11. Model Description

I begin by showing how securitization theory can be translated into a conflict model. I then give an overview of our model with the standardized ODD-Protocol (Railsback and Grimm 2012: 37ff). This is an important tool for agent-based modellers to describe their models and to make them replicable – an important feature of any scientific work. In equation-based simulations, the equation explains exactly what is being simulated. However, as the ABM technique is rather a system of procedures than of equations, the ODD-Protocol helps us to understand what is being simulated. However, the ODD-Protocol is only thoroughly understood by scientists familiar with ABM-studies and not very reader-friendly. Therefore, the subsequent sections describe the step-by-step implementation of the theoretical assumption into the simulation model and provide some brief background information on ABM in general.

11.1. OVERVIEW AND ODD-PROTOCOL

11.1.1. Different Interpretations of One Event

As was demonstrated in the last chapter, the behaviour of state as well as non-state actors can be conceived of as securitization. In fact, they show different *securitizing moves,* but I concentrate here on one of the most important ones: the government arrests individuals who adhere to an unofficial interpretation of Islam while sympathizers of such groups either protest peacefully against or physically attack the government. I here focus on how the detention of Muslims is interpreted differently by governments and in-

dividuals respectively. I define 'arbitrary arrest' in the simulation as fol-
lows: an individual who is not a jihadist and who has not protested is ar-
rested because he is a sympathizer of unofficial Islam.

As we are concerned with conflict-behaviour it is important to note that
the securitizing move by governments is assumed to be a centralized strate-
gic decision that is taken according to the 'global' situation, and which is
executed by all security forces acting in the same way: they start to arrest
sympathizers of unofficial groups arbitrarily if they fear that unofficial Is-
lam has become too widespread. The securitizing behaviour of citizens (or
non-state actors) on the other hand is based on local information about ar-
rests: there is no strategic group-behaviour by non-state groups led by deci-
sion-makers but rather (because of the assumption that radicalization takes
place individually rather than on a group level) the agents individually de-
cide to protest against the arbitrary arrests they have observed in their im-
mediate neighbourhood.

Table 25: Securitization in the Simulation

	Government/ State Actor	**Citizens/ Non-State Actor**
Reference object	Freedom from terrorist acts	Freedom from religiously motivated arrests
Securitizing move	• Outlawing of groups • Arrests of group members	• Protest against arrests • Attacks against security
Dispositive	• Number of security forces • Reach of security forces	• For protests: sympathizers of unofficial Islam • For attacks: jihadists

11.1.2. ODD-Protocol

I rely here on the concept of the ODD-Protocol described in Railsback and Grimm (2012).

Table 26: ODD-Protocol

1. Purpose
The model represents how a vicious circle of the securitization of Islam by state and non-state agents develops. From this I want learn how state repression and Islamic radicalization reinforce each other. In particular, I hope to demonstrate how arrests of alleged terrorists can be interpreted in two different ways: on the one hand they help to maintain national security and state power but on the other they threaten human security and human rights because arbitrary arrests occur and devout sympathizers of unofficial Islamic groups are arrested as alleged 'terrorists'.   Goals of the Model: It is the goal of this study to find out how the reinforcement of mutual securitization works in theory and whether it brings about a vicious circle of conflict.   Furthermore, I want to ascertain whether the securitization of Islam by Central Asian governments explains the radicalization of Islamists in Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan
2. Entities, state variables, and scales
2. Entities, state variables, and scales   Entities   Two types of agents: State agents: • Security forces   Non-state agents/ citizens   • Non-Muslims   • Adherents of official Islam (ethnic Muslims and traditionalists)   • Adherents of unofficial Islam (undesirable and banned groups such as Sufis, modernists (corresponds to Nurcilar), fundamentalists (corresponds to Tablighi Jama'at), Islamists (corresponds to IRPT, HT), jihadists (corresponds to IMU and IJU)

Behavioural Strategies:

- Security forces aim to eliminate jihadists by means of justified arrests; furthermore they want to deter other citizens from becoming sympathizers of unofficial Islam by arresting them arbitrarily.

- Jihadists: aim to eliminate security forces by attacking them directly; furthermore they try to provoke a disproportionate response from the security forces by attacking citizens (in order to galvanize their co-citizens)

- Objective of all citizens: Maximum religious freedom (absence of religiously motivated arrests) and maximum physical security (absence of attacks)

Attributes

State agents own:

- Range (of security forces) (estimation; value: radius of 1. 2 grid cells)

- Context-legitimacy (describes the legitimacy a state derives from contextual factors such as its good governance and socio-economic situation) (based on empirical data; range: 0 – 10, lower means less legitimacy)

- Political Terror Scale (PTS); describes the extent of human rights abuses by the state) (based on the empirical data presented in Table 19: 1 – 5, lower means fewer human rights abuses)

Citizens' own:

- Neighbourhood (estimation; value: radius of one grid cell)

- Detention-time: different for detained 'terrorists' and for protestors) (estimation; range: 40 – 180 time steps, 40 for detained protestors, 180 for detained 'terrorists')

- Arrested (counts how many times an agent was arrested)

- Participated-in-protest (counts how many times an agent participated in a protest)

- Protest-time (describes how long an agent participates in a protest)

- Prison-term (describes how long an agent has been in prison)

- Hit (describes if an agent is hit by a terrorist attack)

- Religiosity (describes how easily the population is proselytized; range: 1/1,000 – 1/100)

Temporal and spacial scale:

300 time steps (ticks) are simulated. I assume that one tick is one month or 12 ticks are one year, respectively. (As it is the goal to simulate the time since the independence of the Central Asian states up until today, this means I simulate 25 years.)

The model is spacially explicit (but not geo-referenced): the agents meet in a simulated world in order to exchange information and influence each other. Security forces have global information and local ability to act and citizens have local information as well as a local cruising radius.

3. Process overview and scheduling

Within each time step, the following processes are run, in the given order, by the agents referred to in parentheses. Agents perform their tasks in a randomized order; state variables are updated immediately.

Processes

- Move (all agents): all agents move randomly (if they are not arrested or protesting)
- Proselytize (sympathizers of unofficial Islam): proselytize ethnic Muslims to become a sympathizer of their own group (the lower the context-legitimacy of the state, the easier it is to proselytize them)
- Arrest and arrest-protestors (security forces): searches and arrests jihadists and protestors as well as arrests sympathizers of unofficial Islam (if their number is more than 0.1% of the total population) for prison-term
- Protest (sympathizers of unofficial Islam): they protest if they witness the detention of an agent of his own group during protest-time
- Attack (jihadists): jihadists look for opportunities to attack security forces; if they are next to a member of the security personnel they have such an opportunity – all immediate neighbours are hit
- Radicalize (sympathizers of unofficial Islam): peaceful individuals who are arrested arbitrarily as well as protestors who are arrested because they occasionally participated in a protest are radicalized in prison and become jihadists when released (the more they are exposed to human rights violations in prison the more prone they are to radicalization (one in ten detainees would be radicalized if no human rights abuses occurred. The political terror scale is used as a multiplying factor for this assumption (the higher PTS, the more probable the radicalization: 0.1 – 1.0).

4. Design Concepts	
4a) Basic principles	Concepts, Theories and Hypotheses: The processes in the model implement findings from our case studies and theoretical considerations from securitization theory. • Case studies: the general revival of Islam is illustrated with the *Proselytize* procedure; the *Attack* procedure describes acts of terrorism; the banning of Islamic groups and the persecution of their sympathizers is illustrated with the *Arrest* procedure • Securitization theory: the theory explains how *Proselytize* and *Arrest* procedures justify the behaviour of the opponent and thereby fan the flames of the vicious conflict circle • CLD (see section 10.3.2) shows the conflict assumptions with the corresponding influences and feedback loops (integration of case studies and securitization theory)
4b) Emergence	Results and Outputs: The model is meant to represent the first step in the revival of Islam. Following this, the mutual escalation of securitization and violence by state and non-state actors should emerge.
4c) Adaptation	The model does not include adaptations.
4d) Objectives	No
4e) Learning	No
4f) Prediction	No
4g) Sensing	Citizens are fully informed of the attributes of their neighbours. Security forces have global knowledge of all other agents.
4h) Interaction	Interaction among neighbour agents (within the radius of one grid cell) is direct; they proselytize, attack or arrest each other. These assumptions for the simulated interaction refer to real attempts at proselytization by groups who have a social utopian

	ideology, real attempts to attack security forces, the arrest and detainment of members of Islamic groups; efforts by Islamists to recruit among inmates in prison; the social power of dismissed detainees as martyrs.
4i) Stochasticity	In order not to make the model totally deterministic, one can mimic randomness and NetLogo has a built-in procedure for such pseudo-randomness.[1] The distribution of the agents on the grid when setting up the agents during the initialization is pseudo-random. The direction of the movement of the agents is also pseudo-random (the distance they cover is one grid cell). The probability for the radicalization of an agent is randomized as well.
4j) Collectives	See agent-types in (2. Entities, state variables, and scales)
4k) Observation	Graphs depict: • The development of the numbers of sympathizers of Islamic groups: the ratio of the number of jihadists vs. the number of adherents of unofficial Islam • The number of attacks and the number of arbitrary arrests With these graphs I will be able to find out: • If an escalation of arbitrary arrests (of peaceful Muslims) leads to an increase in attacks (or whether state repression leads to the radicalization of Islamists) Furthermore, I observe at what point in time the security forces start to arbitrarily arrest sympathizers of unofficial Islam (which means that they start to securitize their behaviour).

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1   „NetLogo uses a pseudorandom number generator to output a sequence of *statistically* random numbers which is then used to determine the order of agents called or whenever the appearance of non-determinism is needed." See http:// serendip.brynmawr.edu/exchange/parallelp (13.9.2014).

5. Initialization
Two initializations for every case: The initial situation represents the religious situation of the Central Asian states in the early 1990s. Same conditions for every case: • 5,000 citizens Changing conditions depending on case: • Context-legitimacy of the government • Proportion of ethnic Muslims in population • General religiosity of the society • Number, range and cruelty (PTS) of security forces • Capacities of security forces (human and financial resources) Exact data for each case are presented in *Appendix D*.
6. Input data
Empirical input data from the following sources are used in the simulation (see section 11.2.2 and Appendix C): • Security forces capacities (personnel and military expenditures) (Military Balance) • Political Terror Scale (PTS) • Context-legitimacy of government (empirical index, see Table 28) • Percentage of ethnic Muslims (empirical data, CIA World Factbook)
7. Submodels
See NetLogo Code in *Appendix B*.

11.2. SIMULATION SETUP

I work with NetLogo (Wilensky 2013) here, a simulation program especially useful for ABMs (it can be used for System Dynamics, as well, though). This program is often used by social scientists, which makes this study better replicable than if I used a less well-known program. Furthermore, the program is well understood because of its many users.

11.2.1. Agent Types

I distinguish between the terms 'agent' and 'actor'. When we speak of agent-based modelling we understand agents as "self-contained programs that can control their own actions based on their perceptions of their operating environment" (Gilbert & Troitzsch 2005: 172). Whereas an actor is an individual or a group in the real world, the term agent refers to the simulated individual or group in the computer model. As a matter of fact, there is a direct correspondence between agents and actors, which makes it easy to design the model and understand its outcome (Gilbert 2008: 14). Agents can represent single individuals as opposed to organizations and institutions or bodies such as nation-states (Gilbert 2009: 5). However, the simulated agents are always representations of the real-world actors and conclusions derived from the simulation therefore have to be carefully interpreted and one-to-one comparisons to the real world should either not be drawn or done so with caution.

In the present study individual people are simulated as agents. They exhibit features which allow them to belong to a group. The groups (security forces, official and unofficial Islam) are made up of the individuals sympathizing with them – they support the groups' goals and implement their tactics. When running the simulation, it is possible to analyze the conflict at the macro-level but one can also track the development of the groups separately at the meso-level or the behaviour of a single agent at the micro-level. The main objective of the simulation is to understand how the securitization framing by groups influences the micro-behaviour and in doing so fuels the conflict at the macro-level.

It is common that agents in ABMs have the following features at their disposal (Gilbert 2009: 21f):

- Memory
- Perception
- Performance (motion, communication, action)
- Policy (agent-rules)

In our study the agents remember what they have experienced, for example when they were either arrested or participated in a protest: they have a *memory*. The agents have *perceptions* concerning their environment and

what happens around them. This means they behave according to their memory, perceptions and also according to their groups' features. The agents move and interact (they proselytize, mobilize for protest, attack or arrest each other). The following agent-types are regarded as essential to simulate the revival and securitization of Islam in Central Asia. (They are called 'breed' in NetLogo language.)

- *Non-state actors*: Citizens are represented as 'ethnic Muslims' or non-Muslims. All of them are interested in living in a peaceful and free environment. Those who are devout and belong to a particular group (as defined in chapter 4: Sufis, modernists, quietist salafis or political salafis) are grouped together as sympathizers of unofficial Islam (there is no 'membership' and no such 'group'). They proselytize their co-citizens and have a special interest in the maintaining the freedom of religion. The term 'sympathizers of official Islam' summarizes individuals who are not religious but 'ethnic Muslims' and desirable devout Muslims who follow the official-traditional interpretation of Islam (here called 'traditionalists'). Furthermore, there are jihadists who fight against the government because they want to establish a caliphate with violent means; whereas the main goal of devout Muslims is to proselytize and to show their solidarity with detained sympathizers of unofficial Islam, the main task of jihadists is to attack security forces.
- *State actor*: The government (state actor) is represented in the simulation by the security forces and their specific capacities. Their task is to maintain law and order which they can do more successfully if they have sufficient resources.

11.2.2. Initial Values and Data for Validation

I base my simulation model on empirical data as well as on estimated initial values and parameters and validate the simulation results with additional empirical data. I thereby rely on the following data:

Table 27: Application of Data for Simulation Model

	State Violence	**Non-State Violence**
Empirical input data used for the simulation	• Security forces capacities (personnel and military expenditures) (Military Balance) • Political Terror Scale (PTS)	• Context-legitimacy of government (empirical index, see section 11.3.2) • Percentage of ethnic Muslims (empirical data, CIA World Factbook)
Simulation parameters determined by the author	• 'Reach' of security forces (estimation, same for all cases) • Average arrest-time for alleged terrorists and protestors (estimation, same for all cases)	• Religiosity of the society (estimation based on ARDA reports)
Simulation results	• Arbitrary arrests	• Number of attacks • Number of former peaceful protestors who become jihadists
Empirical data used for the validation of the simulation results	• Religious persecution index (ARDA) • Estimation of detainees on religious grounds (interview with Ponomarev, Memorial)	• Suicide attacks (GTD)

The context-legitimacy-parameter is used for simulating the promptness of the revival of Islam in the specific cases. I have developed a context-legitimacy-parameter which is composed of Gini-Index, HDI, Democracy Index, as well as of a ranking concerning freedom of the press (for more information on these measures see chapter 6). This empirically based parameter is composed of the following rankings and indices which were streched

and/or rounded to a scale ranging from 0 to 10, where lower means less legitimacy:

Table 28: Calculation of Context-Legitimacy

	Kazakhstan	**Kyrgyzstan**	**Tajikistan**	**Uzbekistan**
GINI Family income (index)	7	7	7	6
HDI (index)	7	6	6	7
political rights und civil liberties (index)	2	3	1	0
Freedom of the press (ranking)	1	4	3	1
Subtotal	17	20	17	14
Context-legitimacy	**4.25**	**5.00**	**4.25**	**3.5**

In the next table the initial values (calculated for a total population of 5,000) for the simulation of the four cases are presented. For an overview of all initial values and parameters used for the representation of all cases see *Appendix C*.

Table 29: Initial Values for Simulation

	Kazakhstan	**Kyrgyzstan**	**Tajikistan**	**Uzbekistan**
Security forces	22.5	17	10	15
Non-Muslims	1,500	1,250	300	350
Ethnic-Muslims	3,500	3,750	4,700	4,650
Religiosity of society	1/1,000	1/1,000	1/100	1/100
Jihadists	1	1	1	1

11.2.3. Interactions

When agents interact, they can communicate and subsequently act on the basis of what they learn from these messages (Gilbert 2009: 5). Messages can represent spoken dialogue, pure information flow or the monitoring of other agents. Information "is collected and processed at the agent level and transmitted through interaction structures that are endogenous" (Epstein 2006: 17). In the present study, the *information* agents receive through *interactions* with other agents and by *monitoring* other agents influences their attitude. Depending on the messages they get from others, and on their present condition, they begin (or cease) their participation in the conflict.

Table 30: Interactions of Agents

Icon in simulation	Acting Agent	Adaptive Agent/ Condition	Procedure Name
	sympathizers of unofficial Islam	ethnic Muslims	proselytize
	sympathizers of unofficial Islam	arrest of other sympathizers of unofficial Islam in neighbourhood	protest
	jihadists	security forces	attack
	security forces	jihadists, protestors	arrest arrest-protestors
	security forces	sympathizers of unofficial Islam, if > than 0.1 % of total population	arrest

11.2.4. Space and Movement

As in the social world, agents come into contact with their fellow citizens. Therefore, all agents (independently of their 'breed') move in a random way on the grid (which contains 71x71 'patches' and 'wraps' horizontally and vertically). This holds true except for those who have been detained or are protesting – they stand still.

The simulated environment is a very abstract representation of the actual physical or ideological landscape of a state. Agents are randomly set up in this graphic world, and they meet randomly. Although it would be not be difficult to let agents of one group stay closer together than to other groups I consider it important in our specific case to let them mix because none of these groups are totally isolated from one another. Those groups who do not have a social utopian ideology consist of ethnic Muslims and traditionalists while those with this ideology aim at proselytizing the others – for these reasons they do not seal themselves off to a high degree either.

11.2.5. Time

Computer simulations are categorized according to how they deal with time. In system dynamics, time is represented continuously because the models are based on differential equations. The trajectories of the outcome can be calculated on the basis of the equations. At each time step a change in the model is realized and implemented numerically.

In event based models, on the other hand, changes in the model state are initiated by events, not by regular time steps. Agent based simulations are a special case of discrete time models because they are not based on underlying equations. Instead, the model is represented directly and has an internal state produced by agent rules. I use discrete time steps for running the simulation. At each time step, the agents recalculate their states. Therefore one assumes that the agents' states are updated discretely at every time step, and therefore are synchronous. This, however, is often not the case, because a personal computer has a very limited computing power. Instead, the agents can be activated either randomly or in a sequential order (agent

A, agent B, agent C etc).[2] In our simulation the agents are selected randomly and the simulation works quasi-continuously.

11.3. SIMULATION RESULTS: REVIVAL OF ISLAM

11.3.1. Unofficial Groups Proselytize

A general trend in the religious development of the Central Asian countries is that their populations are becoming more devout. In our opinion, the phenomenon of the 'securitization of Islam' can only be understood against this background. I assume here that devout sympathizers of official and unofficial Islam compete with each other to convert their fellow citizens.

Figure 13: Different Religious Groups Compete for Influence
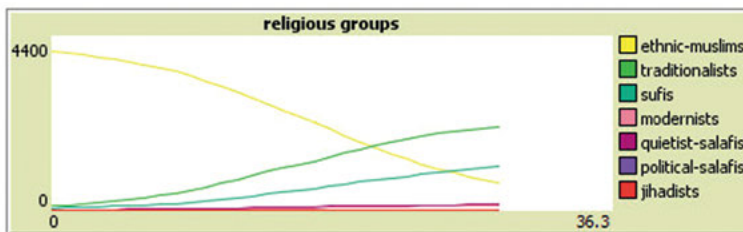

Comment: all groups of devout Muslims proselytize ethnic-Muslims (displayed in yellow in the picture above). As a result, these groups grow at the expense of the number of ethnic Muslims. In Figure 13 the revival of Islam is depicted as a competition between diverse (official and unofficial) devout groups to proselytize ethnic Muslims. However, I have learnt that for the sake of simplicity it is better to group together all unofficial groups under the umbrella term 'unofficial Islam' as the simulation would otherwise become too complex and its explanatory power would be diminished.

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2   Another possibility is to simulate a synchronous execution by selecting them randomly, but executing their new state only in the next time step (Gilbert 2009: 28ff).

As a consequence, I work with the very simple assumption that unofficial Islam is gaining more and more members (due to the proselytizing efforts of the diverse groups summarized under this term), as is exemplified in the following graph:

Figure 14: Unofficial Islam Supercedes Official Islam
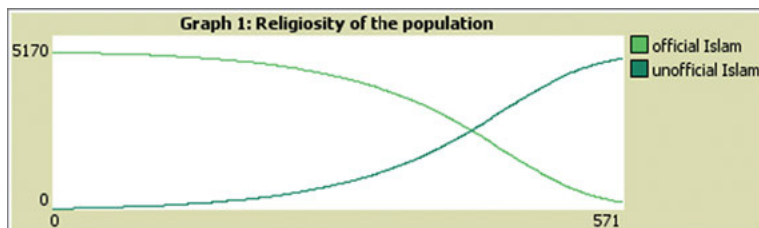
I interpret this to mean that official Islam (numbers of ethnic Muslims and traditionalists) is losing sympathizers to the unofficial proselytizing groups.

11.3.2. Influence of Context-Legitimacy on Revival of Islam

It is easier for devout Muslims to proselytize their co-citizens if the overall legitimacy of the state is low. As we have seen in section1.2, and as has been shown by many scientists, a poor economic-situation, the lack of opportunities for political participation combined with high levels of inequality have helped foster the dissemination of radical Islamic thought. The parameter for context-legitimacy presented in the next table (and introduced in Table 28) has an effect on the speed of the revival of Islam.

Table 31: Context-Legitimacy (Simulation Parameter)

	Kazakhstan	**Kyrgyzstan**	**Tajikistan**	**Uzbekistan**
Context-legitimacy	4.25	5.00	4.25	3.5

11.4. THREATENED REFERENCE OBJECTS

As has already been demonstrated, state and non-state actors refer to different objects in the conflict. The primary implication for the simulation is that proselytizing and the arrest of alleged terrorists are interpreted differently. We now present how state and non-state actors regard their reference object as threatened – a prerequisite to start their securitizting behaviour.

11.4.1. Maintaining Law and Order: Arrests

The government fears not only the danger of terrorist attacks toppling the regime but also the prospect of political Islam gaining a critical majority. It is therefore the main task of the security forces to maintain 'law and order' in each respective country. Jihadists who want to establish an Islamic caliphate by attacking security forces as well as individuals solidarizing with (or protesting for) them are arrested (the latter for abetment). A terrorist attack in the simulation represents a suicide attack. Solidarity with arrested agents is represented as 'peaceful protest'.

The capacity of each state's respective security force to arrest citizens depends on their resources (personnel and financial resources). In the simulation the security forces' capacities are assessed by multiplying the number of military and police personnel by the per capita military expenditure of the state. As we see, the countries' security capacities are very diverse: The relevant parameters for simulation are presented in the next table.

Table 32: Capacities of Security Forces (Simulation Parameter)

	Kazakhstan	**Kyrgyzstan**	**Tajikistan**	**Uzbekistan**
Capacities of Security forces[3]	35	11	4	19

3   Corresponds to the number of security personnel (Military Balance 2012) per 5,000 population, multiplied by the per capita military spending (Military Balance 2012) and divided by 100.

11.4.2. Protecting Freedom of Religion:
Peaceful Protests Against Arrests

Devout Muslims have the human right to worship. Agents identify with similar agents in their direct neighbourhood and share information with them. Because their reference object (freedom of religion) is threatened, if individuals of the unofficial Islamic groups discover that one of their colleagues has been arrested, he or she expresses solidarity with the arrested individual and shows this by 'protesting' against the arrest.

Behaviour-assumption:

•   Sympathizers of unofficial Islam disagree with the detention of all 'alleged terrorists' and show their solidarity with arrested co-citizens in their immediate neighbourhood

Figure 15: Arbitrary Arrests Lead to Protest
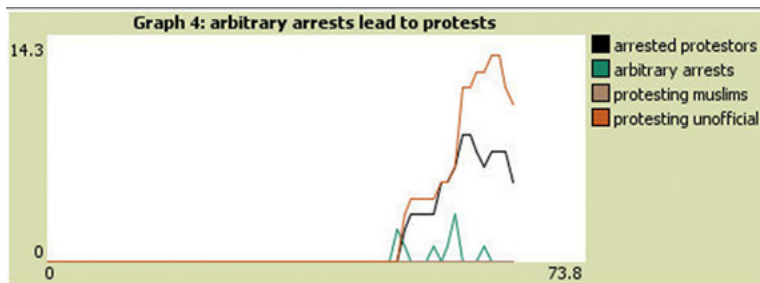
I interpret this to mean that the state loses legitimacy when an arbitrary arrest occurs resulting in a peaceful protest. The more devout Muslims are arrested, the more of them feel threatened by the state and protest against it.

Figure 16: Clouds of Protestors Gather

Legend:

▼ protestor
◄ jihadist
▲ sympathizers of unofficial Islam
▲ sympathizer of official Islam
► security forces
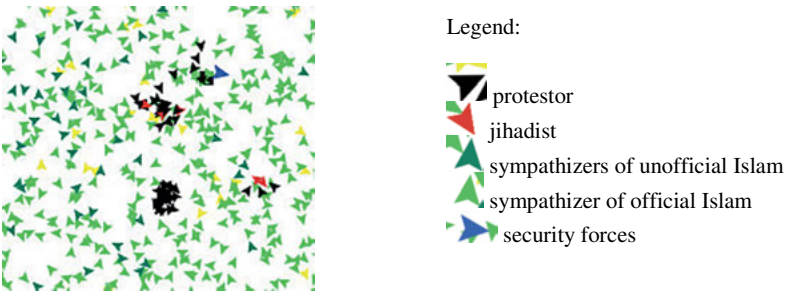
We can see in the figure above that around arrested individuals 'clouds' of protestors develop. This is the case because if any detained member of unofficial Islam is in the vicinity of another member of unofficial Islam, the latter will protest against the detention of the former. For this reason, the number of protestors rises disproportionately to the number of arbitrary detentions. We can furthermore observe how 'political Islam' (total number of individuals who have taken part in a protest on at least one occasion) comes to represent a substantial proportion of unofficial Islam.

Figure 17: Political Islam's Share of Unofficial Islam
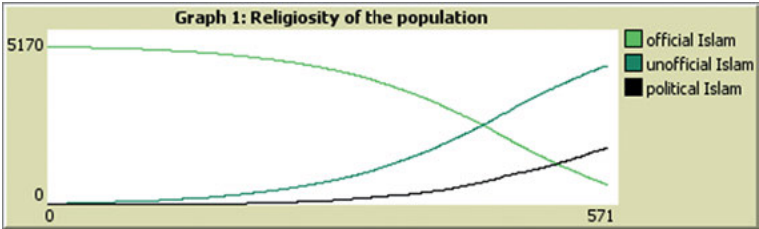
11.5. SECURITIZING MOVES

11.5.1. Detention of Sympathizers of Banned Groups

If the security forces observe many representatives of unofficial Islam, they regard them additionally to jihadists as a threat and therefore ban and arrest them.

Behaviour assumptions:

- Security agents observe Muslims who are sympathizers of unofficial groups (globally)
- If their number is more than 0.1% (assumption) they start to securitize and arrest them

11.5.2. Radicalization in Prison

If sympathizers of unofficial Islam are detained arbitrarily or because they participated in a protest, they might be radicalized in prison. If they are radicalized, they become jihadists – they securitize the protest and attack security forces when they are set free. In the following graph we see how jihadists are gaining sympathizers.

Figure 18: Radicalized Detainees Released asJjihadists

I assume that the harsher the security forces' treatment of alleged terrorists, the greater the probability that they will be radicalized in prison. One in ten detainees would be radicalized if no human rights abuses occurred. The po-

litical terror scale is used as a multiplying factor for this assumption (the higher PTS, the more probable the radicalization).

Table 33: PTS (Simulation Parameter)

	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan
PTS [4]	2.40	2.38	2.75	2.83

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4   1 – 5 (lower means fewer human rights abuses).