Ecological Analysis of a System of Organized Interests

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Abstract

This is a report on a long-term research project about the evolution of system of political organizations. An agent-based computer simulation model is developed with the aim of exploring the inter-connection between tools and concepts from the field of political science with the emerging field of complex systems analysis and the simulation of ecological processes. In political science, we can draw on the exchange theory of interest group formation as well as research on the so-called "ecology of organizations." Many of the individual level premises that are implicit in the political models are made explicit by considering the interest group world as a complex adaptive system. Beginning from some basic premises individual-level premises about the way that individual agents behave and the process of organizational recruitment, the aim is to build a multi-level understanding of the process of political representation. While the development of the architecture of the simulation model has absorbed most of the effort up to this point, there are important substantive questions for which some answers are beginning to come into focus. Insights into the tendency of some organizations to take positions in the center of the ideological spectrum, while others are on the fringes, can be had from the model. The tendency of organizations to specialize their issue-stances in small "niches" can also be considered. The differences in mobilization and position-taking between different kinds of organizations can also be illustrated.

1 The Research Problem

This research project combines concepts from political and social science with concepts and tools from the field of complex systems analysis. The aim is to develop an agent-based model that treats the process of political mobilization as a complex system. The hallmark of a complex system is that there are many small parts that interact with each other only in loosely coupled ways, sometimes producing surprising and unexpected results (Casti, 1997;DeAngelis and Gross, 1992;Epstein and Axtell, 1996;Kauffman, 1993). These small parts are separate, more-or-less individually autonomous units that have only limited information about the environment in which they are

situated. The simulation modeling strategies that have been developed within the field of complex systems rely heavily on concepts drawn from computer science.

On the political science side of the problem, we would like to have an integrated explanation for the following phenomena.

Membership in voluntary political organizations is sometimes stable from year to year, while sometimes it is not.

People regularly join and resign from political organizations.

Organizations devote a substantial amount of effort to announce their services and activities to potential members, only a small fraction of whom actually join.

Policy positions of some organizations appear to exist in isolated "niches," while others take positions across a wide range of issues.

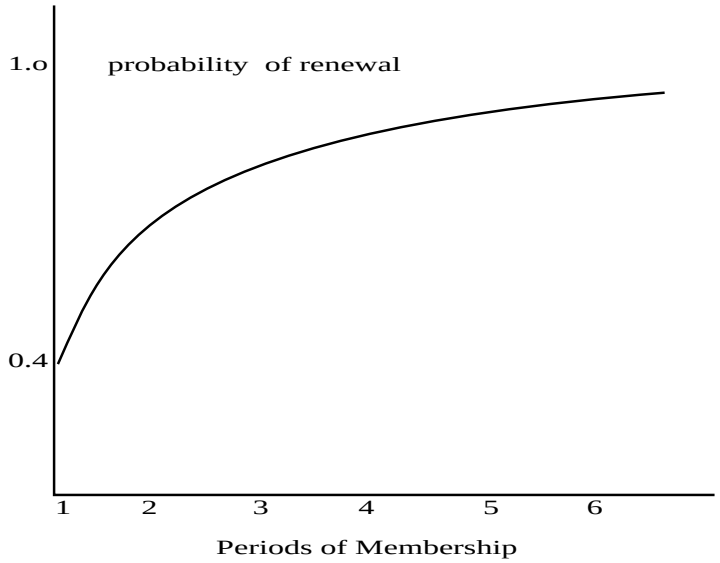
The policy activities of organizations appear to be significantly tied to their recruitment activities.

The principles drawn from political science that underlie the development of this model are *incomplete information* and *rational ignorance*. Rational ignorance flows from the fact that most people have jobs and families that occupy their immediate attention. Citizens are generally uninformed about politics and voluntary organizations that they might join. People join if they are contacted, become informed, and choose to contribute. Among those who join, half or more will resign after one or two years of membership.

Incompleteness of information is a central problem for entrepreneurs who would like to grow the membership base of their organizations. The organizational recruiter's job would be very easy if the people who would join permanently could be identified a priori. The organization could contact them directly and build a permanent, stable membership base. Others, who might drop in and out over the years, could be targeted for recruitment according to their likelihood of renewal. An organization could easily survive in an environment like that because the cost of contacting an individual is small compared to the fees that are collected. The cost of a letter might be one dollar or less, while the dues paid for annual membership may be $30 or $50.

Recruiters do not have an easy method to isolate the people who would actually join if asked, however. This is where the principle of incomplete information comes to the forefront. Organizations contact thousands of prospective members, realistically expecting to succeed in recruiting

Figure 1: Retention Curve



just tens or hundreds of members. Because the emotional and material benefits of membership are small in the eyes of many joiners (Salisbury, 1969; Rothenberg, 1988; Jordan, 1996), it is difficult to retain them without a vigorous re-recruiting effort, probably including a series of mailings or personal contacts.

2 Analysis from the Organizational Level: The *Magic Number*

Without delving too deeply into the mathematical of membership recruitment, this section is intended to outline some dynamics of the recruitment process as it is seen from the organizational level of analysis.

An organization's membership can be seen as a layering of recruiting cohorts. The members who join this year are added to the members who joined in the past and renewed their membership. Interviews with organizational recruiters indicate that the members are not seen as a homogeneous set. Rather, the people who have been members for a longer time are more likely to renew, while the young recruits are the most likely to quit. The organization's ability to keep members over the years is described by its **retention curve.** In Figure **1**, an example of a retention curve is presented. Among first-year members, only 40% will renew, but as time goes bye, the percentage who renew is expected to rise to 90%.

If an organization, in its first year, adds 1000 members, it expects to keep only 400 of them in the second year. Among those 400, however, it can expect to keep about 60% in the following year, and after that, 80% or 90% will be retained.

The organizational recruiter has to contact "enough" prospects to fill the recruiting goals of the organization. The organization expects to lose a certain fraction of its members in any given time period, and so the ability to replace those resigned members is a fundamental requirement for organizational survival, much less organizational growth. The "heroic" initial effort to recruit 1000 members need not be repeated year after year if the organization only wants to maintain its existing size. In fact, the number of new members who must be recruited in order to "stay even" is expected to decline over time because retention increases.

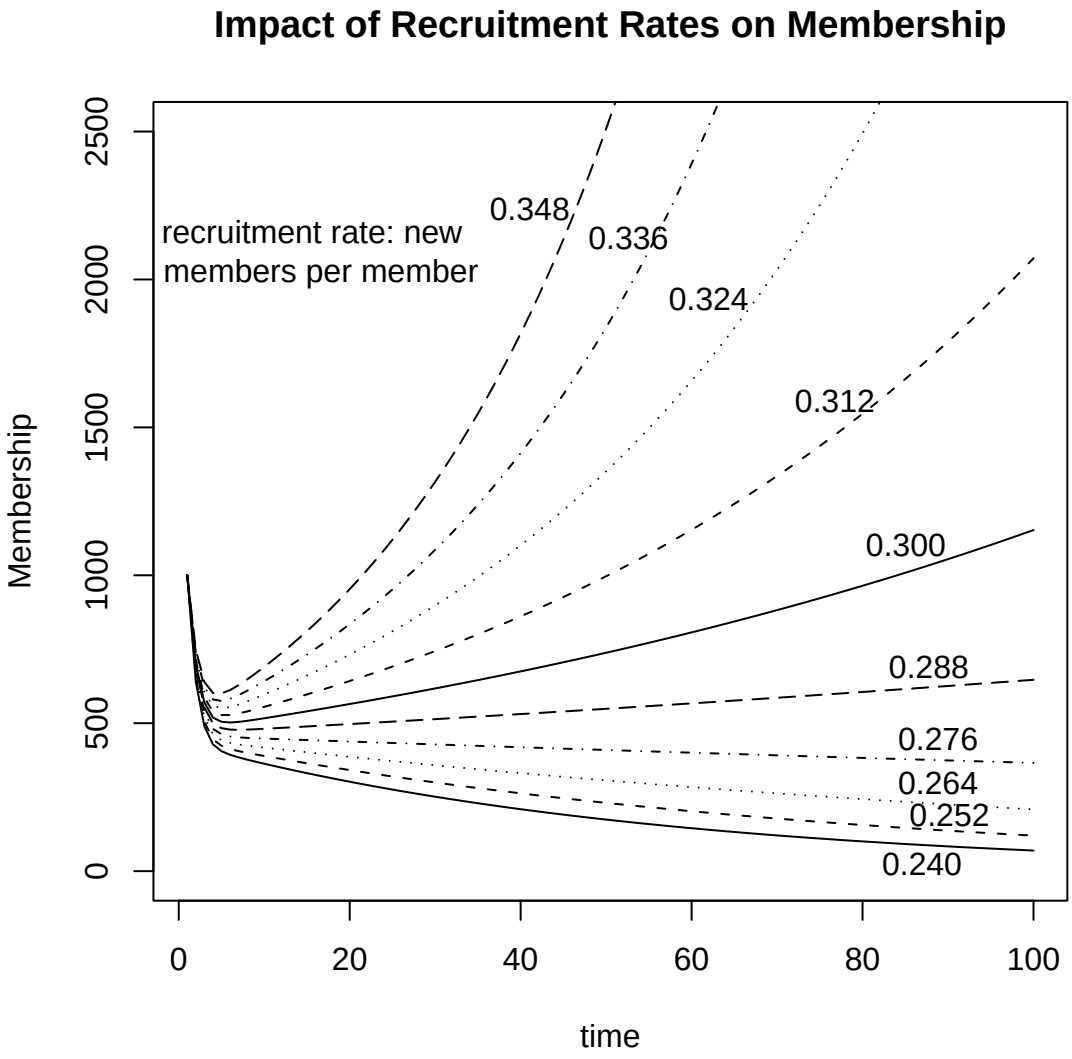
The ability to recruit new members is thus the essential requirement for organizational survival. In order to gauge the magnitude of the problem, some calculations can be done. We need to incorporate the expected retention curve with information about the ability to recruit new members in order to find out if an organization can survive. If the ability to recruit new members is too low, the organization's membership will gradually dwindle.

Suppose that the **recruitment rate**, the number of new members per existing members, is a constant. In Figure 2, example calculations for an organization that begins with 1000 members are presented. The membership levels that correspond with various recruitment rates are illustrated. There is a "magic number" that separates organizations that are expected to dwindle from the organizations that survive and grow. If an organization can recruit more than approximately 0.2808 new members for each existing member, then it can expect to have a growing membership base. An organization needs to recruit slightly less than one-third of its existing membership in order to survive. On the other hand, if its recruitment activities are not sufficient to find at least 0.2808 members per existing members, it should expect to go the way of the Women's Christian Temperance Union.

An organization that knows its retention curve it can calculate a survival graph of the sort that is presented in Figure 2. While there are no doubt differences among organizations in retention, the essence of the problem is the same for all membership organizations: find enough new members to cover membership losses.

Up to this point, we have not tried to explain very much about the recruitment process. In-

Figure 2: A Bifurcation at 0.2808



deed, the difficulty of understanding recruitment is a primary flaw in the organizational level of analysis. The organizational level of analysis has the basic weakness that prevents us from digging very deeply into the reasons that particular people might have for joining a certain organization.

From the organizational level, the best we can do is to stipulate that there is a "potential membership" level that plays the role of the "carrying capacity" in an ecological model. The potential membership represents the largest possible number of people that would ever join an organization. Suppose an organization could contact all citizens in a given instant. The number that would answer in the affirmative is the potential membership. If, for example, 5% of the people in a society would join an organization if asked, then out of a society of 1 million people, we believe the highest potential membership of the organization would be 50,000.

When an organization contacts a random sample of prospects, the actual response rate should depend on the number of potential members that have already been recruited. If the potential is 50,000, and the organization already has 48,000 members, then the response rate to a wave of direct mail should be quite small because there are very prospects remaining to be recruited. If the recruiting targets are a random sample of non-members, then the response rate should not be higher than 2,000/1,000,000, or 0.0002. Even if the organization contacted every single non-member, it could not recruit enough members to replace the members lost due to ordinary membership turnover. Under those conditions, it is simply impossible for the organization to maintain its membership level. Membership will fall, creating a larger pool of prospects, and the organization's membership will likely stabilize.

The number of members in a stable organization is not directly proportional to its potential membership, however. This is true for two reasons. First, some organizations cannot survive because their potential membership is too small. The potential membership must be high enough to support the minimum recruitment rate, or else the membership is expected to dwindle. Second, the stable membership levels of organizations that survive are higher than one would expect simply from their potential membership. In a set of organizations with a given retention curve, one will observe a higher mobilization rate (members/potential) among organizations that have a larger potential membership.

There is one final numerical quirk that can tie together these organizational-level findings.

As the membership in the organization approaches its stable long term rate, the number of members who resign each year should be equal to the number of new recruits. An organization with a large potential membership will, in the beginning, have very high response rates in its recruitment campaigns. Over time, however, the organization will "consume" (or exhaust?) the potential membership. The response rate to a wave of direct mail packages will decline. The response rate will be driven down to the level at which recruitment exactly replaces membership loss. That rate turns out to be the same rate that is consistent with the "magic number" for recruitment rate that was discussed above. The most peculiar, perhaps even bizarre, implication of this result is that organizations of all sizes will drive their response rates down to that same low level which is a reflection of their retention curve, rather than their potential membership. An organization with a small potential membership, say 35,000, should expect the same response rate from a direct mail advertising campaign as an organization that has a potential membership of 100,000, as long as their retention curves are the same.

3 An Individual-Level Analysis

In the organizational analysis, one proceeds from the idea that, in given population, there is a certain number of people who would join if asked to do so. One the stipulates a retention curve and makes statements about the time path of the recruitment process. While that approach pays off with analytical dividends, it still leaves many questions unanswered. At its heart, it is a one-organization-at-a-time approach. It works only if we consider each organization in isolation. More seriously, it is lacking in individual-level foundations. It does not help us to explain why people join particular organizations. The problems of competition among many organizations for a given set of potential members are quite difficult, if not intractable, within that framework.

It would be more desirable to have a model that incorporates our current understandings of political behavior of individuals and political organizations. A purely game-theoretic approach to the problem is mathematically intractable, since we need to account for the diverse behaviors of many different kinds of agents. However, some of the individual parts of a rational choice approach are quite useful as starting points for the development of a new computer model Paul E. Johnson (1991). The computer-based individual level analysis may also be intractable, but per-

haps we learn something from the exercise of constructing the model.

3.1 Individual citizens.

The aim is to develop a working model of a populace in which individuals have only limited information about the political world. There is no reason to assume, for example, that most people are members of the organizations that are closest to them on the policy issues. Rather, we have a right to assume that people who have resources will join the most attractive organizations that contacts them at a given time.

The following premises are offered as a starting point.

Rational Ignorance: Citizens are generally uninformed about political organizations. If they are not contacted, they will not join.

Rational Choice: Citizens may have opinions on some policies and will join organizations whose offerings are "tolerable," i.e., close-enough to the individual's own political standpoint, if they have the resources to do so and choose not to be "free-riders." In this project, simple circles are used to represent the idea that all alternatives equally close to the citizen's ideal are equally attractive (see Figure 3).

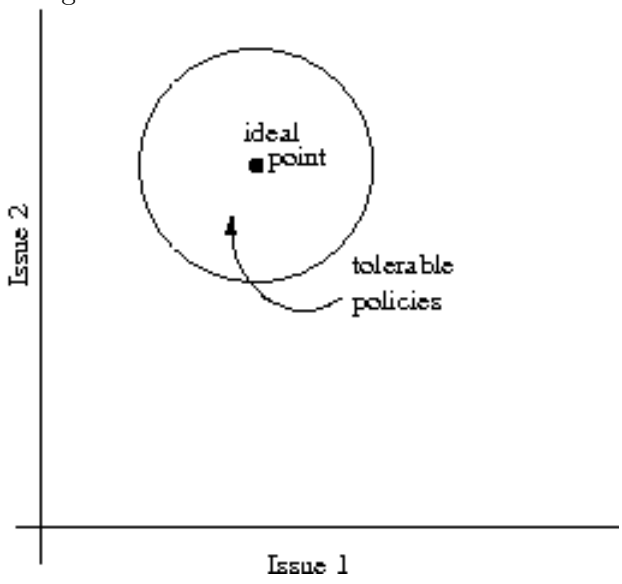
Budget Constraint: Joining is a costly act, so people choose selectively among the organizations that contact them.

Frailty: For many citizens, the benefits of membership are fleeting. People may join and quit and join again in an apparently random fashion.

3.2 Organizers

Recall the exchange theory of interest groups Salisbury (1969), which describes a two-way exchange between the interest group organizer and the class of people who might be interested in joining an organization. The group's material benefits combine with expressive benefits which depend on the closeness of the match between the citizen's tastes and the policy of the organization.

Figure 3: Ideal Point and Tolerable Interval



Position Taking: Organizations take positions on some or all of the political issues that are of interest to citizens. Different types of organizations may follow different approaches in the selection of their political stances. The positions that organizations take may be flexible and responsive to the interests of their members, they may be fixed as the position established by organizational founders, or the positions might be taken as strategic elements in a business-oriented model of membership recruiting.

Contacting: Recruiters may contact existing members and ask them to renew and they may contact random samples of prospects to ask them if they will join. Recruiters may be able to adjust the scale of their recruiting efforts.

4 Computer Model Implementation

The algorithm for group recruiting and position-taking that is described here is a "compute-intensive" problem. The calculations that are required are generally quite simple, but there are many, many separate calculations.

Step 1: Initialization

There are N citizens, each of whom may have opinions on each of M political issue sub-spaces. The sub-spaces are, by definition, unrelated to each other in substance. The citizen's

ideal point is x_i*may include separate positions for each of the M possible political spaces. Within a subspace, the individual an individual may have a specified real-valued ideal point. If the individual "does not care" and takes no position, then the "null" position is noted. Citizens are able to calculate the distance between their ideal and each proposal that is received. For each citizen there is a parameter d_i which indicates how close an organization's proposal must be to the citizen's ideal point in order to merit consideration, i.e., to be "tolerable."

The individual agent are created with other important parameters which determine their response to offers that they will receive. First, the budget parameter specifies the number of organizations that an agent is allowed to join. Second, the free-rider parameter is assigned. In the results described below, the free-rider parameter is drawn from a Uniform distribution on the interval (0.2, 0). If an organization's offering is tolerable, the agent may join, but the agent may also decide to ignore it. This is dealt with by assigning each agent a free-rider parameter that represents the chance that a tolerable offering will be rejected. An important part of the "carrying capacity" of the society is the ability of individuals to join organizations. If the individual budget is reduced from 2 memberships to 1, the character of the model is not changed dramatically, but some of the details are. Finally, there is a loyalty coefficient which represents individual frailty. After one period of membership, the organization will ask the agent to renew its membership. Agents in this model do not have loyalty in the sense that they cling to organizations that offer policies that are inimical to their interests. Rather, agents are loyal only in the sense that, when they are asked to renew their membership at the end of each period, they may choose to do so. If other organizations have made a more desirable offers, the agent will prefer them to an existing membership. Even if no other organization has made such an offer, however, an agent still might refuse to re-join. The willingness to renew membership in a tolerable organization is represented by a loyalty coefficient. In this report, the loyalty coefficient is drawn from the interval (0.6, 0.9).

The ideal points of the citizens in each space can be drawn from various kinds of statistical distributions. In the models described here, the preferences on each issue space are drawn from a Multivariate Normal distribution, but the ideal points can be drawn from other kinds of distributions.

There are R political organizations, each of which proposes an issue package that includes

stances on up to M political issue sub-spaces. The initial positions offered by the organizations inside a sub-space are created by random sampling from the population of citizens. Each organization begins with 0 members, but each is allowed to contact a certain number of prospects. The initial number of prospects that the organizations are allowed to contact is an important characteristic because it affects the rapidity with which they develop their membership base. The ability to contact an initial number of members should be thought of as a subsidy, one which expires after a period of time.

Step 2: Messaging: Organizational recruiting

Each organizational recruiter has resources with which to contact prospective members who are sampled randomly from the population of citizens. This random sampling may be thought of as a process of "direct mail" advertising or "door-to-door" canvassing. At its birth, each organization is given resources to contact a certain number of randomly sampled citizens. The organization deposits an advertising package in a person's "mailbox."

A sincere organization will simply offer citizens a policy package that reflects its "true" organizational policy, while a more sophisticated organization may offer citizens a policy package that differs from the truth.

When an invitation is received, the citizen notices whether it is tolerable, i.e., "close enough" to the agent's most-preferred policy position. If the invitation is tolerable, it is stored in a list of viable proposals.

Step 3: Citizen response

Each citizen is asked to evaluate the viable proposals that have been collected. The proposals are ranked-ordered in terms of their closeness to the agent's ideal. Each agent has a budget that indicates how many organizations can be joined. The "free-rider" parameter, f_i, indicates the probability that the individual will not join an organization, even if an organization's policies are most favorable for that individual citizen. With probability $1 - f_i$, the agent will join the organizations that make the most attractive offers, providing the agent's budget is sufficient.

Step 4. Organizational Maintenance

A. Each organization may revise its policy offerings, changing either its "true" position on any of the issue spaces or by revising its "offer" package that is submitted to prospective members.

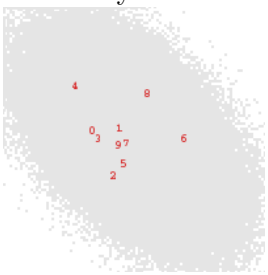
B. Each organization calculates the number of contacts that it will make with new prospects. Various methods of calculating the number of prospects have been implemented in this model. The results described below contrast a "fixed multiplier" method that allows organizations to contact a number of prospects equal to a fixed proportion of their existing members and a "flexible multiplier" method in which organizations can raise or lower the scale of their recruiting effort in light of the success that they experience in recruiting.

C. The messaging process has two phases. First, each organization is allowed to contact all existing members and ask them to renew. The proposal that the existing members receive is always the "true" position of the organization. This is a free exercise, one which is not counted against the organization's quota allowed number of contacts. Second, each organization will select K_j citizens at random and make an invitation to join.

The computer model can be run in a graphical interface allows an operator to interact with the model and observe its condition on the screen, or it may be run in a batch model according to pre-specified settings. The computer model is written in Objective-C and draws heavily on routines from the Swarm Simulation System (Minor, 1996), the Gnu Scientific Library (GSL), and the GNU C library as accessed by the GCC compiler suite. The Swarm and all GNU libraries are freely downloable and usable under the terms of various "open source software" (or "copylefted free software") licenses. The code for this model is also released under an "open source" license is well. It is available at http://pj.freefaculty.org or on request from the author.

The model described here was first considered in 1997, when the fastest available desktop computer based on the Intel CPU ran at 166MHZ and the amount of RAM available on high-end workstations was seldom greater than 256MB. A model in which hundreds of thousands of agents and many organizations could "roam freely" was, quite simply, computationally infeasible. The advances in processing speed and the availability of fast, inexpensive memory have eased the constraints on the modeling process. Nevertheless, a model that has more than one or two million agents and hundreds of political organizations is still something to imagine on yet still faster computers in the future.

Figure 4: Ten Randomly Selected Starting Points



5 Some Results

We choose to highlight some interesting aspects of the model, rather than try to make a comprehensive accounting of all of its features and parameters.

5.1 Spaghetti on the Wall

Begin with a simple two-dimensional issue space in which all citizens have ideal points that are represented by light gray dots in Figure 4. That figure presents a "snapshot" of one of the windows that is used to monitor the progress of the simulation. These ideal points are drawn from a multi-variate Normal (MVN) distribution with a center point at (50,50) and the standard deviation on each dimension is 15, with a correlation of 0.5 between the issues. As a starting point, we begin with 10 political organizations that have issue positions that are also drawn from the same distribution. The positions of the organizations are represented by the small numbers in the Figure.

In this section, we think of these organizations like pieces of spaghetti that are thrown on a wall, and some of them stick (and some don't). The issue positions are fixed and do not change. There is a substantive justification for this approach in the interest group literature, where interest groups are often characterized as inflexible entities that obey the "iron law of oligarchy". Less dramatically, the fixed nature of the positions is a reflection of the fact that an entrepreneur has founded the organization and maintains control over its activities.

The life blood of the recruiting process is the ability to contact prospects and ask them to join. As an organization builds up a loyal membership base, the fraction of members that must be replaced shrinks, easing the challenge of organizational maintenance. In order to help them get "off the ground," organizations need some initial resources with which to advertise them-

selves. In this example, each organization is subsidized at the outset, allowed to contact 5000 individuals drawn at random and ask them to join the organization. The subsidy remains in place for 4 periods.

From the organizational level analysis in an earlier section of this paper, one will recall that there is a recruiting level that divides the organizations that will survive from the ones that will not. The ability to recruit, in turn, depends on the volume of invitations that is sent out in addition to the response rate that is received. "Real life" organizations expect a response rate between 1 and 3 percent, and they generally lose money if the response rate is not in the upper end of that range. A sustained high level of recruiting would generally not be sustainable when the response rate is low, simply because advertising (especially direct mail) is expensive. A fixed recruiting multiplier, one that allows an organization to contact 10 or 14 members per period, might be sustainable for an organization that has a high response rate. On the other hand, there would be pressure to cut back on the scale of the recruiting effort if the response rate were low.

The first simulation results are for the fixed recruiting multiplier model. With each current member, resources are gained with which to contact a certain number of additional prospects. If the contact multiplier is set too low, all of the organizations fade away, while if it is set at a very high level, all of them survive. After some experimentation, the multiplier of 14 was selected for the purposes of illustration.

An illustration of that model is presented in Figure5. Initially, there are 10 organizations recruiting in a population of 500,000 and each individual citizen can afford to join 2 organizations. Ten additional organizations are inserted at randomly selected positions after 50, 100, 150, and 200 timesteps.

Consider the evolution of the interest group society up to the 50th timestep. When the multiplier is fixed at 14 contacts per current member, a very high recruitment level, the membership differences between organizations are quite apparent. The total number of agents in the population is 500,000 in this example, and the largest organization, number 7, succeeds in recruiting more than 2.4% of the 500,000 agents. The differences in membership among organizations are much more extreme than the differences in the support that they would have if they could contact all citizens and ask them to join. The relationship between the organization's potential, as indicated by the proportion of the population who find its policy offering to be tolerable, and the

organization's membership after 50 time periods, appears to be exponential in Figure 6. Organizations with a larger base of potential members are advantaged in the sense that the organizations that form to represent them grow more quickly and attain a higher fraction of the potential membership than organizations with a smaller potential.

In the model with a fixed recruiting multiplier, the distribution of organizational positions raises some questions. In the long run, it appears that there is something of a "hollow core" (Heinz, Laumann, Nelson, and Salsbury, 1993). The positions of surviving organizations are arranged in a ring around the center of the distribution of ideal points. The hollow core is even more apparent in the results of the same model that is run with the restriction that citizens are able to join only one interest group at a time. That "tighter budget" model is presented in Figure 7. The emptiness of the center is certainly a source for future investigation.

What does it mean if an organization's the response rate is low? It may be an indication that the organization has a very small potential base of support, but it might also mean that a relatively large fraction of the potential membership has already been gathered. In either case, the organization will lose money on the recruitment effort. Unless an external subsidy is available to pay the expenses of the large recruiting campaign, we expect that the level of recruiting should be adjusted downward.

A model that includes a flexible recruiting multiplier is illustrated in Figure 8. In this example, the organizations initially contact 5000 prospects (or 14 prospects for each existing member, whichever is greater), but they adjust that "recruiting multiplier" to reflect the success of their recruiting activity. If an organization's membership grows and the response rate is high, then the multiplier will be increased, while an organization with a low response rate will conclude that the market is "saturated" and lower the multiplier.

A number of elements in Figure 8 are worth emphasizing. First, note that the organizations that survive are positioned differently than in Figure 5. There is no "hollow core" here. This reflects the fact that organizations on the periphery are not allowed to maintain high recruitment rates and organizations that are positioned in the center are able to increase the magnitude of their recruiting efforts. Second, consider the fluctuations in membership that are illustrated by the highlighted time paths of organizations 1, 5, and 7. The organizations that are in the center of the population–and are not crowded by nearby neighbors–have high response rates and

Figure 5: Recruiting Multiplier Fixed (14)

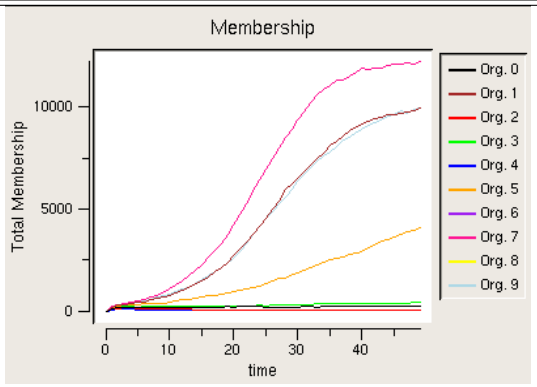
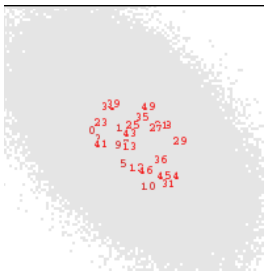
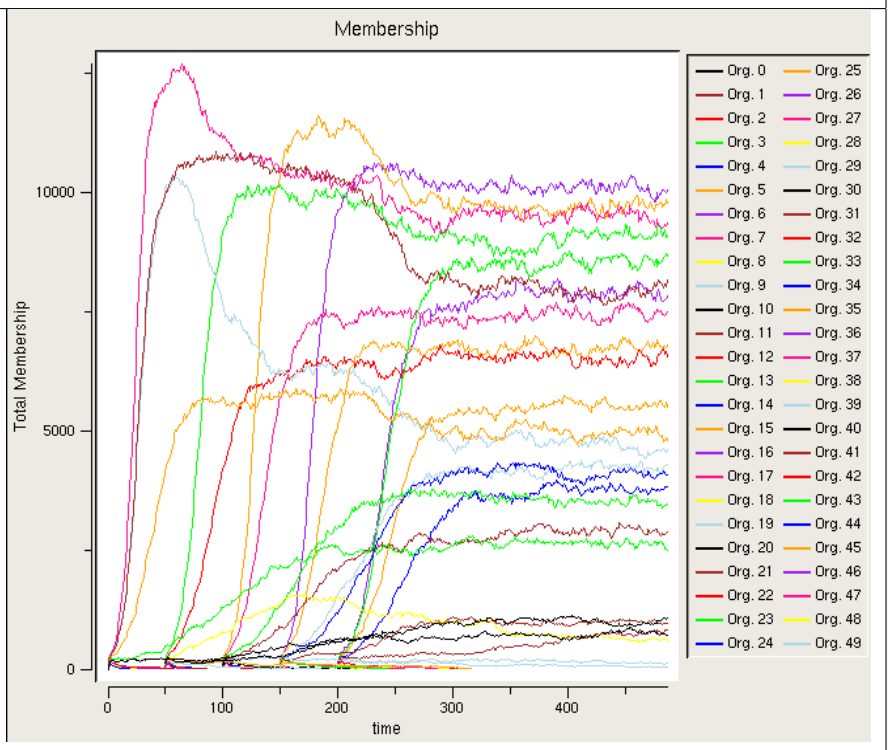
time=50		
time=500		
		budget=2

Figure 6: Potential and Membership Levels

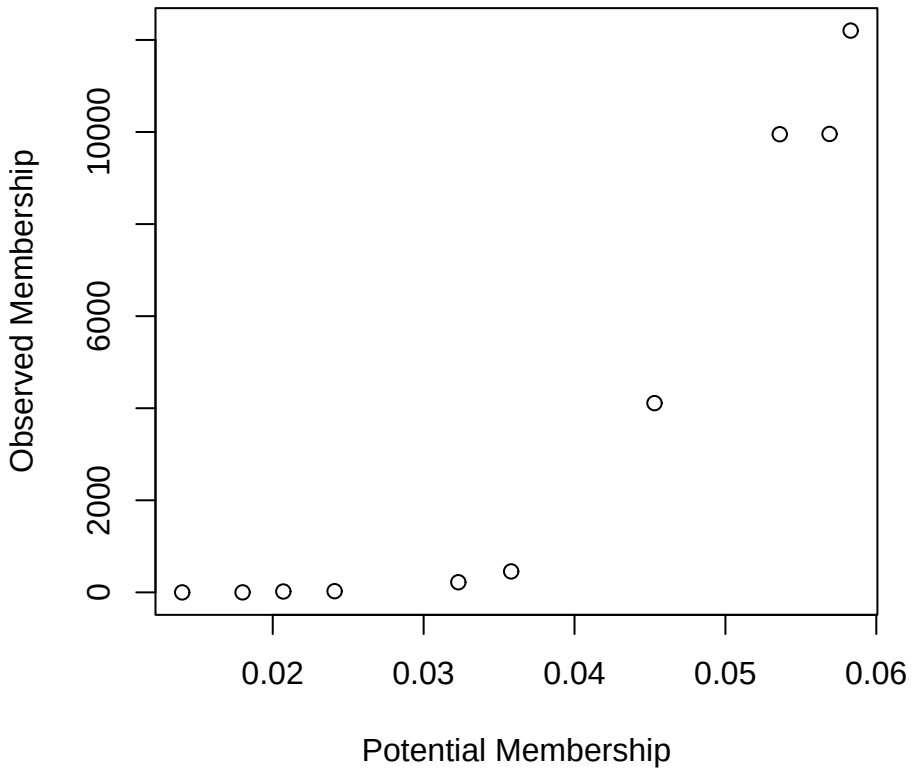
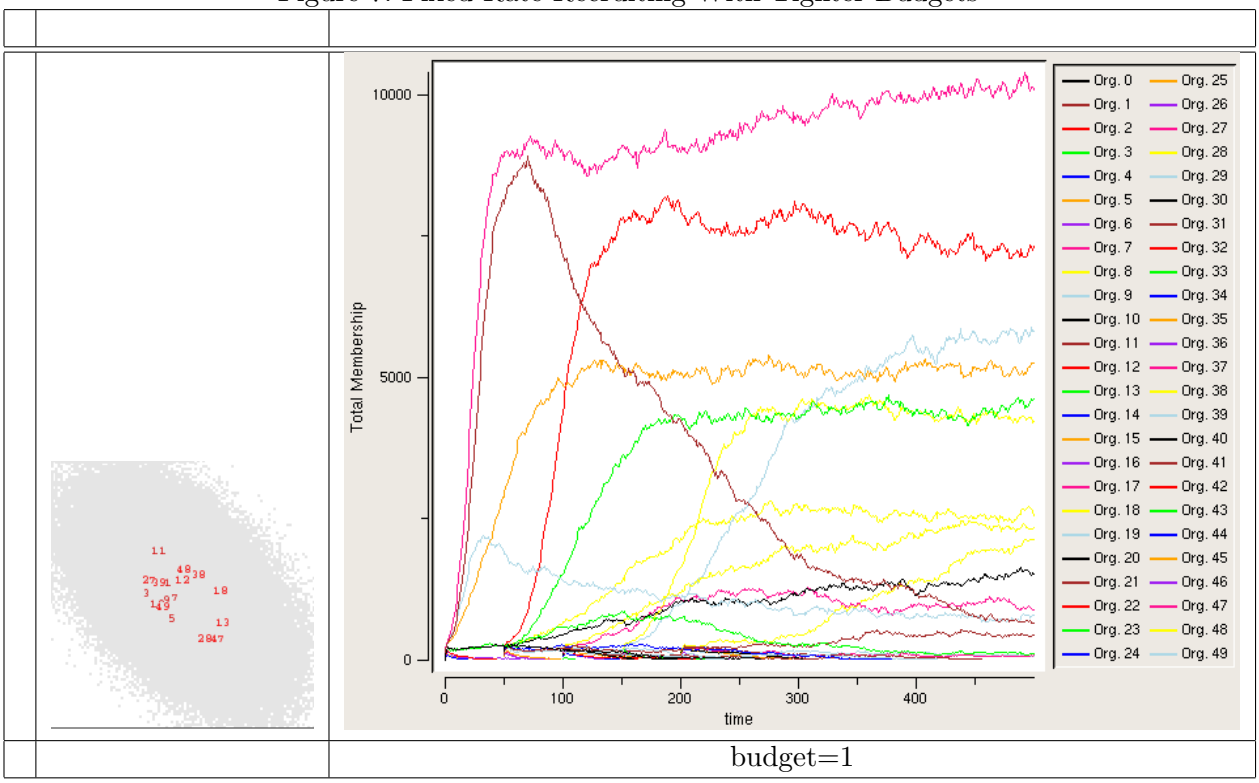


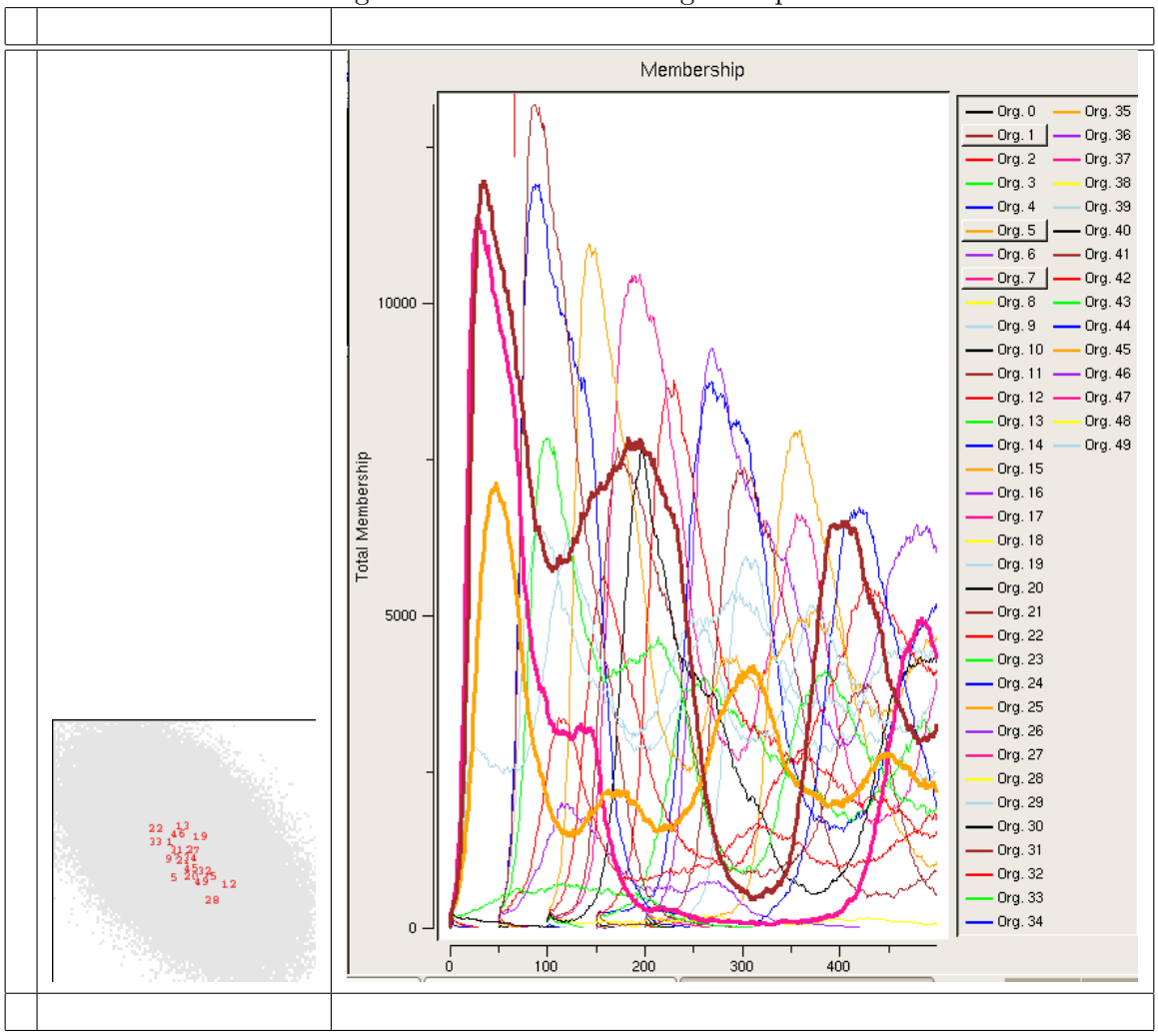
Figure 7: Fixed Rate Recruiting With Tighter Budgets



budget=1

raise their recruiting level, so they grow quickly. When they have grown substantially, and "used up" most of their membership potential, their response rates fall to the magic number, or perhaps below it, causing the recruiting multiplier to be reduced. There is no doubt some complex interaction among the organizations. When one organization decreases its recruitment rate, it will have an impact on the success that other organizations experience. If their success rates rise, they will increase their recruiting multipliers, driving down the success rates of their other neighbors. Some strange dynamics are observed in the membership of organization 7 in Figure 8. The organizations with flexible recruiting multipliers drive their response rate down to a the magic number, so that a small perturbation in their environment can have drastic impact. Third, the introduction of new organizations at times 50, 100, 150, and 200 creates an additional dynamic. If new organizations are added within the vicinity of an existing organization, and the response rate drops, then that may cause a reduction in the recruiting effort, which results in a dramatic downswing in membership.

Figure 8: Flexible Recruiting Multiplier



5.2 Adaptive Position Taking in Democratically Governed Groups

The organizations described in the previous section did not have flexibility in their issue stances. Organizations which started at extreme positions were quickly eliminated because the response rates were not sufficient to maintain them. In this section, we consider one king of organization that can adjust the issue positions over time to avoid that fate.

Consider a"democratically governed group"(Paul E. Johnson, 1990). The members of the organization exercise self-determination. The current members are asked to create the organization's policy, and the new group policy is used in the advertising effort to attract new members. The multi-dimensional median is offered as a representation of the outcome of an internal decision-making process. Policy change is expected to occur frequently as people are drawn in and out of the organization. Such organizations might gain members as their policy changes, but they also risk alienating existing members who find the organization's policy moving away from them.

Recall that the ideal points of the citizens are a multivariate normal "hillside." As discussed elsewhere (Paul E. Johnson, 1996), policy in democratically governed groups is expected to drift, as new positions are adopted that alienate some existing members but draw in new members. Since group members are, more or less, a random sample of people who would find a given position to be tolerable, then we expect that organizations that are positioned on the edges of the policy space will their policy positions drawn toward the center. In other words, although the members of these organizations do not consciously intend to do so, they tend to be hill climbers.

This model is designed so that the citizens can join one or more organizations. If each citizen has the resources to join two organizations, then a model with two democratically governed groups produces convergence. The two organizations start from different positions, but they gradually converge in the center of the preference distribution, often at almost exactly the same position. To the naked eye, their positions appear to be identical.

If there are more organizations, the dynamics are a bit more interesting. If there are only a few organizations, their positions tend to migrate to the positions in the policy space where there are the most citizens.

When the same 10 randomly chosen starting points illustrated in Figure 4 are assigned to

democratically governed groups, the patterns of issue stances and membership are quite different. In Figure 9, the state of the simulation at time points 50 and 500 is displayed. In this model, each organization contacts 14 prospects per current member (from a population of 500,000) and each prospective citizen has a budget with which to join 2 organizations. Because the positions of the organizations are responsive to their members, the ideological stances of the organizations have shifted, generally improving their ability to survive and develop a more substantial membership base. As in the previous simulations, 10 additional organizations were inserted at randomly selected positions at times 50, 100, 150, and 200.

One of the interesting characteristics of these models is that the positions adopted by the democratically governed organizations tend to be evenly spaced in the center of the issue space. If there are just a few organizations, they will occupy the top of the distribution of preferences. If there are more organizations, as shown in Figure 9, the organizational positions are evenly arranged around the top of the preference distribution.

An important part of the "carrying capacity" of the society is the ability of individuals to join organizations. In these examples, the agents will tolerate organizations that offer a position within 5 units of the agent's ideal, and the agents allocate their budgets so as to join the organizations that have the most desirable positions. If the individual budget is reduced from 2 memberships to 1, the character of the model is not changed dramatically, but some of the details are. That "tighter budget" model for the democratically governed groups is presented in Figure 10. When the agents can only join one organization, the interest group constellation is considerably more sparse, of course, but there is one other issue worth mentioning. In Figure 10, there is significant adjustment in membership patterns after timestep 500. Note that organization 13, one of the ones that was created at time 50, grows slowly and between times 500 and 1000, the growth in its membership is the most notable change.

5.3 A Large, Complicated Political Space

The results that have been discussed so far employ only one 2 dimensional political space. The computer model is able to represent a considerably richer set of possibilities. A significantly richer model is found if we suppose that the issues of political interest are decomposed into three (or more) separate issue spaces. That is, an organization's political position consists of a stance in

Figure 9: Democratically Governed Groups

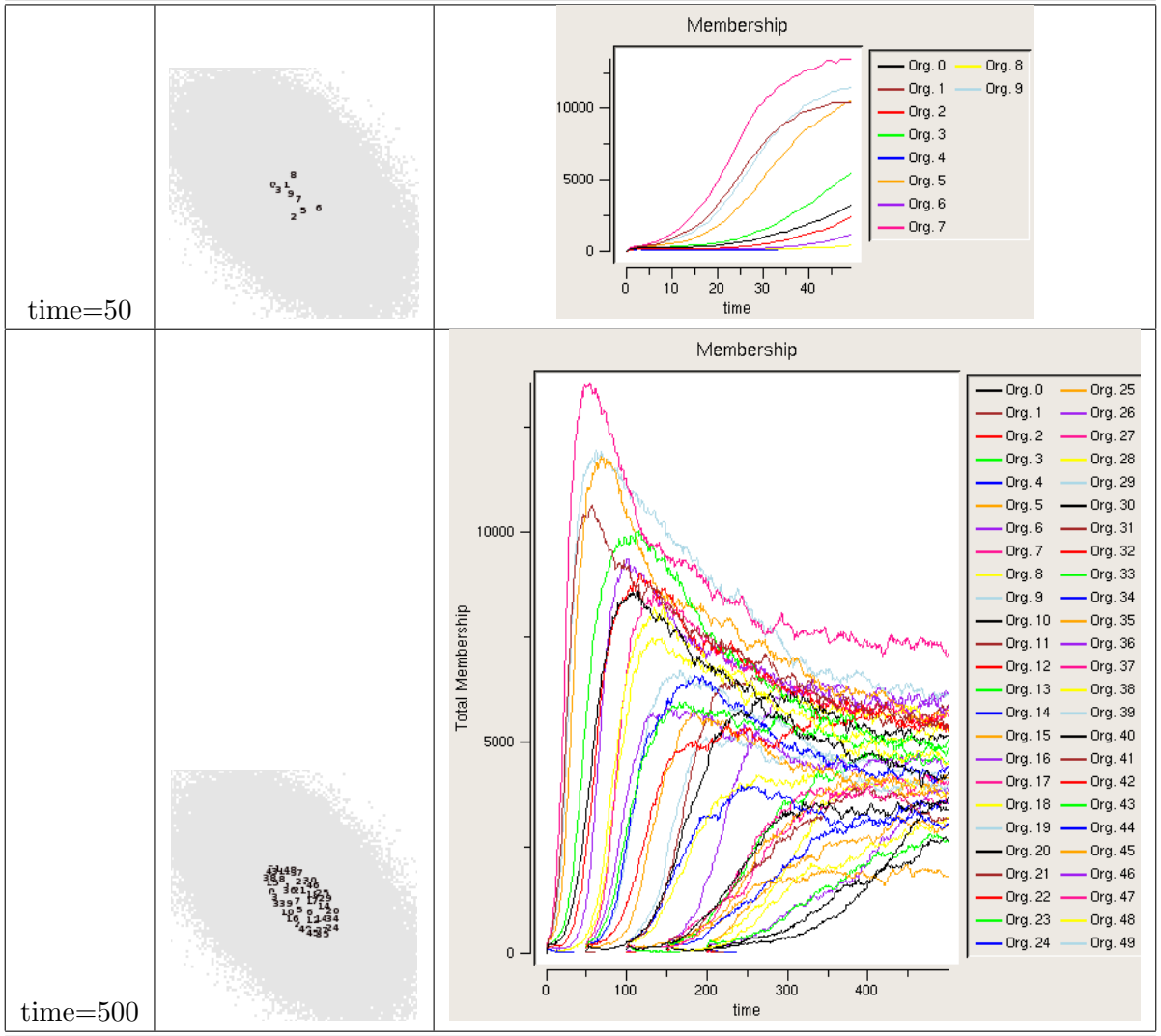
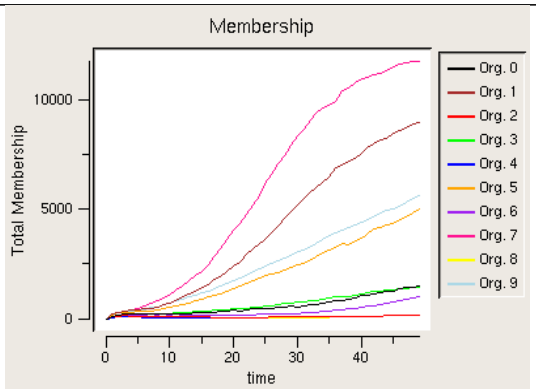
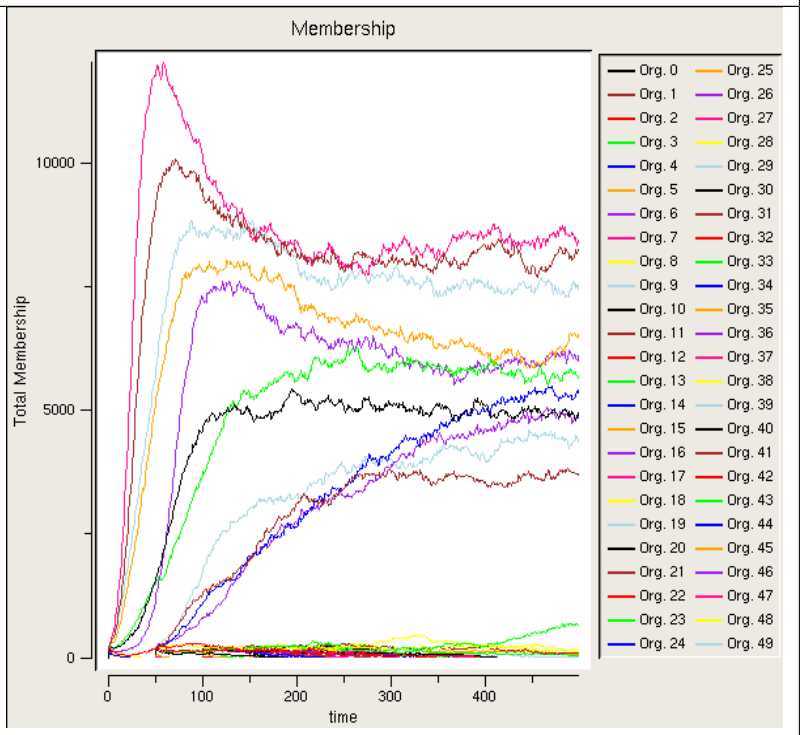


Figure 10: Democratically Governed Groups with Tighter Budgets

time=50



time=500



time=1000

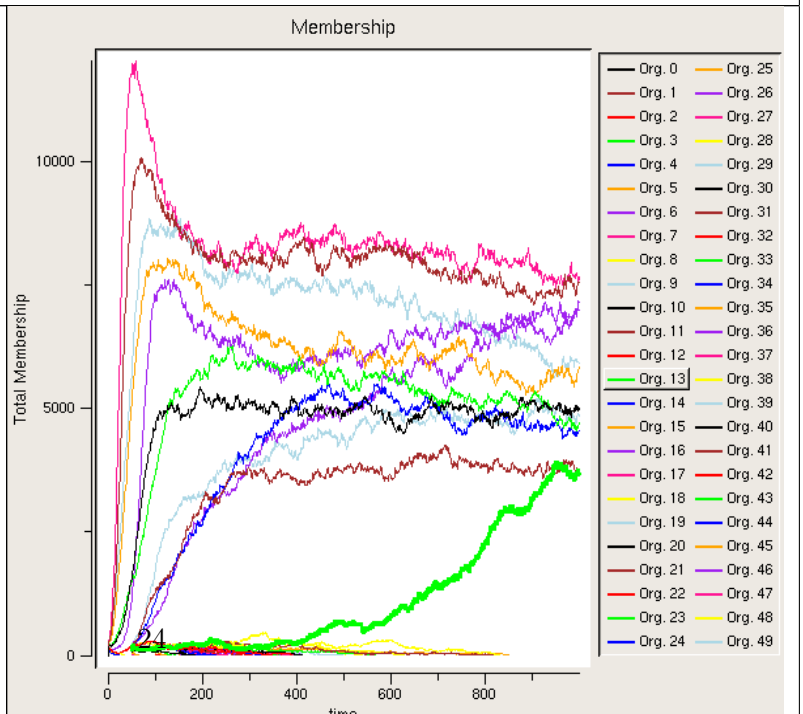
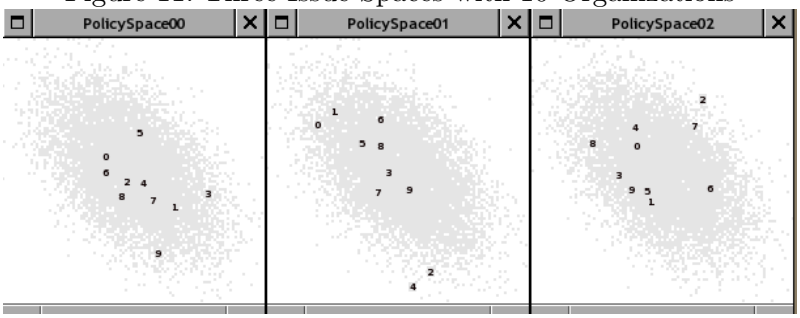


Figure 11: Three Issue Spaces with 10 Organizations



each of three issue spaces. Issue space 1 might represent the economy, while spaces 2 and 3 represent defense, crime control (or any other issues that might be of concern). A political organization may adopt positions in all of these spaces.

A screenshot from a computer model with 3 separate issue spaces is offered in Figure 11 (this figure shows only 10,000 citizens). There are 10 organizations that have positions in each of the three spaces. The issue spaces are separable things, representing a sort of "morselized" political world view that public opinion research seems to find in studies of the American electorate. The citizens are willing to join organizations that are tolerable, in the sense that the summed difference between an organization and the citizen in all of the spaces is not too great. As in the model with only one space, we can experiment by adjusting the width of the tolerable set in order to demonstrate that the resulting political organizations might be either sparse or dense.

When the political world has several separate issue spaces, what is the impact on the interest group universe? The most significant differences for democratically governed groups are as follows.

First, the dynamics of organizational position taking are different. In the model with one space, democratic organizations move toward the peak of the distribution. In the model with three spaces, one sometimes observes organizations that begin close to the center and their positions are drawn away from it. How can that be? An organization may attract members who like its positions on spaces one and two, but on the third space the members might support a change in policy toward a political extreme. Since the citizen positions across issue spaces are not connected (by definition), it is the simple luck of the draw that determines whether an organization is lucky (or unlucky) enough to have pressure towards the extremes in one or more policy

space. Second, in contrast to the one-space model in which the array of organizational positions is symmetric and even around the top of the preference distribution, in the model with three issue spaces, organizations may appear to be clumped together or overlapping, while others are isolated at relatively extreme positions. Third, in the one-space model, the organizations with positions in the center always gather more members than organizations that are on the edges. In the multi-space model, that is not always true. One can sometimes find organizations that offer center positions in one or two spaces might remain unpopular with the public because of their extreme position on the third space. One can also observe a situation in which several organizations are clumped in the center, "over using" the membership base, while some isolated organizations are free to recruit as they may.

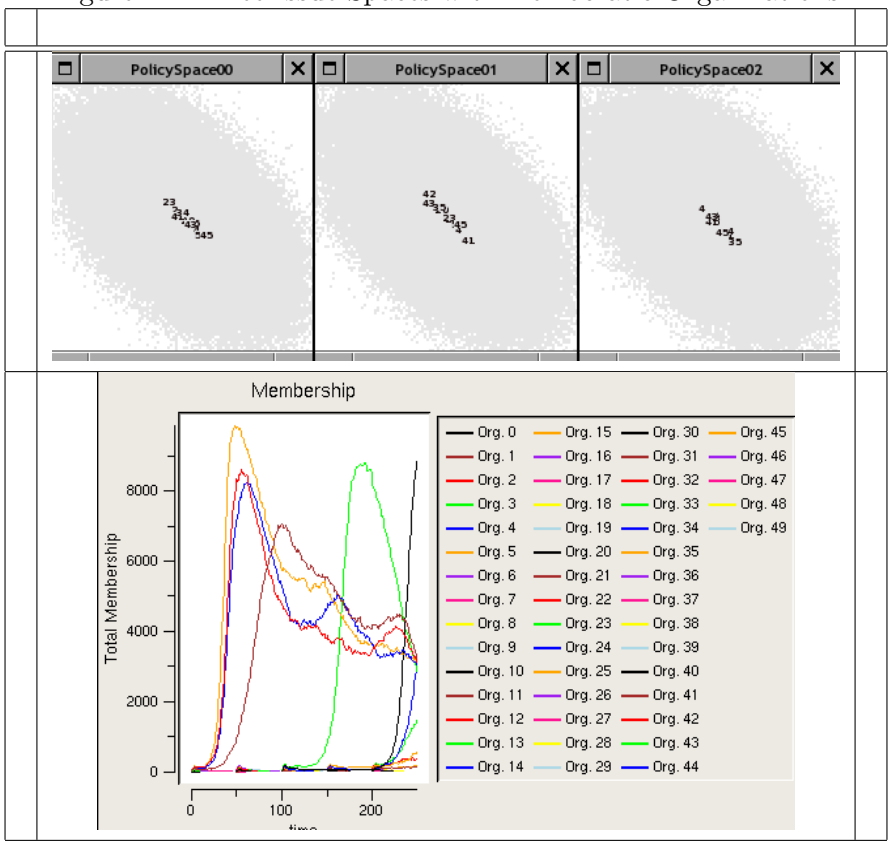
The tendency of democratically governed groups to clump in the multi-space model is illustrated in Figure 12. This simulation was conducted in the same way as the simulations discussed in the previous sections. There are 10 organizations at the outset, and then 10 more are added at times 50, 100, 150, and 200. The organizational positions are not distanced from themselves in the way that was observed in the model with only one space. Furthermore, as the organizations crowd together in the issue space, their membership level is clearly diminished. The voting tendencies of the members in these organizations are drawing their policies in so tightly that the ability to recruit members is diminshed.

At the current time, there is not as much to report about these models as one would like. The multi-space models are the ones that are the most computationally intensive. A single run that includes one million citizens and 50 organizations added in waves of 10 has taken more than 150 hours on a Pentium IV computer running at 3.2GHZ. The code has been profiled to isolate logjams and optimization results in moderate improvements in performance.

6 Conclusion

The results obtained thus far lead to the conclusion that the "knife edge" effect of the "magic number" that is observed in the one-organization model is likely also at work in the richer model of many organizations competing in a compilicated policy space. The level of recruiting effort and the support for (and willingness to pay for joining organizations with) certain positions plays

Figure 12: Three Issue Spaces with Democratic Organizations



a driving role. There are also gaps in the logic between the one-organization model and the richer ecological model proposed here. One thing worth mentioning is that the idea of "carrying capacity" or "membership potential" is very elusive in a spatial model with many organizations.

There are several important components of the model that are not described in detail here because of limitations imposed by time and space. One component concerns the competition between different kinds of organizations on the political landscape. In addition to the ideologically fixed and democratic organizations discussed here, there is also a class of organizations that is more business-oriented. These organizations are controlled by entrepreneurs who adjust the organization's positions in ways that might raise membership. The interaction of several kinds of organizations is different than the homogeneous interaction in this paper. For example, the drift of democratic organizations on the policy space may be blocked by the fixed positions taken by ideologically oriented recruiters. The democratic organizations "can't get from here to there" when other organizations stand in their way.

A second component worth mentioning extends the multi-spatial model described in the last section. Rather that insisting organizations and citizens take positions on all of the spaces, one can allow citizen ideal points and organizational stances that are silent on whole policy spaces. There can be single-issue citizens and single-issue organizations. Citizens who don't care about a space can join an organization if they like its offerings on some spaces. In such an environment, it is also important to have organizations that can drop positions in some spaces or adopt positions in others. For the democratically governed groups, this process is particularly easy to model: the entrepreneur will simply ask the members to find out if they have preferences on one space, and if they do, the median can be calculated and then the entrepreneur can ask for majority support to adopt that new position. Similarly, when the recruiter wants to drop a position in a space, the members can be asked if they would be happier to belong to an organization that is silent on a space.

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