Combining Relative Agreement and Spatial Voting: An Integrated Micro-Macro Modeling Approach to Group Formation

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Abstract

In this project we create a baby-model that its aim is to represent the interactions between political parties and their voters/members in a more realistic way than the existing models do. The general idea behind this model is to observe how the interactions in the macroscopic level (between the parties) affect the interactions in the microscopic level (between the voters/members) and vice versa. For this reason we take two models, that each one of them represents of these levels and combine them. These models are the Relative Agreement for the Micro-level interactions and the Spatial Voting for the Macro-level interactions. What we find is that the model is successful in representing many aspects of the reality in a simplified way; the emergence of political parties covering most of the opinion spectrum, the diversity of opinions inside a party, people leaving their party and joining another one, parties with just a few members and others that have a lot of them, appearance and disappearance of extremism and finally competition between the parties. All of the above are real life political dynamics that can come as a result of our model's dynamics.

Keywords: **Relative Agreement Model, Spatial Voting**

1. Introduction

It can be easily claimed that modelling the political scene and the interactions between its consisting components (voters and political parties) can be a really useful and interesting topic in contemporary research. People interact each day by exchanging opinions, by influencing each other, by forming groups or political parties and in various other ways that form the dynamics of todays political world.

Generally the interactions inside the political system can happen on two main levels. One is the microscopic (Micro) level of interactions between humans, who are either voters and/or members of a political party. The second level is the macroscopic (Macro) level, on which the attention moves on the function of each party and the interactions between them; their formation, destruction, merging and movement of their position in the political map (a right winged party that moves towards the centre is an example of a party's opinion movement).

Both Micro and Macro interactions between voters and political parties have, respectively and independently attracted the attention through the literature. These approaches can shed light to various small parts of reality, but an important question hasn't been asked yet: "what are the effects of the interaction between the voters and the parties and vice - versa?" Answers to this question may move us from looking at the tree, to gazing at the forest and facilitate the research on realistic modelling in the world of politics. This work may provide us with a baby-model of the general political interactions between the Micro and Macro level, without losing any of the properties of the interactions on each of the two levels independently.

Beginning with the interactions in the microscopic level, we study the Relative Agreement (RA) model (Deffuant et al. 2002; Deffuant 2006; Meadows and Cliff 2012) with which we should be able to describe and simulate the interactions between a population of voters. After every person is initialised with a randomly generated opinion and a fixed level of uncertainty about their beliefs, they start interacting. This process converges to three kinds of dynamics, central, bipolar and single - extreme (described later), and can give us, successfully, an insight on the emergence of extremism in a population.

On the other hand, political parties, as in real life, are formed when some specific

conditions are met. Their main goal is to attract as many voters (or members) as they can. In the approach that we are going to use, an individual will always vote for the political party that its position in the political map is closest to hers/his own political views (Spatial Voting model), while the parties will always change their main opinion in a way that helps them to maximise their voting base. As we are going to see later, Spatial Voting is going to make the parties move more to the centre of the political map, because this is the best way for them to maximise their voting base.

As we see these two models tend to push the dynamics of the political map in two different directions; the Relative Agreement towards extremism and the Spatial Voting towards moderatism. So, it is really logical for us to ask the question: "what is going to happen when these two approaches are combined?" In this case it is somehow difficult to set some expectations on the result of this combination, because we don't set a normal hypothesis and wait for something to happen; conversely, we combine two really different approaches and then we "start walking through the dark forest touching whatever is around us", hoping that we will find something very interesting and that we will end up with a good description of the political reality.

Still it is also possible to ask some secondary questions and look for some interesting answers. Questions such as " Why are some political movements more open than others?", "What are the dynamics that decide the level of openness in a group?", "Why do certain groups become very closed, when others manage to stay open?", "How are opinion trends created inside a party?" Of course, a definitive answer to all these questions cannot be given using baby-models, but we can still come up with various exciting findings and set the groundwork for further fruitful research on these topics in order for some more complicated and correct models to be created in the future.

2. Introducing the combined model

The RA model was firstly introduced by G. Deffuant (Deffuant et al. 2002; Deffuant 2006) and it has been evolved from another model in opinion dynamics called the Bounded Confidence model (Krausse 2000; Hegselmann and Krausse 2002). Here in this project we are going to use the version of the RA model mentioned in the 2012 paper of Meadows and Cliff and we are going to combine it with the main idea of the Spatial Voting model.

2.1 The Relative Agreement part

A population of N agents is initialised with each person having an opinion (describing hers/his political view) and an uncertainty about that opinion. Opinion is a variable ranged from -1 to 1, with the values between ± 0.8 to ± 1, respectively, defined as an extremist's opinion and the rest of them as a moderate's opinion. The uncertainty value ranges from 0 to 2, where typically low values ($0.1 - 0.3$) are initialised to extremists and higher values to moderates (0.4 to 1.4).

In the beginning the population is initialised with a certain percentage of it being the extremists and the rest of it being the moderates. The agents are being uniformly distributed between the moderates' opinion range and the extremists' opinion range, while their uncertainties are being set at certain values depending on whether the agent is an extremist or a moderate. At each step we choose a random agent to interact with another randomly selected agent and update their opinions and uncertainties. The updating process is defined by the following set of two equations:

$$x_j = x_j + \mu(\frac{h_{ij}}{u_i} - 1)(x_i - x_j) \tag{2.1}$$

$$u_j = u_j + \mu(\frac{h_{ij}}{u_i} - 1)(u_i - u_j) \tag{2.2}$$

Where the indexes i, j represent the agents, the variables x, u the agent's opinion and uncertainty respectively, the parameter μ is a weight of how much we allow

an agent to be influenced by another agent's opinion considering that she/he agrees with it, and finally the term h is the opinion overlap term. The overlap term is given by the expression

$$h_{ij} = min(x_i + u_i, x_j + u_j) - max(x_i - u_i, x_j - u_j)$$

and essentially shows if there is a common ground for talk between two agents. In order for an agent to influence another agent the relative agreement term, $(\frac{h_{ij}}{u_i} - 1)$, has to be positive. This shows that the opinion of agent i is is within the range $(x_j - u_j, x_j + u_j)$ and thus agent i can influence agent j. So with this this procedure at each time step we can have (or have not) opinion influence between members of the population N.

The RA model has three different kinds of convergence. One is central convergence that happens when the moderates have very low uncertainty, but still higher than the extremists, and creates dynamics where most of the population has central opinions, while two small extremist groups exist. The second one is the bipolar convergence that happens when the moderates are very unsure about their opinions and drives half the population into far-left opinions and the other half into far-right opinions. Finally the third one is the single-extreme convergence where most of the population ends up having either far-left or far-right political beliefs.

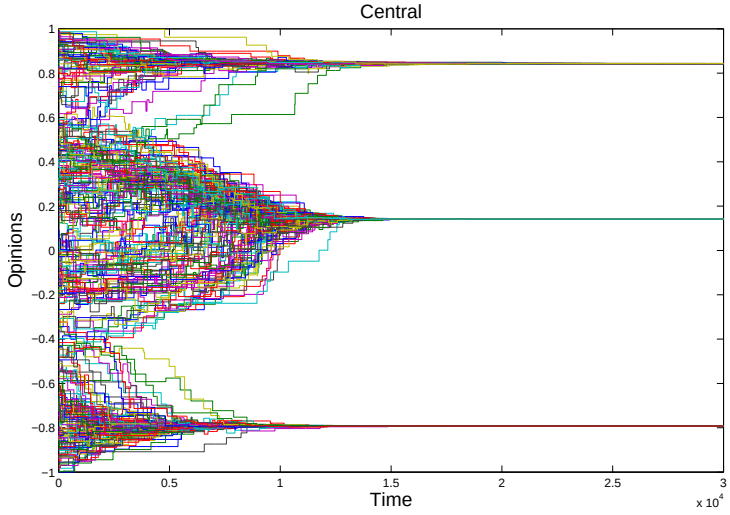


Figure 2.1: *For* 30% *extremists,* $\mu = 0.5$*, extremists' uncertainty* $= 0.3$ *and moderates' uncertainty* $= 0.4$ *we observe central convergence. Meaning that most of the agents are attracted towards the centre and that the extremest's power over the population is limited.*

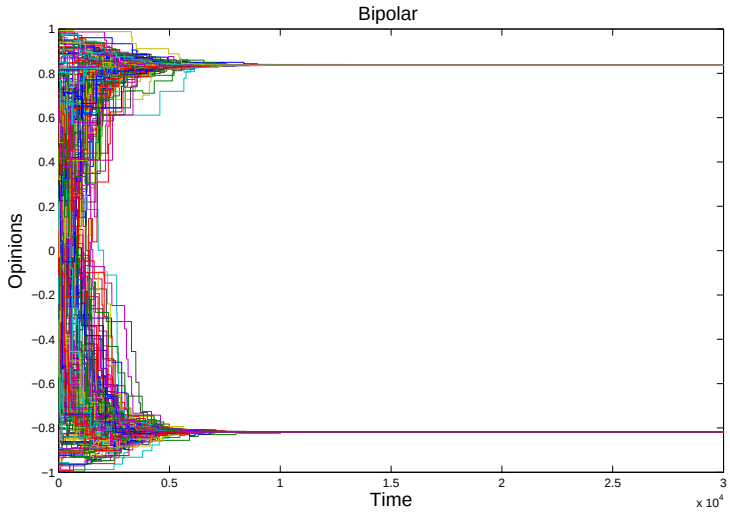


Figure 2.2: *For* 30% *extremists,* $\mu = 0.5$*, extremists' uncertainty* $= 0.3$ *and moderates' uncertainty* $= 1.2$ *we observe bipolar convergence. Meaning that extremists have the power to attract a highly uncertain population towards their own political beliefs.*

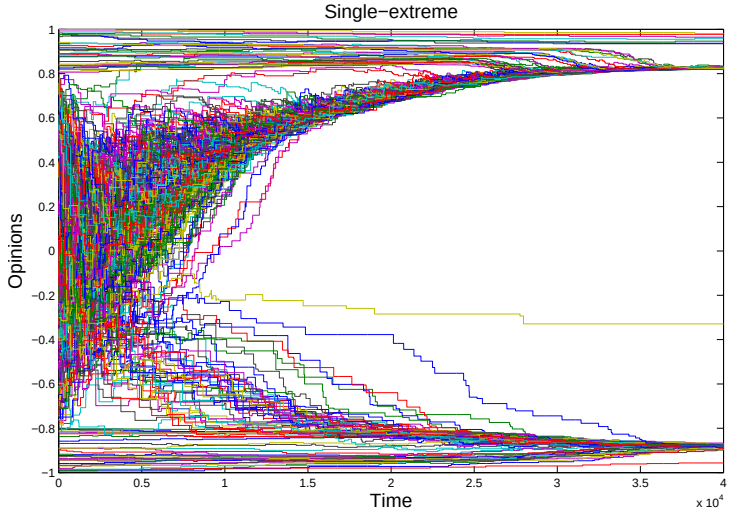


Figure 2.3: *For* 20% *extremists,* $\mu = 0.2$*, extremists' uncertainty* $= 0.1$ *and moderates' uncertainty* $= 1.4$ *we observe single-extreme convergence. In this special case the majority of the agents is attracted towards one extreme of the opinion spectrum.*

2.2 Spatial Voting and group formation

Leaving the interactions between people aside, we can look at the political dynamics from another point of view; that of the group formation and interaction. A group can be formed if and only if three conditions are being met; there is a minimum number of people willing to form the group, the distance between the most extreme opinions of these people does not go above a level and the uncertainty levels of the group members is also less than a threshold. So, if a group of people inside the population is found meeting all these conditions they are allowed to create a political party. What is true is that in real life political parties have way more members than in our simulations and they also end up having a lot of people voting for them without being members of the party, but as it was mentioned above this is a baby-model and its main goal is to start looking at the reality from a certain perspective while it can't give us an exact representation of it right now.

As it is well known every party has a party line that it represents its main beliefs and goals. Usually the members of a party follow more or less the party line, while the voters just have to agree with it in order to vote for the party. What is obvious is that a party will always want to maximise its members or voters base (sometimes both, but this is really hard to achieve). In our model we consider mainly the case where the party wants to maximise its voters base and changes a bit, at every time step, its main political beliefs in order to achieve the maximum agreement with the society. So, including the condition that a person will always vote for a party, and that this party will always be the one that has its party line closest to hers/his beliefs, then the parties will always move their beliefs towards the centre.

The reason of why that happens can be easily understood if we consider the case of an extremist group; a far-left party will always be the closest party to the left extremists even if it moves its main beliefs towards to more central ones. This motivates the party to actually do it and go towards the centre and really raise its voters base. Of course this creates a "hole" in the left side of the political map that will be covered with the creation of a new party that will also move towards the centre and so on.

In order to model all those said above we initialise the party line as the mean value of the opinions of its members. At each time step the parties search around the area for the opinion that gives them the maximum number of voters and adopt this opinion. Of course they are not allowed to move too far away from their previous party line, as this is something that in real life actually "destroys" a party that is doing it. Finally, whenever the three conditions of group formation are being met, then new parties can be created depending on a probability.

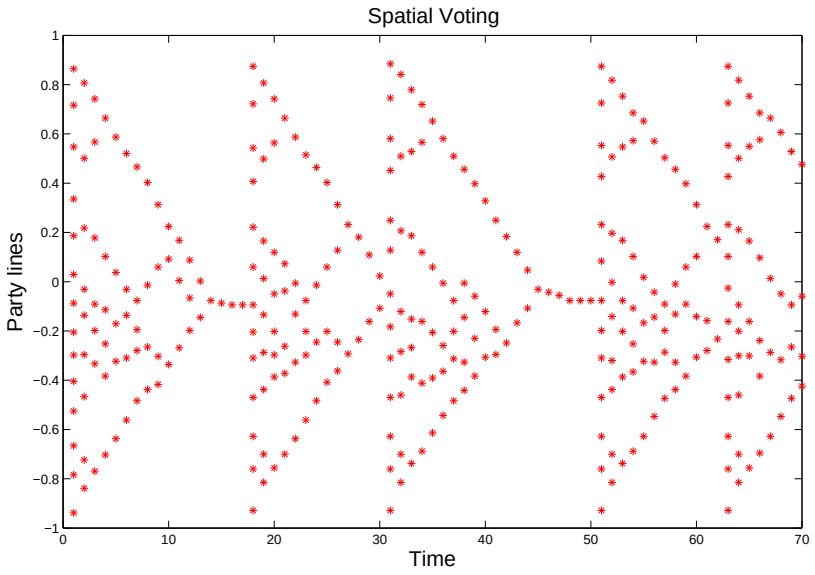


Figure 2.4: *In this figure we see how the parties change their main beliefs in order to attract more voters, when the voters have stable opinions and they don't interact. The dynamics of this model goes towards the centre all the time independently of how the groups merge and get created.*

2.3 Combining the models (parameters description and algorithm)

The two models presented above have two different demands. The first says that in each step we have an interaction between two agents and the second that there are no interactions at all. For combining them we have to allow the interactions to happen with a certain probability at each step, so that depending on this probability we can play with how each model affects the combined one. We can also play with it by changing the probability with which new groups can be formed and by allowing them to have some extra interactions with undecided voters around their area.

What is more, in this model we set the hypothesis that only the members of a party are allowed to interact with other agents, whether they are also members of a party or not. This means that we can't have interactions between simple voters and that the political parties have a huge influence to society. While this is a somewhat unrealistic view of how the interactions happen in the real world, it is not so unrealistic to think of a society that the simple voters' interactions are not so important compared to the interactions that are governed by the political parties and based on that to start building a baby-model to represent this kind of reality.

Another hypothesis that we make in this model is that an agent that is a party member has a different probability of interacting with members of its own party and with other agents. A very important result of this hypothesis is that when the population ends up having only agents that are members of a party, then the dynamics stabilises. This happens for two reasons, firstly because the internal interactions can't really affect so much an agent's opinion (inside party interactions is a procedure that adds only a tiny factor to an agents opinion each time, while it makes hers/his uncertainty fall down). The second reason is that normally all the other agents are too far away for them to be able to interact and successfully influence each other. Why this hypothesis is useful will be clear in the next section, where we are going to see that it allows us to get trends inside the party

As it can be seen this model should be full of parameters (it actually has 12 in total) and due to that it has to be very complicated for someone that wants to completely explore it. So instead of blindly exploring it, what we are going to do is conduct some theoretical experiments based on some hypotheses and observe whether they give us useful results or not. Before doing that lets explain all the parameters (the algorithm is explained in the appendix), for clarifying as much as possible all the details of our model.

2.3.1 Parameters

- μ***:*** This parameter shows how much is an agent willing to change hers/his own opinion or uncertainty provided that she/he agrees with the other interacting agent. So it is like describing how much open minded is an agent. For simplicity reasons when we want agents that are not open minded we are going to set this variable equal to 0.2 and when we want them to be open minded equal to 0.5.

- ***Proportion of extremists:*** At some runs the proportion of the extremists in the whole population may differ and it can give us some interesting results. Usually we set them to be at the 14% of the total population (always half of them are left and the other half are right side extremists).

- ***Extremists' uncertainty:*** We consider the extremist population to be highly sure about their opinions, so in all the runs all the extremists are initialised with a very low uncertainty of 0.3.

- ***Moderates' uncertainty:*** The moderates' population is initialised with the same uncertainty for all of them at each run, but that uncertainty is always greater than the extremist uncertainty. We set this uncertainty, depending on the experiment, between $0.4 - 1.2$.

- ***Minimum group members:*** This parameter is set at the 3% of the total population, so that we have about 9 initial political parties that cover the whole spectrum.
- ***Maximum opinion distance:*** The maximum distance between the most extreme members of a party is set to be 0.15.
- ***Maximum group uncertainty:*** Generally, we want for simplicity reasons, every agent to be able to join a group. For this reason this parameter is set to be equal with the moderates' uncertainty.
- ***Maximum group movement:*** This parameter sets how much a party can change its line in the political spectrum in order for it to maximise its voting base.
- ***Probability of new groups:*** At every time step some agents my be found not to be members of any group. With this probability we can control how often these agents are allowed to form new parties. This parameter is fixed in all the runs to be equal to 0.5, so that every second step all the agents that can form groups, do it.
- ***Probability of external interactions:*** In different runs, depending on the hypotheses we make, an agent can interact with agents that are not members of her/his own party (provided that she/he is member of a party) with a different probability.
- ***Probability of internal interactions:*** This probability represents the frequency of the inside group interactions and is usually, but not always, set to be equal to the previous one.
- ***Extra interactions:*** The last parameter represents how many extra interactions gets a party undecided voters around its area. We set it to be at maximum 4.

3. Exploring the model

3.1 General remarks

While this model is a combination of the Relative Agreement and the Spatial Voting model, it has some unique dynamics of its own that give us a more realistic view of the reality. First of all, it can converge to more than three of four political parties, which gives us the diversity of modern politics. Also, in contrast with the RA model, now the agents even though they all become members of a political party, they don't have all of them the same opinion. So for the first time we see the appearance of inside-party trends and different opinions as a normal result of our model's dynamics.This is something really important because it is a very realistic representation of the political dynamics.

Some opinions inside a party might be more popular than others and end up having higher density of people around them; this can represent the appearance of a leader. In addition, some parties appear to be more closed than others, meaning that their members are less spread across the allowed opinion range and they are more concentrated near the central opinion. We sometimes also see that parties can attract other parties and either merge into one huge party or remain separated, but still very close with each other. Finally, another interesting thing that appears in the model is that unsure agents can be influenced by other parties and either get out of their party and then get absorbed by it again or they can actually get really influenced by another party and join it.

These are not the only findings that we can extract from the model, but they are the main ones that appear from its dynamics. All of the main findings can be seen in figure 3.1. More things will be observed later when we are going to set some theoretical experiments to see whether we can model some more realistic cases.

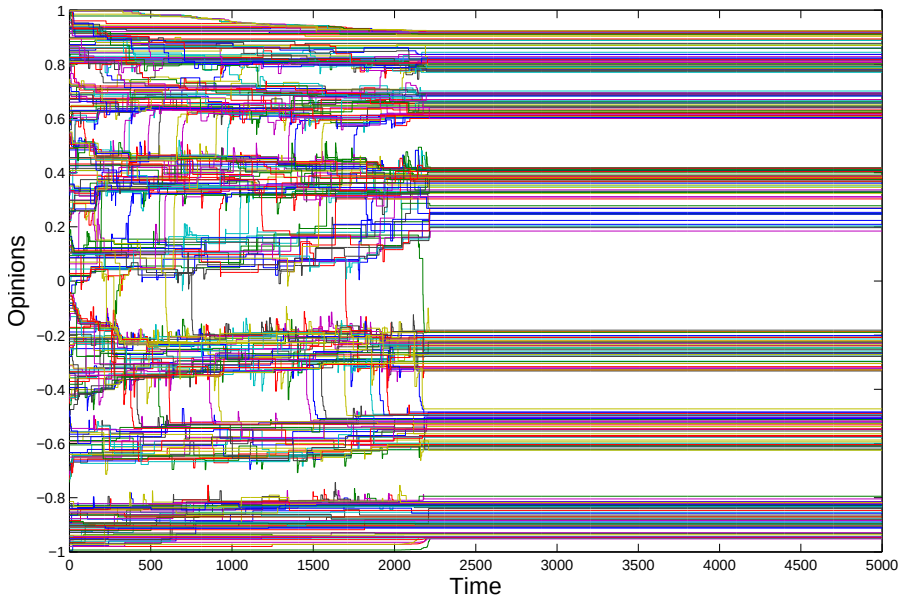


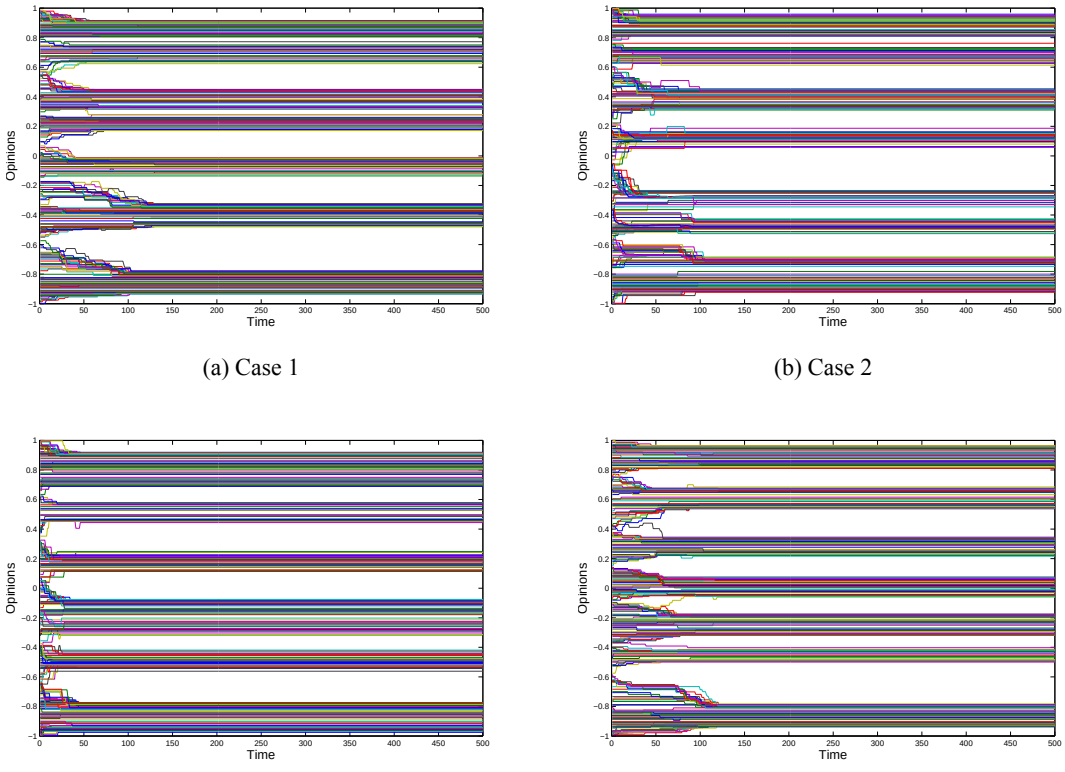
Figure 3.1: *Here we can observe all of the main parts of our model's dynamics. The appearance of parties covering most of the political spectrum, the appearance of inside-party trends, closed parties and more open ones, the attraction and merging between the parties (in this case the resulting party is the most open and would normally win the elections), the influence of opposing parties to other party members and finally the stabilisation of the model's dynamics after everybody gets to be a party member.*

3.2 An exploration of the model's dynamics

The first set of theoretical experiments that we are going to conduct is a general exploration of the model in order to observe the general dynamics that occur after changing some of its parameters. So by varying the parameters μ, "moderates' uncertainty", "probability of external interactions" (keeping the internal ones equal to the external), setting the proportion of extremists at 14% and keeping the others set at the values explained in the relevant section, we consider the cases presented in table 3.1. What we can generally learn from this set of experiments is that it is not enough to have more interactions between the members of a society in order for the dynamics to stabilise faster, we also need the agents to be more open minded; in addition a highly certain population generally stabilises a lot earlier than a more uncertain one. Finally if people are more open-minded, they tend to change between parties a lot, but this doesn't affect the stabilisation speed (figures 3.2 & 3.3).

#	Moderate's uncertainty	μ	Probability of external interactions
1	0.4	0.2	0.3
2	0.4	0.5	0.3
3	0.4	0.5	0.8
4	0.4	0.2	0.8
5	1.2	0.2	0.3
6	1.2	0.5	0.3
7	1.2	0.5	0.8
8	1.2	0.2	0.8

Table 3.1: *The table presents the parameters' combinations for the 8 theoretical experiments of this set.*



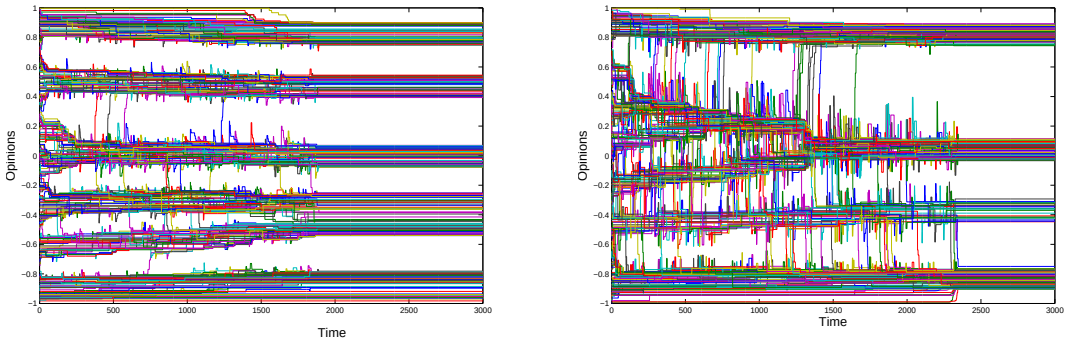
(a) Case 1

(b) Case 2

(c) Case 3

(d) Case 4

Figure 3.2: *For these cases the population stabilises very fast (in case 3 even faster than the rest). One thing that is interesting is that it is not enough to speed up the interactions in order for the population to become stabilised faster, we also need them to be more open-minded. All graphs are in the same time scale (1-500).*



(a) Case 5

(b) Case 6

(c) Case 7

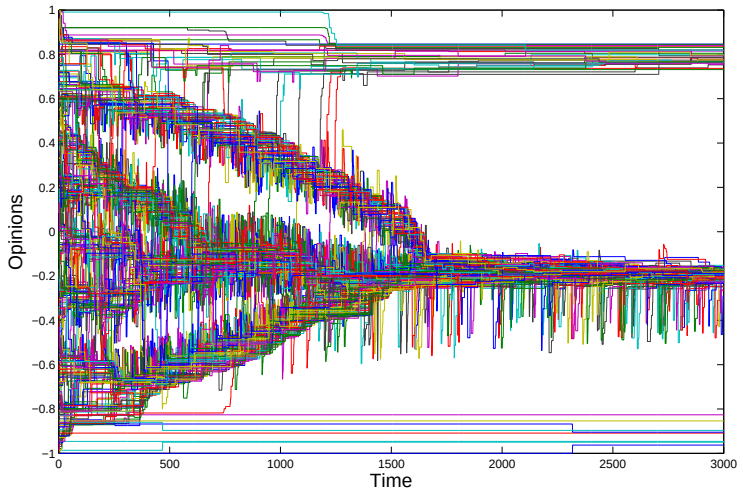
(d) Case 8

Figure 3.3: *Here things become more interesting than the previous cases. We see that whenever we raise the parameter μ people tend to change parties more often than in the other cases. Again, the case with both high μ and more frequent interactions is significantly the faster to stabilise. The time scale in all cases is (1-3000).*

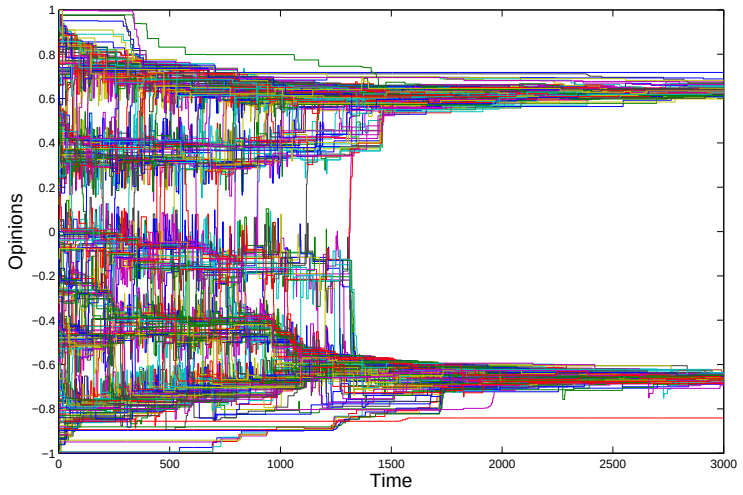
3.3 The appearance of extremism

In this experiment we are going to set the parameter $\mu = 0.5$ and the "moderates' uncertainty" equal to 1.2, so that it would normally allow the Relative Agreement model to have bipolar convergence, and search for the proportion of extremists of the total population that is enough to "break" the central convergence. We find that the critical proportion for going from central convergence to something similar to the bipolar convergence is to initialise 6% of the population to be extremists (figure 3.4). What is very interesting is that even for these parameter values, when the initial extremists are not enough, we will actually have a central convergence and not a convergence to three or four different political parties. Finally, for the first time, we can see the "destruction" of a party, that comes as a natural occurrence of

the model's dynamics, and also its absorption from the two extremist ones.



(a) Proportion of extremists $= 5.8\%$



(b) Proportion of extremists $= 6\%$

Figure 3.4: *Even though a level of initial extremists set to* 5.8% *can attract some agents and strongly influence the the agents in the centre it is not enough to actually "break" the central convergence. In the second case the extremists manage to attract all the agents and form two extremist parties. It is very interesting that in this case we observe for the first time the "destruction" of a central party and its absorption by the extremist ones.*

4. Influence of the social media to the shaping of political views

4.1 Two different societies

The first theoretical experiment that we are going to conduct and in a way represents the reality is the one to picture the effects of the social media to a society. Long before the appearance of the internet and the social media, people in more closed societies tended to be highly clustered with those of the same political beliefs as them and usually had very few interactions with those of different opinions in politics. In contrast people, now that the social media dominate our society, are always interacting with people that have different beliefs than them, sometimes whether they want it or not, and they are always getting information from sources that are opposing their supporting political party. This whole new reality gives new dynamics to the society and our main goal is to see whether this model can, in some realistic ways, represent these two cases.

Starting with populations uniformly spread across the spectrum of opinions we set the initial extremism to be at 14%. In the case of the closed society we set people to be less willing to change their opinions, even if they agree with the ones that they are interacting, and to be more certain about them. Also we have a low level of external interactions and a moderate level of internal ones. In contrast in modern societies, where the social media give to people larger communication capabilities, we assume that people tend to be more open minded and less certain than in the previous case and tend to interact with each other a lot more. The parameter values selected for this experiment (table 4.3) are of course only hypothetical, but due to lack of real data we can only rely to hypotheses that we consider to be good.

Cases	**Moderate's uncertainty**	μ	**External interactions**	**Internal interactions**
Closed society	0.4	0.2	0.3	0.5
Modern society	0.8	0.5	0.8	0.8

Table 4.2: *The parameter values selected for the theoretical experiment on the effects of social media to society.*

The results of this experiment (figure 4.1) do not give us something really different from what we expected to obtain. In the first case we see that the agents mostly stay where they where initialised; this can represent the fact that people in closed societies like tend to stick to opinions that their family, for example, has. The stability of the society is very high and this shows that only strong external events, such as wars or the coming of a new generation (studied later) can change it. In the case of the modern society we can see that people tend to change opinions very often until the model stabilises. This means that political parties can have a higher influence on peoples' opinions nowadays. Also the society tends to stabilise very fast and the only thing that can change it is, again, an external event.

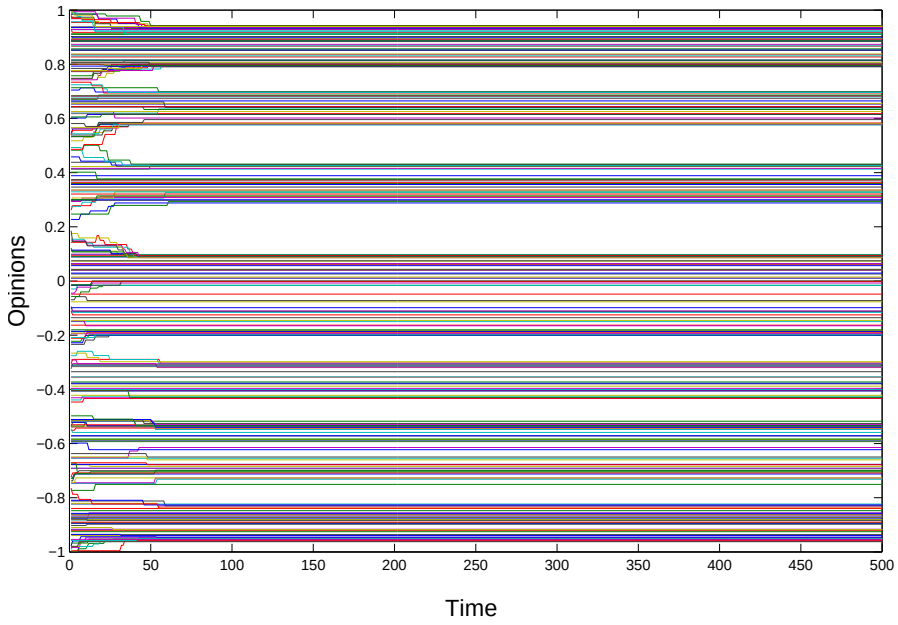
For the assumptions of this baby-model we consider that results to be ok representations of this case. In order to model these cases in a more realistic way more parameters have to be added to the model, but our intention is only to set the groundwork for more research into this direction and not to build the perfect model. In the following section though, we are going have a glimpse on what can be the effects of a new generation in a society and how this can change the dynamics of the whole society, or not.

4.2 The effect on new generations

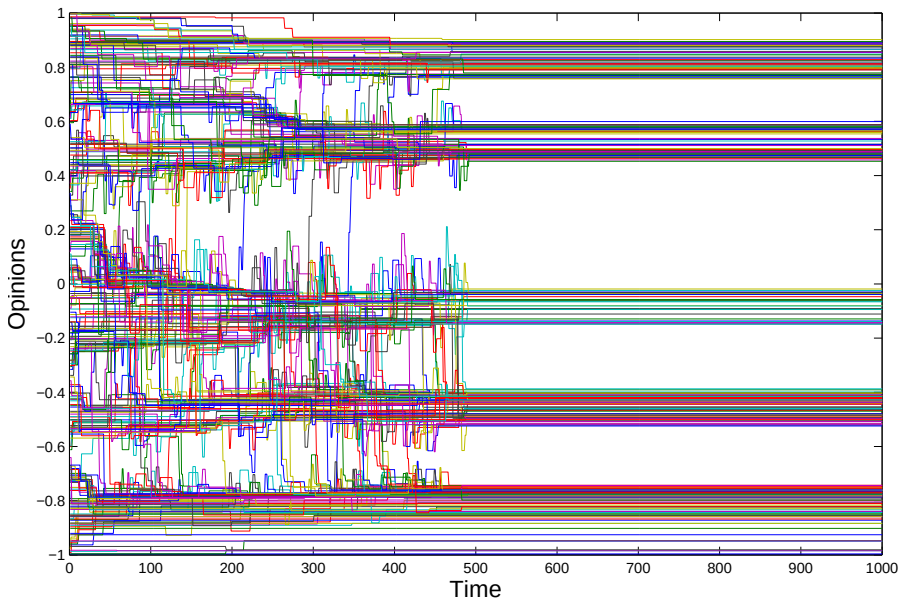
This simple experiment intends on giving us an insight on how a stabilised population can change its dynamics due to the coming of a new generation. In this case we start by making the hypothesis that we begin with a uniform population that interacts like the first case of the previous experiment (in this case the moderates' uncertainty is 0.5) and that after the population has been stabilised, some members of the society die and some new members are being born. The new members, even though they initially have the same political beliefs as their parents, are not members of any of the political parties, which gives the opportunity to other agents to interact with them. We also assume that the total population, after the coming of the new generation, is uncertain in a randomised way because of various sociological factors (such as the appearance of social media, the ageing of its members or the movement of the kids to other places).

Cases	**Moderates' uncertainty**	μ	**External interactions**	**Internal interactions**
Old generation	0.5	0.2	0.3	0.5
New generation	0.6 - 1.2	0.5	0.8	0.8

Table 4.3: *The parameter values selected for the theoretical experiment on the effects of a new generation to an old-fashioned society.*



(a) Closed society



(b) Modern society

Figure 4.1: *The figures represent the difference in the dynamical behaviour between a closed society and a modern one.*

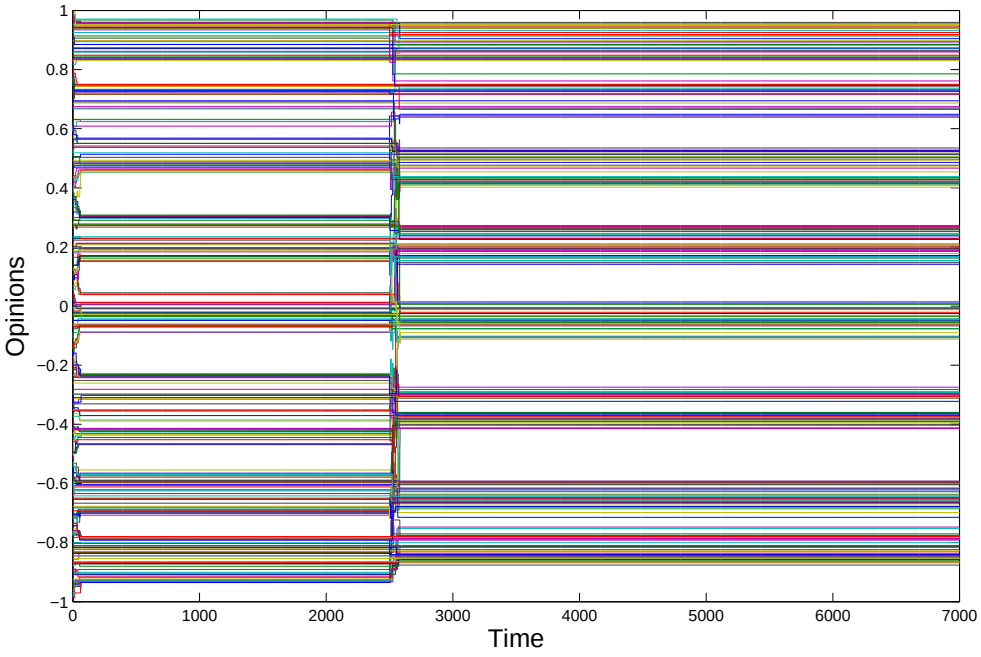


Figure 4.2: *The graph represents the case when we add a new generation to an old-fashioned society. This is a run for* 20% *of initial extremism.*

The results (figure 4.2) give us some really interesting findings. First of all, the new generation is also stabilising in the same way the old one does, even in almost the same time. Also it has the tendency to move, split and merge the parties while it also can turn a party from being open to become closed.

Even though the way of representing the new generation is very simplistic it shows us that very interesting things can happen. This addition to the model seems to be the key for modelling real life political interactions. If it is carefully matched with real life data, it may give even more exciting results, but this need a lot more work in order to be done correctly.

5. Conclusions

After all the exploration of the combined model we can say that we have some very exciting results that help us model the political reality of a society in a more realistic way. By applying the model to some realistic problems we get lots of different types of findings. One of the most important is the appearance of different opinions (trends) inside the party. This actually contradicts the RA model while it represents correctly what is happening in real life politics. It can show the appearance of leaders that gather lots of the party members around them; also it shows that some parties will end up to be more closed than others, which was something that we were trying to see since the beginning.

With the help of some simple theoretical experiments we also managed to find the conditions for which the dynamics of the model stabilise faster. It seems that we need the people to be both open minded and to interact a lot with each other in order for it to happen. Also for runs with highly uncertain moderate agents we get people to frequently change sides and join other parties. Even though this was more than expected, as a result it confirms that the model has realistic dynamics. What is more, it was found that for an initial population of extremists in a society less than 6% (which is not so little for a normal society), the extremism has no effect to it, even if the agents are highly uncertain. This is actually a very interesting finding, because it shows that even when the people are going through hard times and they are highly uncertain, the extremism will not always have an effect on them.

Finally, the two most promising results are the ones that come from the last two experiments. We see that when we make some assumptions about a society and the parameters that describe it, then the model will give us results that actually match up to a level that society. This was presented with the "two societies" experiment. Then if we add some extra events to the society, such as the coming of a new generation, we can shake a bit the dynamics of the model and get some realistic results like party merging, destruction or movement, while some others can grow significantly or become more closed.

So the combination of the Relative Agreement and the Spatial Voting model seems to be successful in its goal, to represent the political interactions in a more realistic way and to set the groundwork for further research on it. It will be extremely

interesting and useful to end up having a model that can actually predict the dynamics that come from individuals - groups interactions. In order, though, for this to be a reality in the next years, some further work has to be done through that direction and some interesting ideas have to be applied in the future are the following.

First of all, in real life when a party tries to change its party line it has to confront the resistance of its members to that change. So if an "inertia" term would be added to the model, then the dynamics of it will be even more realistic. Secondly, here we assumed that the parties will always try to maximise their voting base, but normally this is not always the case. There are parties (like the communist parties) that mostly try to maximise their members base, so it would be very interesting to assume that, for example, far left parties try to maximise their members base and that far right parties try to maximise their voting base and wait to see what will happen.

Furthermore, Spatial Voting as considered here allows the agents to vote only for the party that is closest to their political opinions, but normally people vote for even more reasons a political party. These reasons can be their ethnicity, their family tradition, their political connections and even for religious reasons. So it is also very exciting to add these more dimensions to the Spatial Voting model. Lastly, what seems to be the most important thing that the model needs is the addition of external events, that in real life actually happen all the time, and that can completely shake the model's dynamics. Events such as new generations, wars and natural disasters can make the model a lot more interesting and realistic.

Appendix

The algorithm

- Initialise all the parameters
- Initialise the agents, the original parties and the party lines (as the mean opinion of its members)
- If the "probability of external interactions" allows it we choose randomly two agents, not belonging to the same group, and make them interact.
- If the "probability of internal interactions" allows it we choose randomly two agents, belonging to the same group, and make them interact.
- If there are agents not belonging to any of the groups we choose at most four of them and make them interact with the group closest to them. The group opinion is represented by the party line and the group uncertainty as the mean uncertainty of the group.
- For every party we search around its area to find where it can maximise its voting base. Depending on that, the parties update their main political beliefs.
- Using the new party line as the centre we update the group members depending on the three conditions for the group formation.
- We search for non-party member agents and depending on the "probability of new groups" new parties are formed.

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