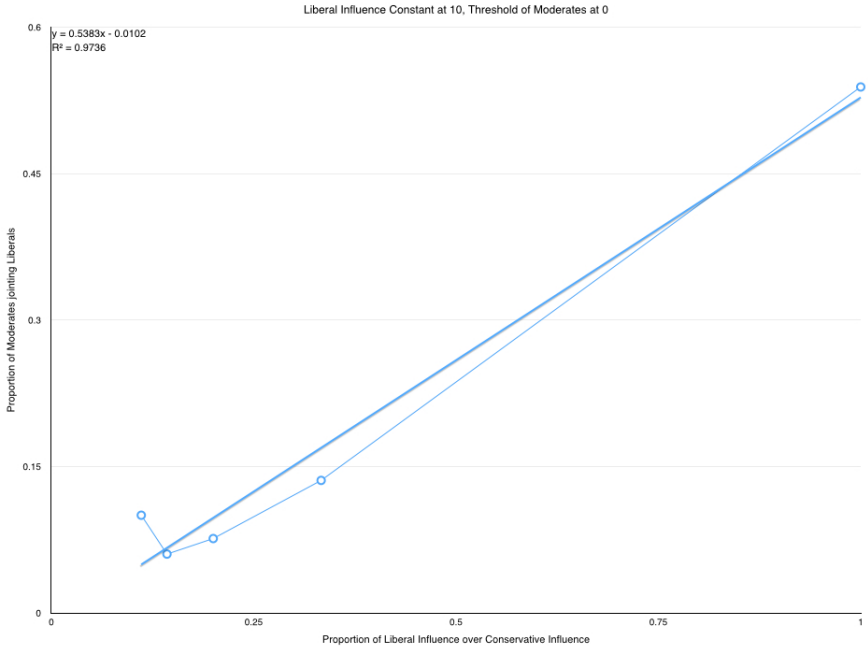

Liberal Influence Constant at 90, Threshold of Moderates at 0
y = 0.1851ln(x) + 0.5504
R² = 0.8878
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence
0
0.25
0.5
0.75
1
2.25
4.5
6.75
9

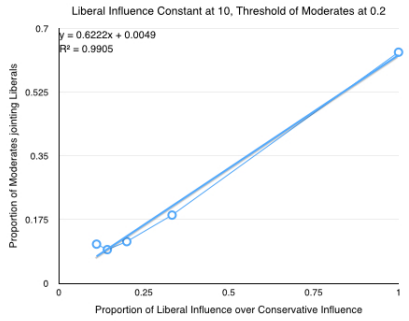

Liberal Influence Constant at 90, Threshold of Moderates at 0.2
y = 0.1461ln(x) + 0.6026
R² = 0.8075
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence

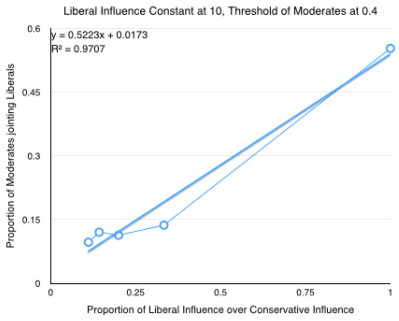

Liberal Influence Constant at 90, Threshold of Moderates at 0.4
y = 0.3581ln(x) + 0.2639
R² = 0.5072
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence

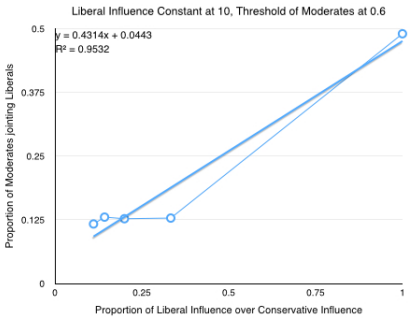

Liberal Influence Constant at 90, Threshold of Moderates at 0.6
y = 0.1464ln(x) + 0.6217
R² = 0.6592
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence

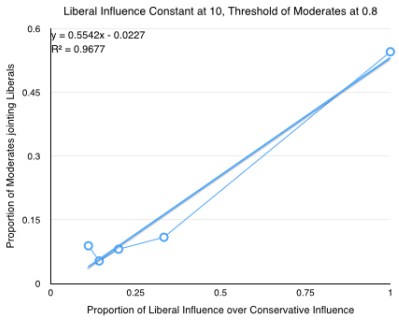

Liberal Influence Constant at 90, Threshold of Moderates at 0.8
y = 0.0671ln(x) + 0.752
R² = 0.1016
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence


Liberal Influence Constant at 10, Threshold of Moderates at 0
y = 0.5383x - 0.0102
R² = 0.9736
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence
0
0.15
0.3
0.45
0.6
0.25
0.5
0.75
1


Liberal Influence Constant at 10, Threshold of Moderates at 0.2
y = 0.6222x + 0.0049
R² = 0.9905
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence
0
0.175
0.35
0.525
0.7
0.25
0.5
0.75
1


Liberal Influence Constant at 10, Threshold of Moderates at 0.4
y = 0.5223x + 0.0173
R² = 0.9707
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence
0
0.15
0.3
0.45
0.6
0.25
0.5
0.75
1


Liberal Influence Constant at 10, Threshold of Moderates at 0.6
y = 0.4314x + 0.0443
R² = 0.9532
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence
0
0.125
0.25
0.375
0.5
0.25
0.5
0.75
1


Liberal Influence Constant at 10, Threshold of Moderates at 0.8
y = 0.5542x - 0.0227
R² = 0.9677
Proportion of Moderates jointing Liberals
Proportion of Liberal Influence over Conservative Influence
0
0.15
0.3
0.45
0.6
0.25
0.5
0.75
1

Bibiliography

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