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Mobilizing for Change: Simulating Political Movements in Armed Conflicts

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Abstract

Theories on the establishment and propagation of political movements through mobilization have emerged and evolved over the last half century. Among the major theoretical frameworks that have been advanced are resource mobilization theory, political process theory, and culture theory. However, despite these developments, relatively few methodological approaches have applied bottom-up computational modeling and simulation in explaining movement development in conflicts. With developments made in computational methods, the integration of social theory with modeling and simulation is a natural progression in creating tools that allow analysts, policy makers, and researchers the means to assess the successes or failures of political movements during armed struggles. This article presents an agent-based model and simulation that applies several frequently used theoretical approaches to political mobilization and explores the extent to which group resources and identity shaped conflicts in Central Asia. Given their historical, cultural, political, economic, and geographical circumstances, the authors seek to determine why different movements experienced contrasting political mobilization outcomes. Results show that receiving outside resources could help a relatively weak group, with limited mobilization, overcome opposition that is initially better mobilized, while shared identity and sufficient risk taking are shown to be potentially strong factors in producing successful mobilization. More broadly, the approach advanced enables analysts and researchers to better anticipate future mobilization events and projected paths of conflict by developing and understanding cause and effect relationships within relevant theoretical frameworks.

Keywords

mobilization, movements, social theory, agent-based modeling, simulation, conflict, Central Asia

Introduction

Since the second half of the 20th century, the study of political movements in violent conflicts has led to the development of theoretical frameworks that explain how movements arise, develop, and

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succeed or fail in achieving their goals. Topics covered by the research community include how movements mobilize in specific political contexts. While some of the research has focused on how movements create meaning and justification for followers, perspectives such as framing (Benford & Snow, 2000), resource mobilization theory (Jenkins, 1983), political process theory (Polletta, 1999), and culture theory (Ross, 1997) have been among the most commonly applied theoretical frameworks in explaining movement mobilization. These and other theories advanced in the last few decades investigate underlying causes and motivations that lead people to join movements. In light of recent mobilization in the Near East and North Africa, these theories gain relevance and scrutiny.

Largely missing from research on political movements are bottom-up quantitative modeling and simulation approaches that integrate major theoretical perspectives and enable analysts, policy makers, and social science researchers to study mobilization comparatively, within different spatial and temporal settings. By increasingly integrating social theory on political movements with modeling and simulation approaches, researchers and analysts are able to study cause and effect relationships, demonstrate and explain how theory affects spatiotemporal behaviors, and begin to anticipate future mobilization events by movements. We present a quantitative agent-based modeling and simulation (Epstein, 1999) approach that integrates major social theoretical frameworks in order to measure how underlying factors affecting the mobilization of political movements appear to have shaped three historical case studies in Central Asia. Based on this, our intent is to demonstrate a computational model and simulation approach that applies different theoretical and behavioral designs in order to (1) replicate empirically observed mobilization events and (2) allow alternative scenarios to be studied and researched so that the relevance of different parameters is evident. By addressing these two points, a simulation method could then be applicable to understanding present or future mobilization events by forecasting possible outcomes.

While addressing these goals, we also seek to apply the simulation approach to three case studies that demonstrate how differential power and cohesion within political movements is likely to shape conflicts, inasmuch this was a major theme in the case studies. We propose that there exists a balance between a political movement's resources and identity such that identity may enable sufficient political cohesion to achieve political objectives despite significant resource shortfalls. On the other hand, strong movement identity may not be sufficient in circumstances where there are overwhelming resources used to punish a movement and if potential recruits fail to perceive benefits in joining a movement relative to the risks involved. At a general level, the article demonstrates how advanced methods are used to integrate major social theoretical perspectives that have been advocated for decades within a computational social science methodology. Using such techniques, we are able to provide theory-based explanations as to how political movements succeeded or failed in achieving their mobilization goals and allow alternative perspectives to be explored.

The ensuing discussion will first present background research and theories that address political mobilization. We then consider our case studies and their relevance to political mobilization. Subsequently, computational modeling is discussed, demonstrating how theoretical approaches are integrated and applied. The results of three case studies from Central Asia are later presented to show the modeling approach's utility and to demonstrate the objectives. The discussion concludes by considering the relevance of the results and how we have addressed the goals advanced. We anticipate that computational methods advanced here can be made applicable to forecasting future mobilization events by looking at known past events, comparing multiple events and their results, and developing a methodology that makes forecasting future mobilization a reasonable endeavor (Landman, 2008).

Mobilization and Conflict

Much of the research literature on political mobilization within conflict investigates ethnic (e.g., Carment, 1995), class (e.g., Bartolini, 2000), and ideological differences (e.g., Sowell, 2007) that

shape how movements developed. Other relevant publications on mobilization discussed here include polities and how they are able to shape and galvanize individuals during political events based on shared qualities and identities (Ferguson & Mansbach, 1996). Major theoretical perspectives advanced over the last several decades attempt to address why movements succeeded or failed in attracting recruits to their causes and achieving political power through mobilization. In this article, we have chosen several theoretical perspectives to integrate in our approach because these are among the most citied in the research literature on mobilization. By constructing an approach that bridges qualitative and statistically determined studies with studies that apply simulations such as this, we believe it will demonstrate how to integrate and test theories using methods advanced in the article. Below, a short summary on the relevant theoretical and conceptual approaches to this article is provided.

What cannot be ignored in the discussion on the mobilization of political movements is how framing theory and frame analysis have influenced the discourse on movement mobilization (Benford & Snow, 2000). Framing, as applied to the mobilization of movements, postulates that collective actions (CA) of movements not only represent the existing ideas and stances of movements, but that movements produce and maintain meaning for followers, antagonists, and those neutral to them. A movement's discourse, strategies, ideologies, and behaviors project what the movement stands for, shape how the movement develops and attracts others, and also aligns the frames or beliefs of its constituents. The framing process involves the salience of ideas that promote a problem definition, interpretation, judgment, and viewpoints of daily occurrences that define movements and the stances they represent (Entman, 1993).

While framing can be used to explain how a movement's identity is communicated, emergent theories look at fundamental processes that draw people to movements. One perspective promoted to explain movement mobilization is resource mobilization theory (RMT), discussed by such scholars as McCarthy and Zald (1977) and Klandermans (1984). This theory largely takes the viewpoint that individuals in movements are motivated to attain resources; through these resources people are effectively mobilized to achieve the movement's objectives. Individuals largely act rationally and participate in a movement if they see a perceived benefit. More recently, political process theory (PPT) has taken into account that political opportunities, strength of movement organization, effective leadership, the attainment of resources, and political grievances can all play significant roles in developing political movements and mobilization (McAdam, Tarrow, & Tilly, 2003). Cultural theory (CT) takes a perspective that emphasizes ideology, beliefs, values, and cultural cohesion in how movements mobilize. This perspective emphasizes that perceived injustice serves to unite individuals and shared culture makes groups and political movements more cohesive. This can be accomplished through symbols and shared ideas or identity. Culture helps unify groups in the pursuit of common causes, can be used to propose solutions to problems pursued by movements, and instill emotional responses that unite individuals (Newman, 2002; Ross, 1997).

In addition to the middle-range theories (Boudon, 1991) discussed above, which describe the formation and development of political movements at an operational level and can be used to describe specific empirical case studies, additional concepts such as social networks and spatial or idea diffusion are critical in shaping how movements develop. For instance, Cox, Rosenbluth, and Thies, (1998) and McClurg (2003) have described how social networks affect individuals' behaviors and political participation. Critical to perspectives on social network effects is how much influence people receive and have on others in shaping actions that ultimately direct how movements recruit and evolve. Another important operational concept is the spread of ideas and influences through geographic and individual proximity (Strang & Soule, 1998). Idea diffusion and spatial proximity of individuals to others and events have been investigated in situations dealing with social upheaval and violence (Myers, 2000), whereby individuals' actions and choices could be affected by what is occurring around them. Other approaches look at discrepancies between outward allegiances or loyalties people have to movements while also having hidden feelings or affects (i.e., affective

valences) toward them (Kuran, 1995). Preference falsification is a norm, whereby people do not express their private attitudes but rather claim a public stance (of alignment) that is actually counter to their attitudes. Such hidden orientations and attitudes can surface and shape whether people join or spurn a movement partially as a result of behavior choices shaped by cognitive dissonance (Kuran, 1998).

Integrated group and individual goal-oriented approaches, such as those discussed above, are also incorporated within CA theories that address why individuals and organizations join or participate in movements based on different motivations (e.g., rational, altruistic). The research paradigm addresses why a deprived actor chooses different reasons based on common or individual experiences (Lichbach, 1996a, 1996b). These and other ideas presented here are implemented in a mobilization simulation that addresses which behaviors might be more relevant in shaping political mobilization; before this is considered, however, we now advance the case studies examined.

Case Studies

We examine three cases studies below that represent how political movements mobilized during periods of conflict in Central Asia. In our research approach, we advance the idea that there is a balance between a political movement's resources and identity, whereby identity enables sufficient political unity to enable the achievement of political goals even if there are resource shortcomings. Nevertheless, in cases where overwhelming resources are used in opposing a movement, and if possible recruits fail to recognize usefulness in joining a movement when considering the risks involved, then strong identity will potentially be insufficient. Here, the cases show how one can assess the balance between a movement's resources and identity in shaping the mobilization of political movements. We also chose these specific cases because they all arose, either directly or indirectly, from the withdrawal of Soviet power in the region and appear to apply aspects of the theories discussed by this article. This withdrawal created opportunities for regional actors to assert authority and/or compete for power. These cases, therefore, have both similarities and differences that allow a comparison of results and the ability to address their unique mobilization circumstances using a developed model. The cases provide good examples of how quantitative and qualitative understanding can be used to develop and apply computational simulation in order to explore unknown behavioral qualities relevant to mobilization. The following cases are studied: (1) the early phases of the Tajik Civil War in 1992, (2) the so-called Kyrgyzstan Tulip Revolution in 2005, and (3) the events surrounding the Andijan massacre in Uzbekistan during 2005. Specific data relevant to these cases are available for download in the supplementary data.

The simulation data, entitled Security Community Model, and other files that explain our approach in greater detail are found at: http://discovery.ucl.ac.uk/1347967/, see SupplementaryData.zip (CIA World Factbook, 2012; DIVA-GIS, 2012). Within these files and data, the file VariableInputAndModelPackage.pdf in the Supplementary Data folder explains what variables are used and the meaning of the contents. The case studies described in this section also reference works that provide qualitative and quantitative information used to instantiate simulations discussed, linking simulation variables with relevant sources (see batch_params.xml files in BatchDataFiles in SupplementaryData for values). Specifically, these works are used to develop values that address initial support and data for the movements simulated.

The Tajik Civil War (1992)

The Tajik Civil War represents an example in which the collapse of the Soviet Union led to regional-based rivalries whereby political movements established themselves and competed for political power over the country (Akbarzadeh, 1996). The main movements involved in this struggle consisted of the Neo-Communist, or the old Communist leadership, and an Islamic-Democratic alliance

that was composed of several factions. Local social networks, organizations, desire for political power, and the quest for access to economic resources shaped how individuals joined specific movements (Allison, 2004; Jonson, 2006; Kılavuz, 2009; Lynch, 2001). In addition, allegiances to movements were affected by regional preferences and a desire to support others from their geographic area. After a period of demonstrations and movement organization held after elections in 1991, the Islamic-Democratic movement was successful in dislodging the Neo-Communists from power in the capital city of Dushanbe. At this time, the Islamic-Democratic movement appeared to have been successful in gaining support in various parts of Tajikistan, including the central and eastern provinces. The Islamic-Democratic movement also attracted support from Afghanistan. By December 1992, however, the Neo-Communists were able to reassert themselves in the capital through material assistance from Russia and Uzbekistan, with those countries beginning their support for the Neo-Communists sometime in the fall. By late fall and early winter, the Neo-Communists' ability to attract support from the western and central parts of Tajikistan increased, demonstrating the resource benefits given by Russia and Uzbekistan. After the Islamic-Democratic movement lost the capital, the war continued until 1997, with the Neo-Communists ultimately being successful and able to maintain their hold on Tajikistan.

Kyrgyzstan's Tulip Revolution (2005)

The so-called Tulip Revolution of 2005 in Kyrgyzstan resulted in the overthrow of the government led by President Askar Akayev. The opposition, consisting of disaffected candidates and Kyrgyz nationals, reacted negatively to election results earlier in the year; by early April 2005, the government was overthrown. The People's Movement of Kyrgyzstan (i.e., NDK), formed in September 2004, served as the unifying opposition movement against the government when the uprising began to emerge. The Tulip Revolution lasted about 1 month and the overthrown government was unable to reassert support after losing its primary support base (Fuhrmann, 2006; Khamidov, 2006; Otunbayeva, 2005; Radnitz, 2006). As in the Tajik Civil War, social networks and relationships seemed to have played an important role in transferring knowledge and recruiting individuals to the opposition. Additionally, regional patronage and interests motivated individuals in joining sides for or against the government. While the opposition may have been relatively resource-poor in this struggle, they appeared to have been well unified in their antagonism against the government.

The Andijan Events in Uzbekistan (2005)

The Andijan massacre was an event that occurred on May 13, 2005, in which many demonstrators against the central government were killed by the state security services. This event, in fact, related to a larger set of events where demonstrators in Uzbekistan's Fergana Valley attempted to organize against the central government (Human Rights Watch, 2008; Ilkhamov, 2006; Kendzior, 2006). Although the events surrounding the Andijan massacre are unclear, there is evidence that there was an attempt to establish an organized political movement (i.e., an opposition) to counter the government and potentially overthrow it in a revolution similar to the color revolutions in the former Soviet Union states (Zhang & Fahmy, 2009). The intent may have been to start demonstrations in the eastern parts of Uzbekistan, where the opposition was strongest, with the hope that such demonstrations would spread to other parts of the country. What is clear is that the demonstrations were short lived, lasting less than 1 month, as the government with overwhelming resources heavily repressed any nascent opposition.

Computational Simulation Approach

Computational agent-based models and simulations addressing political mobilization are not new (e.g., Cioffi-Revilla & Rouleau, 2010; Doran, 2005; Srbljinovic, Penzar, Rodik, & Kardov,

2003). Our applied mobilization simulation extends some of these ideas to competing movements, considering their growth and evolution by specifically focusing on movement recruiting within major theoretical frameworks advanced by scholars. Within recruitment, we include the retention of individuals who are already in a movement, as individuals can defect from a movement in which they are already members. The model we present, entitled Security Community, generalizes movement behaviors using the theories discussed, while also addressing specific case studies. Empirical case inputs were employed using quantitative representation of qualitative data where needed (Altaweel et al., 2010; Yang & Gilbert, 2008). Algorithms and variables applied were developed by exploring the relevant literature and developing variable relationships through unit testing, sensitivity analysis, and code walkthroughs of model inputs and interactions. These steps also allow model and code verification. Parameter iterations and sensitivity analyses allowed the testing of various inputs and to see which outputs produced results closest to those matching empirical observations (Gilbert, 2008; North & Macal, 2007; Sargent, 2007). The number of agents modeled was approximated based on the minimum number of agents needed to produce comparable results even if the number of agents increased; simulation time is intended to represent time from the empirical cases (Cioffi-Revilla, 2002). Due to simulation stochasticity, numerous simulation runs were executed, contributing to verification and validation. For the purposes of this article, model validation is defined as producing reasonable, qualitative representations of what happened in empirical cases based on the ratio of mobilized individuals within movements (Sargent, 2007). Given a requisite level of validation applied in cases, variations of input parameters allow forecasting in what-if scenarios to better understand how inputs affect simulation outcomes.

The simulation applies similar algorithms to an earlier solidarity dynamics simulation (Ruby, Mellarkod, Sallach, & Macal, 2005), which examines interactions between individuals and political authorities, but modifications and extended methods are applied to better represent the different theories discussed. In both simulations, agents select which competing authorities to align with or spurn based on incentives, punishments, or social influences. Relationships between independent and dependent variables in models are further developed using process tracing of events and known phenomena (George & McKeown, 1985).

Figures 1 and 2 indicate the workflow of the modeling approach; these figures should be used to follow the discussion presented. The simulation is applied within a larger Java project that is implemented within Repast Simphony 2.0 (North, Howe, Collier, & Vos, 2007). Details about the simulation tool and applied model include Javadocs, mathematical notation, a UML structure diagram, state machine diagrams for the Person and Movement classes, and code (http://discovery.ucl.ac.uk/1347967/: SupplementaryData/ReadMe.pdf for information). In Supplementary Data, VariableInputAndModelPackage.pdf provides details on the inputs used and class and state structures using UML and state machine diagrams. The description below gives an overview on the model's functions in the Movement and JoiningMovement (JM) classes (see UML structure in VariableInputAndModelPackage.pdf), which form the two main classes focused on by this article's simulation scenarios.

Model Details: Movement Class Workflow

The main goal of the model is for a movement's recruiters to successfully convince individuals, represented by the Person class, to join a movement. Figure 1 shows the general Movement class' workflow (Laplante, 2004) during a simulated time step which is instantiated by all the movements (i.e., government and opposition) modeled. This class controls the mobilization process and its parameters are evolved by the JM class that will be discussed shortly. As the simulation progresses, the step() method is first called, which applies generateResourceProfits() (see ModelDetials.pdf for algorithmic detail) that determines resources available for the movement based on the number of

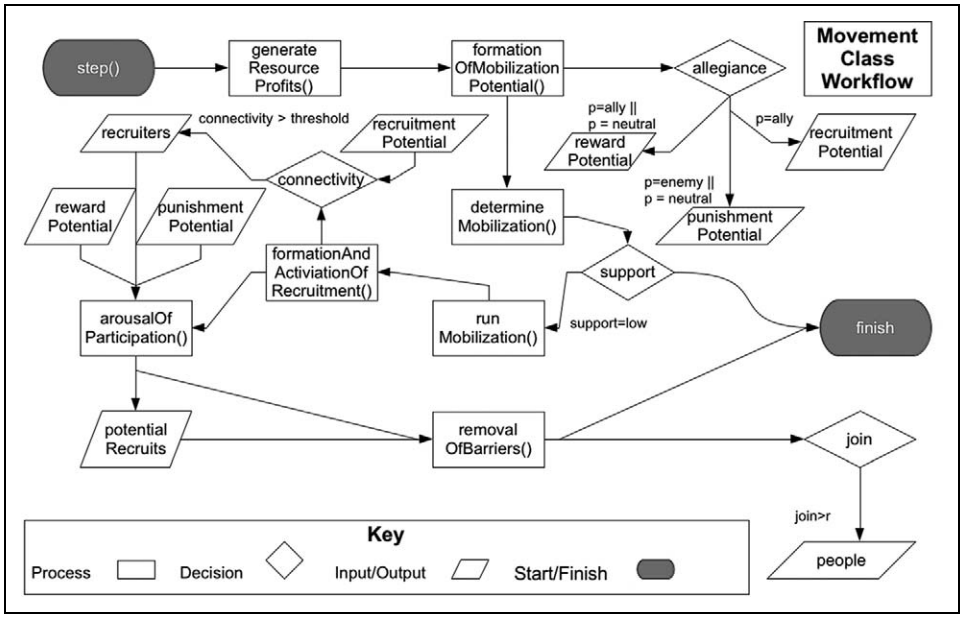

Figure 1. The movement class workflow during one simulated tick.

members in the movement. The next method, formationOfMobilizationPotential(), categorizes individuals (*p* for an instance of Person class) based on their stances toward a movement as shown in Figure 1. Neutrals or allies, for instance, are placed in the rewarded container based on the simulation type chosen (i.e., to punish or reward neutral individuals). The determineMobilization() method triggers the mobilization model by checking to see if support is relatively low, which is based on user input, and then if support is low the mobilization process begins. The next set of steps are all based on Klandermans and Oegema (1987) and apply concepts advanced in their article. The runMobilization() method calls steps that prepare the mobilization model, initiate mobilization (in the JM class), and process new recruits. The first method in this process, formationAndActiviationOfRecruitment(), simply looks at the connectivity of potential recruiters (from formationOfMobilizationPotential()), determines whether their social network connectivity is greater than a given input threshold, and then applies the recruiters along with those punished and rewarded to the mobilization model that is called within the arousalOfParticipation() method. This method essentially calls the JM class applying the inputs mentioned (Figure 2). After the mobilization process is complete, the result is a container of potential recruits (potentialRecruits). The final method, removalOfBarriers(), simply determines the ratio of people from the potentialRecruits container to join the movement based on an input setting (see VariableInputAndModelPackage.pdf in SupplementaryData) and a random number. The simulation then continues or finishes depending on remaining simulated time.

Model Details: The Joining Movement Class Workflow

While the methods discussed above largely set up the model and process the output, the processes below discus how potential recruits try to join a movement. The processes apply RMT, PPT, CT, social networks, idea diffusion, and cognitive dissonance that enable recruits to be brought into a movement. The flowchart in Figure 2 is used to discuss the JM class methods during one simulated time step. In the class, the methods' algorithmic details and relevant variables to be discussed, with the exception of runModel() and factionAdjustment(), are detailed in ModelDetails.pdf.

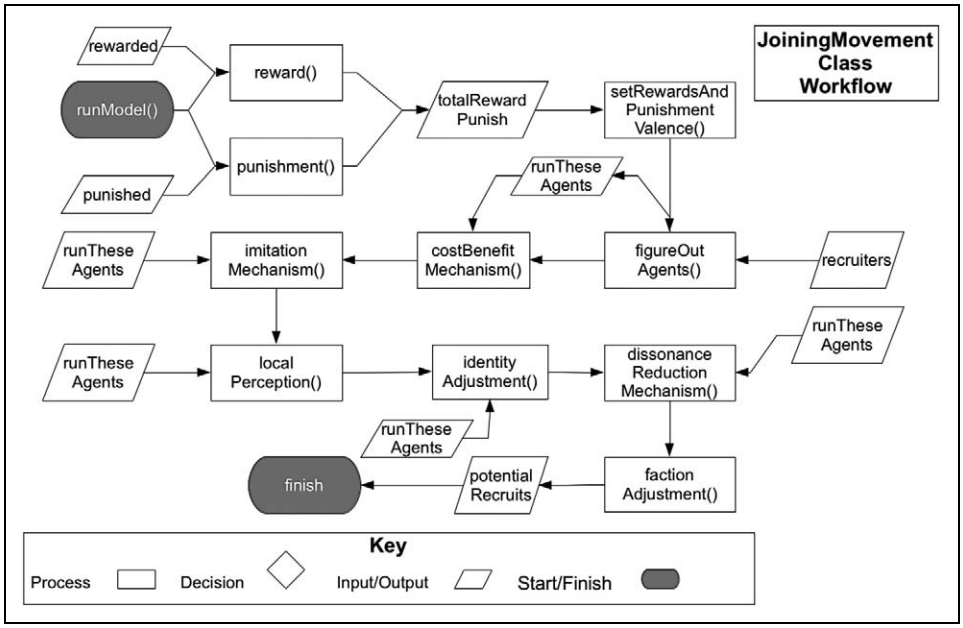

Figure 2. Workflow in the mobilization model within the JoiningMovement (JM) class during a simulated time step.

With the JM class called by arousalOfParticipation() in Movement, the first method called in JM is runModel(). This method calls reward() and punishment(), which take as input the rewarded and punished containers that have agents being rewarded and punished, respectively. In general, followers of a movement are rewarded, while those who are enemies of a movement are punished. Reward and punishment apply concepts from RMT and PPT, as these steps apply resources as a means to attract people to movements, and resources and punishment also create opportunities for individuals to join or leave movements. Strategies by movements, controlled by a strategy variable, determine if neutral individuals are either rewarded or punished. Next, the setRewardsAndPunishmentValence() method is called, which adjusts individuals' affect toward a movement in response to the rewarded and punished agents by a movement (i.e., totalRewardPunish) by adjusting their valence. This method assesses agents' private attitudes toward a movement, with agents adjusting their valence toward a movement based on how others in their social network, including how they feel about those individuals, are rewarded or punished by a movement. The method figureOutAgents(), called next, determines which agents the movement will attempt to recruit. This is done by looking at individuals from the social networks of movement recruiters (recruiters input in Figure 2) and other random individuals that might be targeted by the recruitment process.

After the potential recruits (runTheseAgents) are determined, these individuals weigh the costs and benefits to aligning themselves closer to a movement in costBenefitMechanism(). Potential recruits look at their social networks and determine if people in their networks are benefiting from the movement. The potential recruit will then adjust alignment based on how other agents are benefiting from a movement and which direction of alignment (i.e., more positive or negative) is most beneficial. The alignmentBand variable allows an agent to evaluate other individuals that have qualitatively different alignment. This is based on the number of alignment bands, which are discrete alignment ranges between −1.0 and 1.0, with the agent adjusting alignment based on the alignmentAdjust (0 to 1.0) variable that regulates the ratio of adjustment made. The value for alignmentBand indicates the range of each discrete alignment band between −1.0 and 1.0, with agents only

considering others' adjacent alignment bands, while a greater alignmentAdjust variable allows greater alignment shifts, positive or negative, based on perceived benefits or opportunities to joining a movement. This method reflects concepts from RMT, as personal resource benefits are judged by agents in this step, with alignmentBand and alignmentAdjust variables reflecting emotional responses by agents to perceived benefits. In addition, the method reflects opportunities individuals perceive that allows them to be influenced by a movement, which represents an important concept within PPT.

The imitationMechanism() then adjusts potential recruits' (i.e., runTheseAgents) alignment according to individuals' social networks and how much influence people have on them, including others' alignment. This function allows agents to be influenced by nonmaterial influence, specifically overall influence exerted by social relationships. The localPerception() method, applied next, assesses how local perceptions, or the general public attitude toward a movement in a given area, influence a potential recruit; alignment is adjusted based on the level of influence that overall alignment (i.e., cumulative alignment of individuals in a defined space) in the local surroundings has toward a potential recruit's alignment. This step reflects idea diffusion and spatial proximity influences on alignment.

The identityAdjustment() method is then applied, which incorporates CT and PPT. Potential recruits adjust their alignment based on the fact that they have strong or weak identity with a specific movement. Identity here represents shared grievances or cultural attitudes held by individuals or groups that shape cohesion to a movement. In the penultimate method, dissonanceReductionMechanism() adjusts dissonance, defined as the difference between the valence and alignment toward a movement, in individuals within runTheseAgents. This method accommodates large disparities, and thus preference falsification (Epstein, 2002; Kuran, 1998), between alignment and valence that may result in cognitive dissonance. After this method, factionAdjustment() simply sets the public alignment of individuals based on the previous methods' outputs. The potentialRecruits output contains agents who want to join a movement based on alignment being greater than the neutral alignment range (see alignmentValenceRange in batch_params.xml in SupplementaryData) for a movement. People then become members of a movement if there are no additional barriers to participating in the movement (see removalOfBarriers() in the Movement class).

Simulation Results

The data applied to the case studies are available in the supplementary files (see batch_params.xml files in the SupplementaryData/BatchDataFiles folder) for scenarios. For the batch_params.xml files in BatchDataFiles, files 1–3, 4–7, and 8–11 represent Scenarios 1–3, respectively. Initial alignment values are derived from qualitative descriptions in the cited references for the case studies. Values for province population, social network connections, areas of political support, and movements involved are derived from data cited; the inputs and variables not discussed are not tested here since they are largely known. In cases where the data are qualitatively described, we created quantitative values that represent qualitative concepts using methods described by Yang and Gilbert (2008). Values are determined using parameter sweeps (i.e., testing of different value settings and their outputs over a given range of values) and sensitivity analysis, allowing for quantitative representation of qualitative understanding such as levels of resources that enable different mobilization trends.

Despite the fact that some of the variables are known, whether qualitatively or quantitatively, values for identity and resources, including abilities for governments to punish movements, are not known. Furthermore, related values that affect these variables, such as alignmentBand, need to be investigated to see how they can be relevant to the main variables and concepts tested in scenarios. Based on this, the intent is to (1) search for the parameter settings that result in mobilization outcomes that match our qualitative understanding on the different political movements studied and (2) indicate variations of results by testing important, less known parameters that are relevant for

Table 1. Key Parameters Investigated (i.e., Parameter Column) in Scenarios and Subscenarios (i.e., Scenario Column).

Scenario	Parameter	Movement Object Instances and Parameter Settings
Scenario 1: A	fundingBoost	Government = 20.0, Opposition = 20.0
Scenario 1: B	fundingBoost	Government = 0.0, Opposition = 20.0
Scenario 1: B and C	fundingDelay	Government = 1,000, Opposition = 30
Scenario 1: C	fundingBoost	Government = 50.0, Opposition = 20.0
Scenario 2: A	identity	Government = Bishkek/0.05, Opposition =Jalal-Abad/0.225, Osh/0.225, Naryn/0.175, Batken/0.175
Scenario 2: B	identity	Government = Bishkek/0.1, Opposition = Jalal-Abad/0.175, Osh/0.175, Naryn/0.125, Batken/0.125
Scenario 2: C	identity	Government = Bishkek/0.1, Opposition = Jalal-Abad/0.155, Osh/0.155, Naryn/0.105, Batken/0.105
Scenario 2: D	identity	Government = Bishkek/0.05, Opposition = Jalal-Abad/0.225, Osh/0.225, Naryn/0.175, Batken/0.175
Scenario 2: D	strategy	Government = none, Opposition = neutral
Scenario 3: A	punishmentFactor	Opposition = 5.0
Scenario 3: B–D	punishmentFactor	Opposition = 1.0
Scenario 3: C	alignmentBand	0.25
Scenario 3: C and D	alignmentAdjust	0.5
Scenario 3: D	alignmentBand	0.2

Note. The Movement Object Value Settings column represents the parameters tested in the Movement object. All scenarios, except Scenario 3, have a government and opposition Movement instance. Scenario 3 has an opposition movement only. Subscenarios B–D for all scenarios in the table show how a parameter setting varies from the subscenario before it.

displaying theoretical concepts discussed. The objective, therefore, is to know which parameter settings lead to results that closest match the empirical cases; we also seek to determine how identity, resources, and punishment are relevant in cases and how they affect mobilization outcomes using specific questions presented in case studies. We demonstrate how parameter inputs in Subscenarios B–D in simulations, such as resources and identity, affect results, showing that results achieved in Subscenarios A in scenarios reject the null hypothesis that a movement's resources, identity, and punishment have no effect on successful mobilization (Table 1). Actual time is represented in the results to provide an idea of the time frames addressed by the scenarios. Different time units are used in each scenario to reflect how quickly specific cases could change, either relatively slow (e.g., Tajik Civil War) or fast (e.g., Kyrgyzstan's Tulip Revolution) developing conflicts. We provide overall results showing the supporters for a given movement and province-level outputs for subscenarios that match closest to empirical cases. Each subscenario is executed 1,000 times. Figure 3 shows the three case study scenarios.

Scenario 1: The Tajik Civil War

For this scenario, there are two Movement class instances modeled, representing the Neo-Communist government and the Islamic-Democratic alliance that forms the opposition. In this case, we know that external resources provided by Russia and Uzbekistan, who represent exogenous actors in simulations, helped support the Neo-Communists in repressing the Islamic-Democratic alliance; however, we do not know at what relative levels these resources may have been important in effecting outcomes. For this scenario, we ask at what relative level of external support by Russia and Uzbekistan would the Neo-Communists be more successfully in their recruiting than the Islamic-Democratic alliance? The scenario occurs within 2,000 time units (*ticks*), which here represent the time between July 1, 1992 and December 31, 1992. There are

Figure 3. The three case study scenarios. Bar graphs on each province indicate levels of support for the government or opposition movements and neutral stances during simulations (bars from left to right, respectively, on graphs).

1,353 agents in all subscenarios for this case; collectively they represent a sample of the Tajik population that produces very similar results as scenarios with more agents. Historically in this period, the opposition movement (i.e., an Islamic-Democratic alliance) was able to mobilize people against the Neo-Communist government, but by the winter of 1992, it was forced to retreat and likely lost support in parts of western and central Tajikistan. The results in Figure 4 indicate the supporters for each movement in the different Subscenarios (A–C).

Subscenario A matches more closely to what we know from the historical empirical results. Figure 5 shows the province-level supporters for Subscenario A. The subscenario shows a rapid increase in supporters for the opposition in one province, with more moderate and temporally limited increases in the three other provinces; there is then a period of stagnation for the opposition and

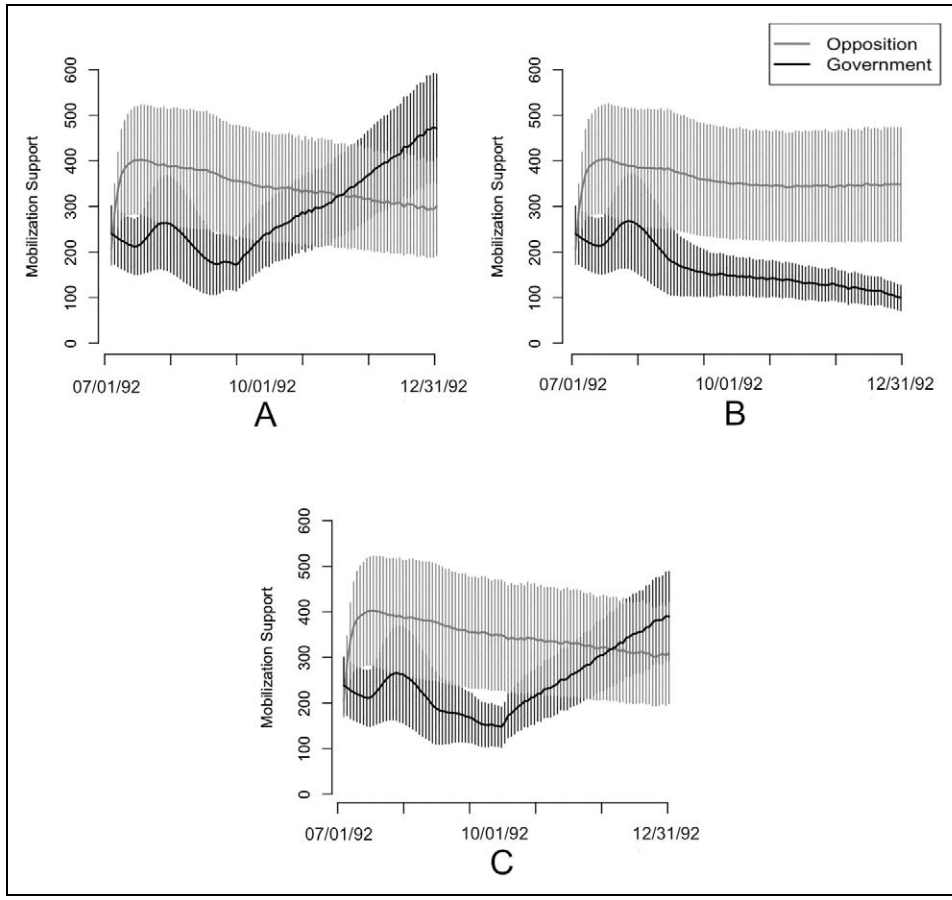

Figure 4. Movement supporters in Scenario 1's mobilization outcomes. The mean (solid lines) and one standard deviation (shaded areas) results for movement supporters are shown.

slight decline in the movement members in most provinces. Eventually, the Neo-Communists (i.e., the government) are able to reassert themselves and bring supporters to their cause. The main parameter tested is fundingBoost, which is a variable that regulates how much resource funding is given to a movement by external powers (i.e., Russia and Uzbekistan). Values used for this input are notional and intended to represent qualitative utility rather than an exact quantity. Resources in this case represent material goods that are used to benefit recruiting and retention of movement members. In the model, resources from outside powers are received recurrently each time after the resources are initially given (see the fundingDelay variable), which in this case occurs at tick 800 or slightly before halfway through the simulation, and when mobilization recruiting is occurring. We know by October or November 1992, the Neo-Communists became more successful in recruiting individuals to their cause, and the timing of when resources were received was critical to when the Neo-Communists were able to reassert their authority through effective mobilization. The subscenario shows that as the government receives external resources, it is then able to reverse the decline in movement membership and use resources to recruit new individuals to its cause. Therefore, at the fundingBoost level demonstrated in Subscenario A, the Neo-Communists are able to overcome the initial advantages and mobilization success of the Islamic-Democratic alliance.

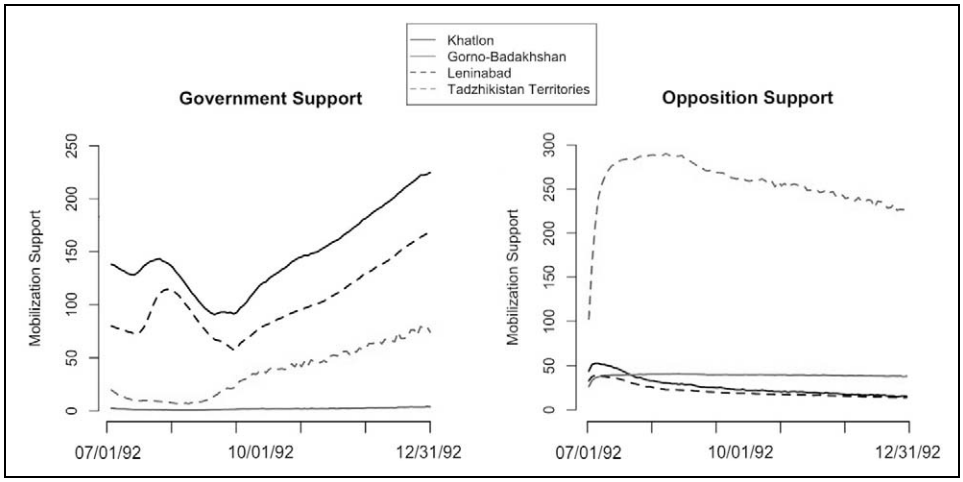

Figure 5. Mean results showing province-level mobilization support in Subscenario A in Scenario 1.

Subscenario B tests what happens when external resources are not available to the government movement (i.e., fundingBoost= 0 for the government). The result in this case shows that support for the government movement declines, as the government fails to retain supportive individuals and is unable to recover in a similar manner to the previous subscenario. This suggests that the government would likely fail to attract members to it without resources given by outside powers. In Subscenario C, the government is given external resources at a level of 50 units when tick = 1,000 or greater, which results in increased support in the second half of simulations similar to Subscenario B. However, support is generally at a lower level than Subscenario A, despite the greater level of external support in Subscenario C, and increased support occurs at a later time for the government, reflecting the effect of the delay in external resource support. Timing of when support is received, in essence, seems to be critical in enabling the Neo-Communists to be successful, as they are unable to recruit as many individuals as Subscenario A when external resources are provided at a later date.

Resources, in this case, are used to reward individuals; with more resources a movement can better reward and benefit individuals. This increases the valence of individuals toward the movement who then are able to influence their social network contacts and attract others around them in different provinces. The results of the subscenarios show that resource assistance to the Neo-Communists from external powers are sufficient at lower levels; however, relative success in mobilizing individuals to a movement is partially dependent on the timing of when resources are received. If RMT is a reasonable explanation for some of the processes that affected Tajikistan in the late half of 1992, then results from this scenario show how this theory could have affected the situation. We know that the Neo-Communists seemed to have collapsed by late summer of 1992; however, they were able to reassert themselves and attract people to their cause by December 1992, in large part based on assistance provided by Russia and Uzbekistan (Jonson, 2006; Kılavuz, 2009). In conditions where external support for the Neo-Communists is absent, there is a possibility for the Islamic-Democratic movement to be relatively more successful than the Neo-Communists in mobilization.

Scenario 2: Kyrgyzstan's Tulip Revolution

This scenario has two Movement instances (i.e., a government and opposition instances); the results are shown in . This 1,000-tick scenario represents approximately 1 month, covering mid-March 2005 to mid-April 2005. All subscenarios modeled 1,077 agents. In this case, we ask how does the identity

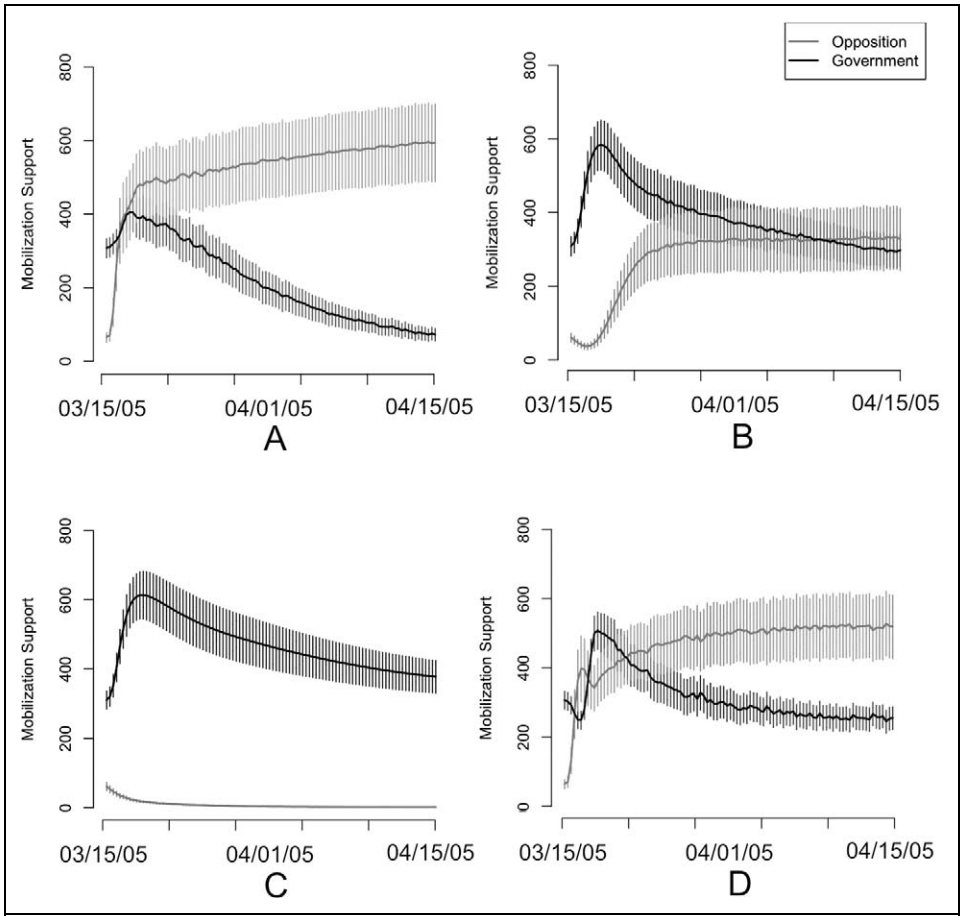

Figure 6. The mean (solid line) and one standard deviation (shaded area) results for movement supporters in Scenario 2.

variable affects people's affinity to one of the movements? The identity variable represents social traits (e.g., ethnic, religious, or other) such as those discussed in CT, whereby cultural commonalities serve to unite people in common causes. Because people may choose to side with those individuals with whom they feel closest to, then a greater value of identity should bring people of common identity together. In fact, even though resources for the government are far greater (initialFunding at 600 for the government vs. 100 for the opposition), in some scenarios, the opposition is able to overcome these resource shortfalls through a strong group identity. As with the previous scenario, identity and resource values represent notional concepts that relate to relative strengths of each variable in affecting modeled behaviors.

In Subscenario A (Figure 6), where the results appear more similar to the support levels observed in the historical case, relatively greater identity values allow the opposition to recruit successfully, while the lack of strong identity lead to a decrease of membership for the government side, despite the strong resource advantage it has. Interestingly, in Subscenario A, as Figure 7 shows, although the province of Bishkek loses many government supporters, the opposition does not aggregate these individuals. For this case, much of the opposition derives from the other provinces, while Bishkek stays neutral. This is primarily because individuals from Bishkek neither have an identity that

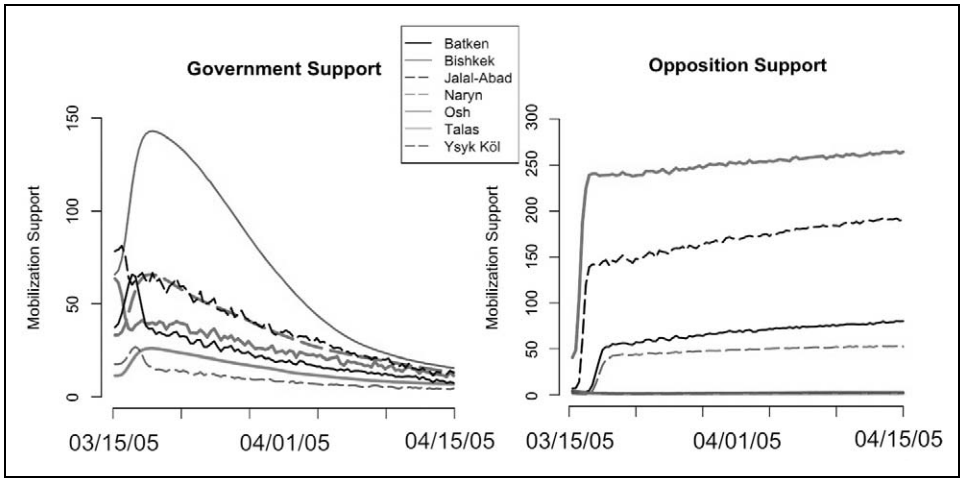

Figure 7. Mean value results shown for province-level support in Subscenario A in Scenario 2.

supports the opposition, nor do they have strong enough identity to continue to support the government as it loses ground to the opposition. What is interesting to note is that the province of Batken, which also largely supports the opposition, does not begin to support the opposition at a relatively high level until a short time after Osh, indicating how the influence of a stronger opposition in Osh and Jalal-Abad spread into surrounding regions such as Batken. Here, the imitationFactor and spatialInfluence variables, set at 0.35 and 0.1, respectively, play a role in affecting individuals' choices to support the opposition. Like other variables, values represent the relative strengths of these inputs in modeled behaviors. In essence, the imitationFactor and spatialInfluence parameters allow social influences based on social relationships, spatial proximity, and idea diffusion to affect alignment of other individuals, albeit in a delayed process.

In Subscenario B, a decrease in identity for the opposition not only decreases the recruits, but the pace at which the recruits are brought into the opposition is also more gradual. In contrast, the government continues to lose supporters but at a much slower pace after an increase in Bishkek identification. For Subscenario C, the level of identity for the opposition is such that the movement quickly collapses with members defecting, and there is no success in recruiting. This highlights the role that identity plays in movement cohesion, whereby a weak identity could lead to the failure of a movement to effectively mobilize. Subscenario D essentially applies the same parameters as Subscenario A; however, the key difference is that the strategy of recruitment for the government is to only reward people who support it (i.e., the *none* setting in the strategy parameter in Table 1) and not those who are neutral to it. Although comparable results to Subscenario A occur for the opposition, the government is able to retain more supporters relative to Subscenario A's results. This is mainly because fewer resources are divided and given in the rewards process; therefore, individuals who are rewarded are able to get greater benefits, increasing their alignment with the government. These results suggest a strategy of limiting who gets rewarded may, in fact, be better for a movement, particularly if other factors such as identity are relatively weak. Results from the scenario also demonstrate that strong identity and group cohesion enable a movement to overcome what might seem to be significant resource advantages held by a movement's opponents. The government's resources and its own abilities to be cohesive are not sufficient relative to the cohesiveness and attractiveness of the opposition. This helps to explain why the Kyrgyz opposition may have succeeded in overthrowing the government in 2005 despite the fact that the government held greater resources for mobilization (Otunbayeva, 2005; Radnitz, 2006).

Scenario 3: The Andijan Events in Uzbekistan

This scenario only has one Movement class instance, the opposition, as they clearly attempted to mobilize while the government in this case mostly repressed the opposition; no evidence indicates the government mobilized supporters so we specifically focus on the opposition supporters. The scenario lasts 1,000 ticks and covers the month of May 2005. In total, there are 2,179 agents modeled. In the previous cases, governments did try to suppress opposition movements, but in those cases there seems to have been active attempts to mobilize the governments' civilian supporters, and the governments were far weaker militarily. The main variables tested in this scenario include punishmentFactor, alignmentBand, and alignmentAdjust. For this case, we ask at what levels do resources need to be applied in order to suppress a movement and how does perceived risk by individuals affect mobilization?

Results for this scenario are shown in Figures 8 and 9. In Subscenario A, although the opposition is able to increase initial support largely due to strong identity values, shortly after tick 200 the opposition rapidly sheds members. The punishmentFactor variable, which represents how much individuals are punished if they belong to a movement or potentially if they are neutral, prevents individuals from joining the opposition even though many people initially have relatively high values of support for the opposition. Essentially, punishment increases the government's ability to discourage support for the opposition and decreases political opportunities for others as advanced in PPT, which is what appears to have happened in Uzbekistan during 2005 (Ilkhamov, 2006). As before, punishment represents a qualitative level that significantly affects model outcomes.

Figure 9 shows the province level results for Subscenario A. The effects of both social network influences (imitationFactor = 0.3) and spatial proximity (spatialInfluence = 0.1) allow the spread of the movement to other provinces in the early stages of simulations, although at a slightly delayed rate than some of the provinces where the opposition has greater initial support; the movement later loses support in all the provinces due to punishmentFactor's effects.

In Subscenario B, punishment is diminished to 1.0, leading to an increase in supporters for the opposition throughout the simulations, but this level of support stays nearly constant at around tick 300 and until the end of simulations. This indicates that decrease in punishment does not lead to a large increase in recruits for the opposition. Some other factors are needed in order for the opposition to have potential success and overcome levels of punishment. The result of this subscenario leads us to Subscenarios C and D that test how alignment shifts occur relative to perceived costs and benefits of joining a movement. In assessing the costs and benefits in the mobilization model, agents adjust alignments at rates that are regulated by the alignmentBand and alignmentAdjust variables, as discussed previously. In Subscenario C, fewer alignment bands, and therefore a greater range per band, and a greater value in alignmentAdjust lead to more recruits joining the opposition. These values allow agents to find individuals that are in a different band, either lower or higher, and then adjust to that band based on greater perceived benefits received by the agents in that band. This entails greater alignment changes as agents react to those who have greater benefits. In essence, the alignment band changes in this subscenario and the decline in punishment reflect concepts from PPT, where decline in punishment and an ability to see greater benefits to a movement indicate an increased awareness of political opportunities. Grievances against the government, as reflected by the identity variable, also assist in pushing support for the movement. In Subscenario D, with alignmentBand's value slightly lowered, agents are slightly better able to differentiate benefits in changing their alignment closer toward another band, with more recruits joining the opposition as more agents are able to perceive benefits to joining the opposition. This demonstrates that not only is identity a potentially important factor in attracting individuals to a movement but that sufficient conditions may need to exist for individuals to see greater benefits and diminished costs and risks in political opposition in order for many individuals to join a movement. In fact, the perception of

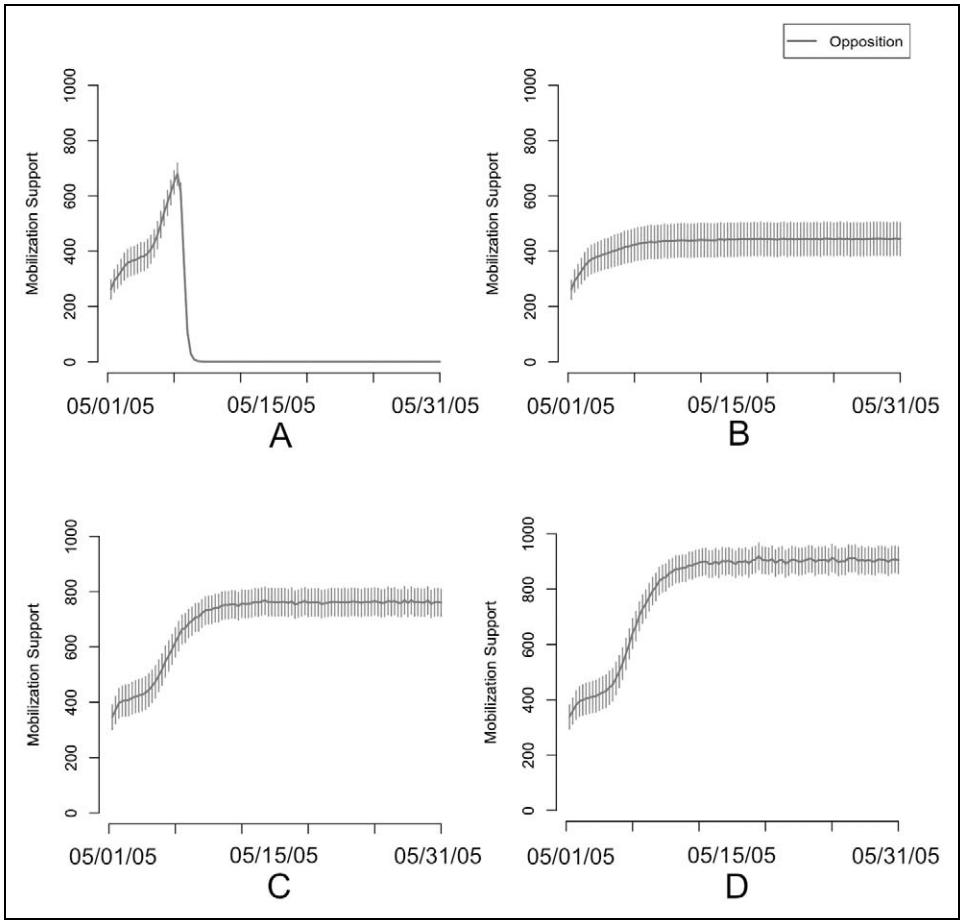

Figure 8. Mobilization results from Scenario 3 showing the mean (solid line) and one standard deviation (shaded area) results.

diminished risk relative to potential benefits may have prompted mass mobilization events such as that witnessed in the Orange Revolution, as a large segment of the population felt confident enough to protest a perceived unfair election (Kuzio, 2005, p. 125).

Discussion and Conclusion

This study presents a modeling and simulation approach that is composed of different middle-range theories applied to political mobilization. The example cases demonstrate a formal process that indicates how resources, identity, and punishment are critical concepts in determining political movement's success in mobilizing during violent conflicts. Simulation results indicate how the applied model's intent, to produce results that reflect mobilization in empirical cases and demonstrate alternative, exploratory mobilization results to better understand relevant parameters, has been achieved. Results show that in some cases, a clear resource advantage is sufficient for one movement to be more successful in mobilizing, while in other cases, strong identity fosters cohesion that enable a relatively resource poor movement to be successful. On the other hand, political movements may fail in the face of opponents that apply overwhelming resources against them that punish or

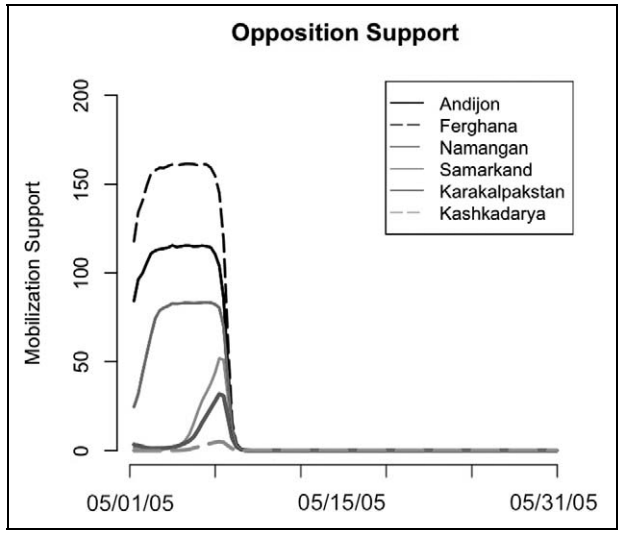

Figure 9. Province-level mobilization results for Subscenario A in Scenario 3.

discourage effective mobilizing. Conditions that enable individuals to see potential benefits relative to the costs and risks involved in joining a movement are possibly needed in order to foster mobilization success. In cases where resources and identity values are low, we see that mobilization fails to be successful for the movement. Variations of the identity and resource variables indicate their relevance to the results, showing their overall significance to modeled behaviors. The importance of resources and identity in results are similar to what has been demonstrated by others (Rowley & Moldoveanu, 2003; Stoecker, 2008) who argue that an appropriate balance and interplay between the two are critical in successful mobilization outcomes. In effect, successful mobilization is not easily achievable without both elements; however, it is possible that strengths in one of these characteristics could overcome weaknesses in the other.

For cases studied, Scenario 1 shows how RMT affects the recruitment of individuals and influences the mobilization outcome that represents circumstances in the Tajik Civil War, with outside resources being a vital reason why the Neo-Communists were able to mobilize effectively after the onset of hostilities and despite having relatively weaker cohesion and identity. In Scenario 2, results demonstrate how CT and PPT, with a focus on shared identity, could have motivated individuals to join the opposition or abandon support for the government in the Kyrgyzstan Tulip Revolution despite a strong advantage by the government in resources. Scenario 3 indicates concepts from PPT, including how political opportunities influence recruits' motivations, in relation to the massacre at Andijan. The government's ability to punish individuals was critical in influencing whether people joined or spurned the opposition. Despite effective identity that bonds individuals against the government, a strong government response suppressed the initially successful mobilization. Alternative scenarios show that if there is some reduction of punishment and people perceive that costs and risks are diminished relative to benefits in joining an opposition movement then there is an increased possibility for a movement to succeed in recruiting.

Although we believe that our simulation method has applied and integrated mainstream theoretical approaches in order to address the main research focus, further improvements can be made. For instance, considering additional cases would be possible, and probably beneficial, so long as such case studies are sufficiently related, and provide adequate information for development. Such a step would assure that the model presented here broadly represents political mobilization in diverse

sociopolitical contexts relative to those presented in this study. Nevertheless, the strength of the current method applied allows one to test theoretical concepts, data interpolations, and assumptions without necessarily having completely documented input. The developed approach is applied to empirical case studies, indicating how researchers can use such simulations to better understand the factors that shape dynamics within historical events. The value that is added by the approach is that clear cause and effect links are made that establish social processes. One is able to study input values and their effects on outcomes with theoretical grounding enforced to explain results achieved.

The utility of having multiple theories within a simulation strategy not only allows an analysis to address specific case studies but also to make larger, more general conclusions such as the research conclusions presented on the mobilization process. The incorporation of middle-range theories within simulation approaches using agent-based methodology has value for operationalizing theoretical contributions that can be used to assess and better understand mobilization dynamics in shaping conflicts. For the vast majority of historical events involving mobilization, the reality is that data are sparse or incomplete at best. However, we often do know how relatively successful movements are in recruiting individuals, allowing results to be measured relative to such understanding. The ability of applied simulations to provide a variety of plausible mobilization outcomes that reflect processes in diverse locations indicates its potential for use in forecasting future mobilization events. In light of recent violence and mobilization events in Africa and the broader Middle East, such theoretically grounded forecasting is needed to understand and explain political movement mobilization.

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