Syria Model Creation Process Documentation

July 2016

This is meant to be a living document, used for both internal verification and external validation of our model. Since this document will be actively updated during the model creation process, different model landscapes may be represented. Whenever specific data about a model is mentioned, we will identify the particular landscape or experiment to which it refers. Also, we will provide links whenever possible to specific external data sources as well as internal links to raw data sources and scripts.

All references to "/server/" are to the local Lustick Consulting servers.

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Landscapes

Below are the landscapes referenced in this document. When a new landscape is created, it is usually to correct some portion of the model, but most of the previous data will remain relevant.

- ID 933 - Original landscape. Discovered an error in the cartogram creation process. (POP instead of POP_2010).
- ID 935 - New model, with a small discrepancy in the way elite globalizing, corruption, and business are seeded
- ID 937 - Now using district-level night lights data, and corrected zoning punctuations.
- ID 939 - Corrected religious and ethnic seeding
- ID 941 - Corrected tribal seeding, and added landscape border
- ID 942 - We discovered an error in our “external attack” code, which is used to force attacks upon agents during the crackdown in 2011, as well as US bombing attacks in one counterfactual. Agents were mobilizing using internal rules, and being attacked externally at the same time, which caused a permanent reduction in influence. We have corrected this by adding a rule for each timestep that forces agents onto their original influence level.
- ID 943 - Added cohesion statistic

Experiments

- ID 855 - Baseline using landscape 933 (200 runs)
- ID 857 - Baseline using landscape 939 (200 runs)
- ID 865 - New punctuations (crackdown, introduction of Iranian influence, and red line crossing)
- ID 876 - Baseline of Landscape 942, after debugging of multi-zone dph level statistics.
- ID 877 - Democratic Bubble
- ID 878 - No 2013 Iranian Offensive or Hezbollah ID
- ID 879 - US Retaliation against Assad regime following chemical attacks.
- ID 880 - Strong US retaliation against Assad regime and military following chemical attacks.
- 886 - Baseline
- 898 - Baseline with Timestep 0 Seeding of FSA & JaN
- 899 - Baseline with earlier and wider seeding.
- 900 - 899 + Unified Support
- 901 - Baseline Again
- 902 - Democratic Bubble
- 903 - Weakened Extremists
- 904 - No Iran
- 905 - US Retaliation
- 906 - Strong US Retaliation

- 907 - Unified Support
- 908 - Baseline with fixed parameters.
- 909 - Unified Support
- 910 - Weakened Extremists
- 911 - US Retaliation
- 912 - Strong US Retaliation
- 913 - Democratic Bubble
- 914 - No Iran
- 915 - Baseline (for No Iran)
- 920 - Baseline for No Iran with no Hezbollah steering
- **921 - No Iran with no Hezbollah steering**
- **923 - Rerun of weak extremists with fixed parameters.**
- **924 - Baseline with fixed Cohesion metric**
- **925 - Unified Support with fixed Cohesion metric**
- **926 - US Retaliation with fixed Cohesion metric**
- **927 - Strong US Retaliation with fixed Cohesion metric**
- **928 - Democratic Bubble with fixed Cohesion metric**

Geography

The shapefile we're using of Syria is originally from the GADM database of Global Administrative Areas, and delivered to us by Lockheed Martin for the W-ICEWS-X project. The original shapefile can be found in "/server/Datasets/Shapefiles/Syria/SYR_adm". We then add in population data to that shapefile, which is from the Syrian Arab Republic's Central Bureau of Statistics (CBS), as posted on Wikipedia (https://en.wikipedia.org/wiki/Governorates_of_Syria) and City Population (http://www.citypopulation.de/Syria.html).[1] Data on cities was captured by collecting the ten largest cities according to the 2004 census and geolocating them.

Next, we build a cartogram based on the population data using Scapetoad (http://scapetoad.choros.ch). All output can be found in "/server/Datasets/Shapefiles/Syria/SyriaCartogram2". Below we show the original and cartogram versions of city locations and first and second administrative districts. Lastly, we use some Lustick Consulting developed software tools to convert the cartogram output into agents. Our current "agentsize" parameter is set to 10,000, meaning that each agent will represent about 10,000 people in Syria.[2] In the code below, we show how a user could easily change

[1] Although the 2004 figures can be found online directly from the CBS (http://www.cbssyr.sy/index-EN.htm) it's not clear how City Population acquired the 2011 data, and whether those numbers are estimates or based off of real survey data.

[2] During this verification process, we found that there was an error during the model creation process (landscape 933). We found fewer agents than expected based on the 2010 population totals. About 2.1 million people should translate into about 2147 agents, but our model only has 1807. This was because the population data used was from the 2004 rather than the more recent 2010 census. This has been updated after landscape 935.

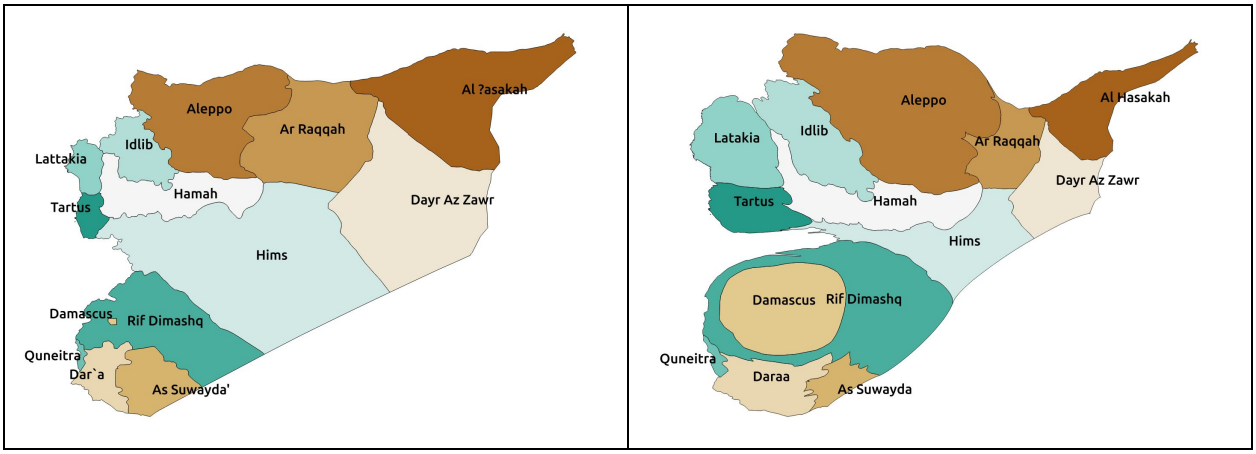
those parameters to test whether there is a significant difference when using different assumptions.

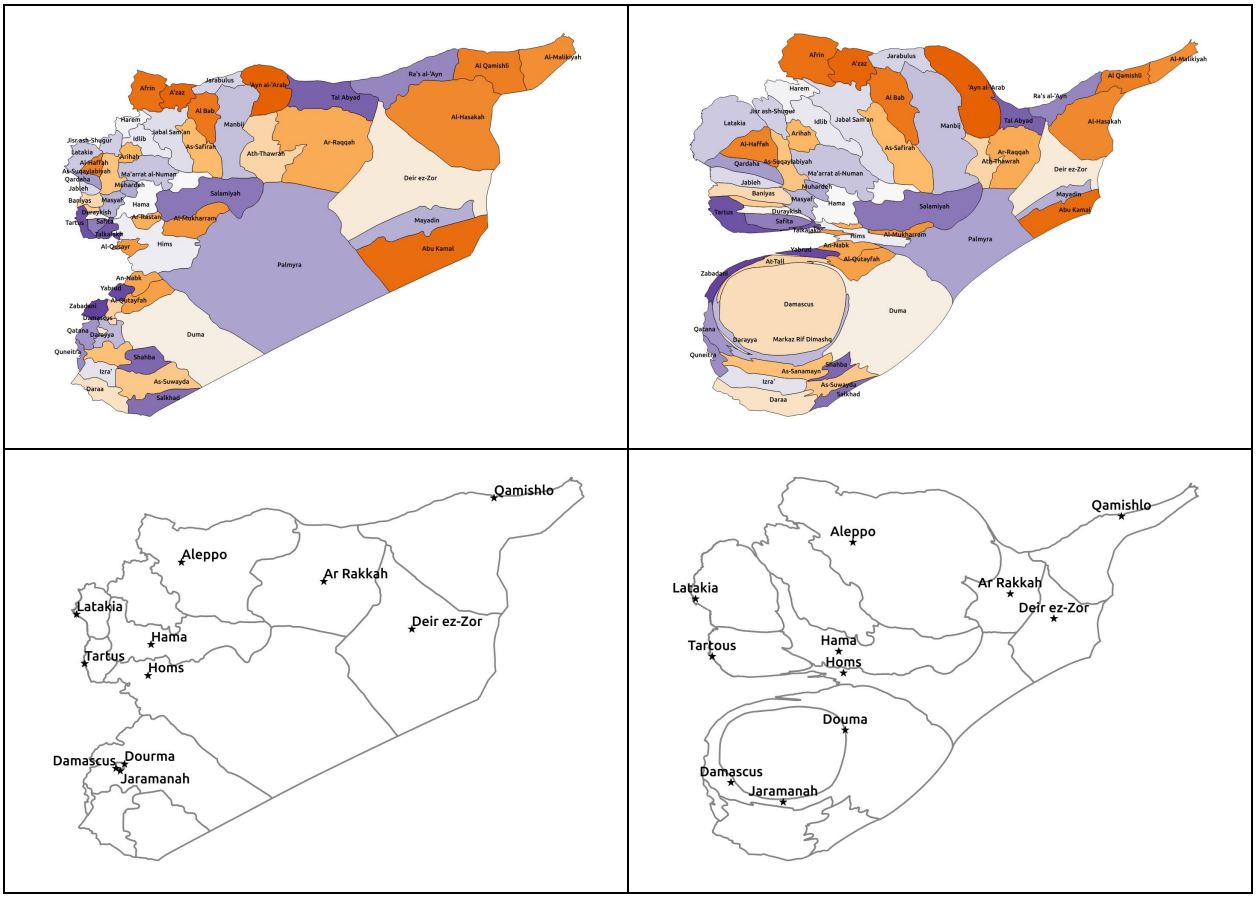
This process was carried out on June 22nd, 2016 and we do not expect it to be rerun unless errors are discovered. All output files can be found in "/server/Datasets/Shapefiles/Syria/SyriaCartogram2" and "/ExperimentationSystem/output/cartogramScripts".

Cartogram code from "/ExperimentationSystem/data/Templates/Syria_Template.py":

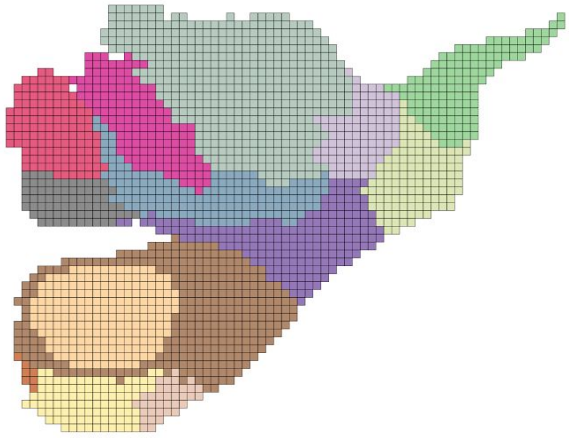
```
{'notes':'Syria Cartogram Data',   #Governorate populations from 2011 census, via Wikipedia.
 'operation':'convert_to_scripts', #City populations from 2004 census, via citypopulations.de.
 'name':'/server/Datasets/Shapefiles/Syria/SyriaCartogram2/',
 'value':'''[{"fileName":"SYR_adm1.shp", "level":"admin1", "regionName":"Governorate",
"nameCol":"NAME_1", "popCol":"POP_2010"},
            {"fileName":"SYR_adm0.shp", "level":"admin0", "regionName":"Country",
"nameCol":"NAME_ENGLI"},
            {"fileName":"SYR_adm2.shp", "level":"admin2", "regionName":"District",
"nameCol":"NAME_2"},
            {"fileName":"SYR_cities.shp", "level":"settlement", "regionName":"City",
"nameCol":"NAME"}]''',
 'options':'{"agentsize":10000, "country":"SYR", "touch":"ALL_TOUCHED=FALSE"}'
},
```

Below are some visuals showing the cartogram creation process.





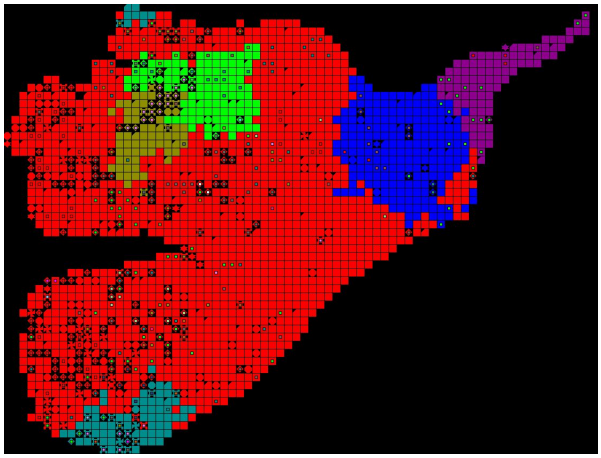
Final model output, first administrative level, including the cartogram validation output identifying the number of agents per governorate.



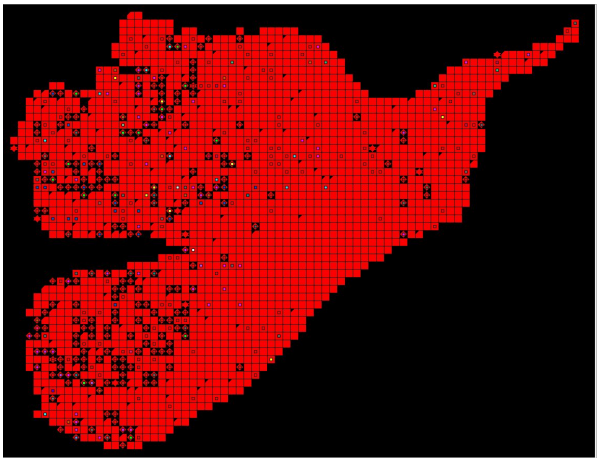

```
--- CARTOGRAM VALIDATION ---
Country Code:       SYR
Primary Object Num: 15
Primary Population: 21367134.0
Expected Agent Num: 2136
Coordinate Size:    74,56
Final Agent Number: 2146
Global Agent Error: 11.0
Absolute Error:     55.0
City 2-Qamishlo_City assigned {'admin1': 1,
'admin0': 1, 'admin2': 23}.

[['Region', 'Expected Agent Count', 'Final Agent
Count'], ['Al_Hasakah_Governorate', 127, 131],
['Aleppo_Governorate', 460, 460],
['Ar_Raqqah_Governorate', 92, 95],
['As_Suwayda_Governorate', 36, 36],
['Damascus_Governorate', 221, 205],
['Daraa_Governorate', 100, 101],
['Dayr_Az_Zawr_Governorate', 120, 120],
['Hamah_Governorate', 159, 158],
['Hims_Governorate', 176, 183],
['Idlib_Governorate', 146, 148],
['Latakia_Governorate', 128, 128],
['Quneitra_Governorate', 9, 7],
['Rif_Dimashq_Governorate', 283, 299],
['Tartus_Governorate', 79, 75]]
```

After further model analysis, another error was detected that likely doesn't come up very often, but could also be an issue in other PS-I models. Since the landscape goes all the way to the edges of the map, it appears that agents touching the side of the landscape can listen to agents on the opposite side. This phenomenon can be seen in a run where the Southern Front DPH zone moved from the Dara'a up to northern Syria. That error has been corrected by adding a border of one agent around the whole country (landscape 941).

Landscape 939



Landscape 941



Identities

Below is a short description of our standard model building process, including the types of data sources we use:

> *"Our country models are built using open-source census, election, survey, and expert input data. Survey data (from surveys such as the World Values Survey and Arab-barometer) measuring respondents' business activities, trust in the state, nationalist sentiment, view on corruption, view on the military, opinion of the United States, and level of education are all used to construct identity groups. More specifically, the percentage of people in a particular country region who respond that they have high trust in the military are endowed with the military identity in their repertoire. Data used to initialize political party identification comes from election results at the regional level, and again percentage of votes informs the number of agents in a region that should be subscribed to a particular political party identity." - Lustick Consulting Standard Model Building Process, 7/8/2015*

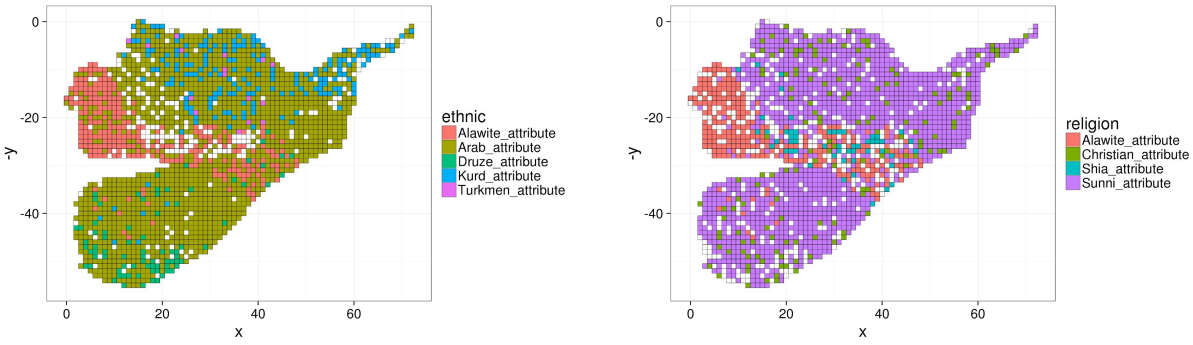
In the case of Syria, we have no data from the World Values Survey or Arab-barometer. In addition, there have been no elections with meaningful results in the past several decades. In order to approximate these measures, we have used a variety of data sources and estimates, outlined below in detail.

Ethnic/Religious

Ethnic and religious data for Syria was created via a two-step process. First, we created governorate-level estimates of all ethnic and religious groups in Syria.[3] The source for this data included the Gulf 2000 data, Wikipedia Governorate pages, and a number of online maps from sources such as http://www.acaps.org/, http://www.humanitarianresponse.info, http://sahipkiran.org/, http://www.twcenter.net/, http://www.businessinsider.com/. Next, we moved that information to our Syraq Data Matrix, at which point the values may have been edited, changed, or updated. We only included the largest groups, which came out to five ethnic groups and three religious groups. We also chose to keep Alawite as a single identity with both an ethnic and religious component.

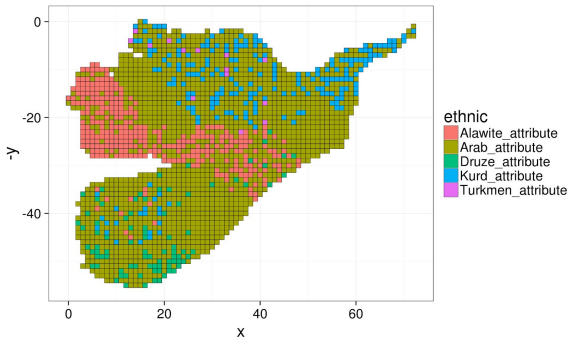
Below is the landscape-level output for Ethnic and Religious identities for landscape 935:

[3] This file can be found here: "/ExperimentationSystem/data/SyriaData/SyriaCollectedData.xlsx"

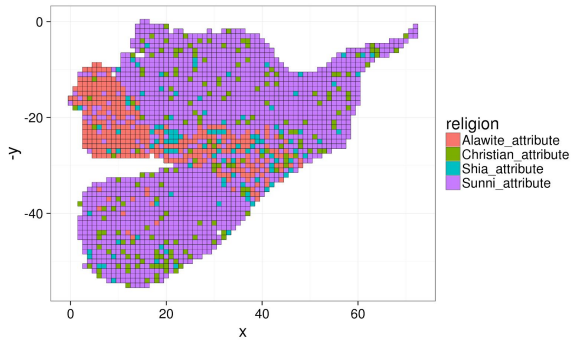


In Landscape 938, we updated the seeding for ethnic and religious identities by forcing 100% of agents to have an ethnicity, and 100% of non-Alawites to have a religion. This is for attributes only, agents are still given subscription to ethnic and religious identities based on thickness scores.

Ethnic initialization, landscape 938



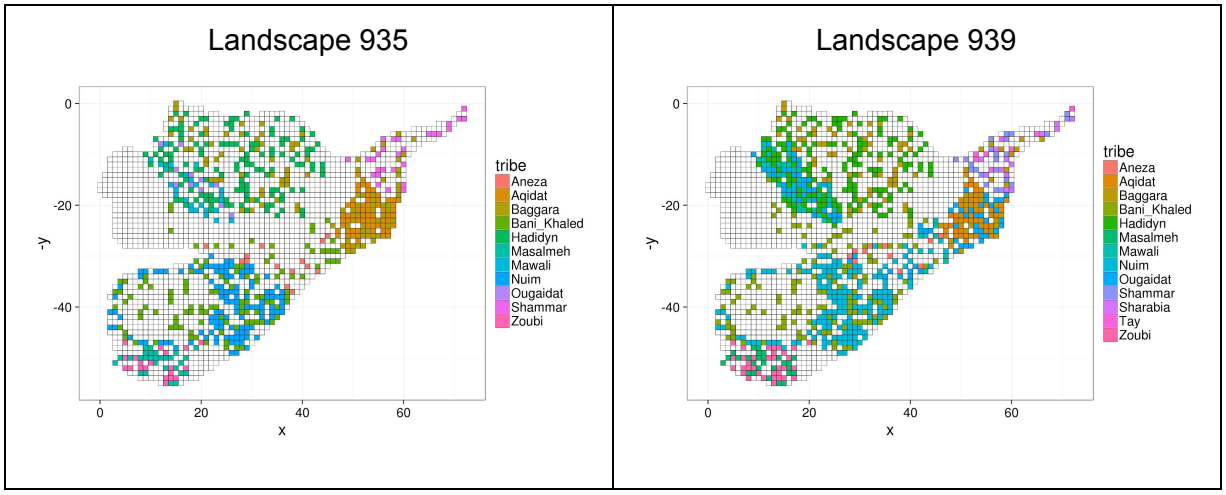
Religious initialization, landscape 938



Tribal

We currently have eleven Syrian tribes in our model. Estimates come from a number of sources, including Wikipedia, the Congressional Research Service, GlobalSecurity.org, and a number of other websites and maps online. Tribes were seeded only in agents with both the Sunni and Arab attributes. Our raw tribal estimates were doubled in order to take into account that limitation. Here is a list of our sources:

- http://www.dtic.mil/dtic/tr/fulltext/u2/a464737.pdf
- http://www.globalsecurity.org/military/world/iraq/images/tribes.jpg
- https://en.wikipedia.org/wiki/Al-Obaidi
- https://en.wikipedia.org/wiki/Dulaim
- http://www.arab-reform.net/sites/default/files/Jihadists%20and%20the%20Syrian%20Tribes%20Transient%20Hegemony%20and%20Chronic%20Dilemmas_0.pdf
- http://www.fairobserver.com/region/middle_east_north_africa/tribal-factor-syria-rebellion/
- http://www.dtic.mil/dtic/tr/fulltext/u2/a464737.pdf

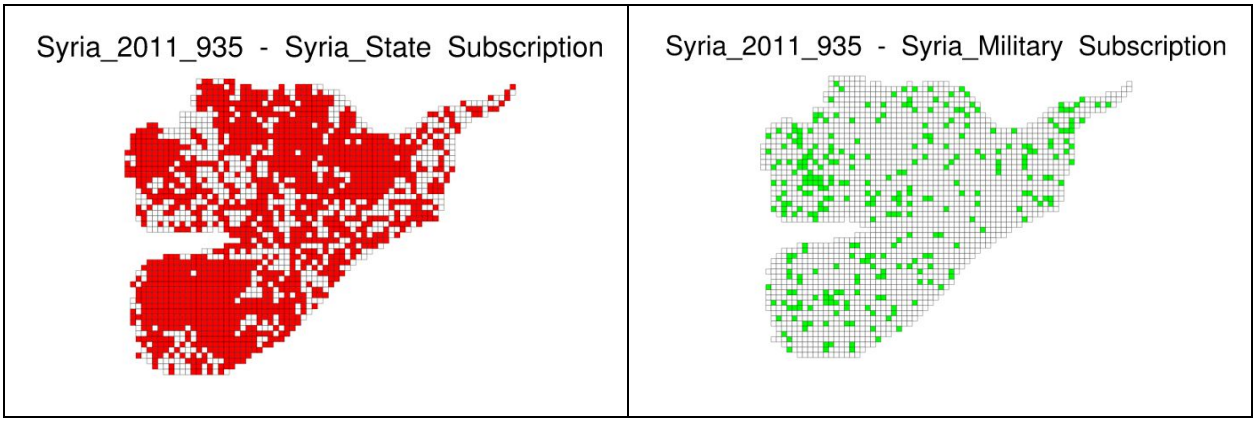


For Landscape 939 we changed the tribal seeding slightly to accommodate smaller tribes that were being washed out during calculation. The images above show the changes.

Regime (State and Military)

The Syria State and Syria Military identities were seeded using event counts from the ICEWS event data. This data was created by capturing the average proportion of events carried out by the Syrian State, including the Government sector and Bashar al-Assad actor prior to 2011-03-01 per governorate. We then doubled this number to ensure that the identity encompasses civil society as would be expected in an authoritarian country. This gives us a very rough estimate of government activity and support per governorate. We captured the same data for the Syrian Military, including the Military sector and “Military Personnel - Special (Syria)” actor.

In addition, we seeded influential with higher values of the Syria State and Syria Military identities. For model inputs, see http://lustickconsulting.com:8000/modeling/identityDiagnostic/935_Syria_State/ and http://lustickconsulting.com:8000/modeling/identityDiagnostic/935_Syria_Military/



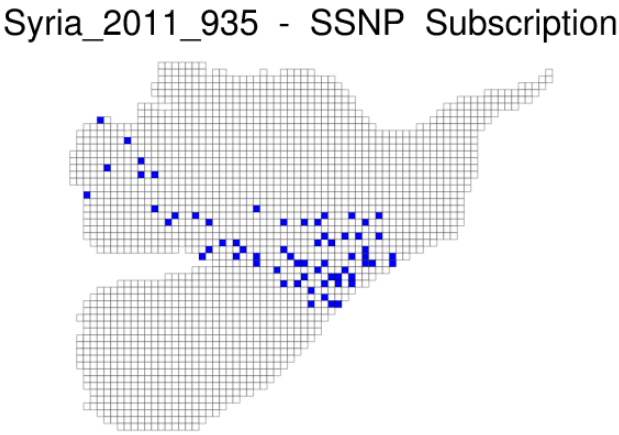
In addition to the initial seeding, the Syria State and Syria Military identities are steered over time and are also incorporated into several punctuations. And lastly, both identities have special elite network listening rules.

National Defense Forces

The National Defense Forces are pro-government militias in Syria introduced in 2012.[4] They are not initialized in the model, but are included in a punctuation script (landscape 935).

SSNP

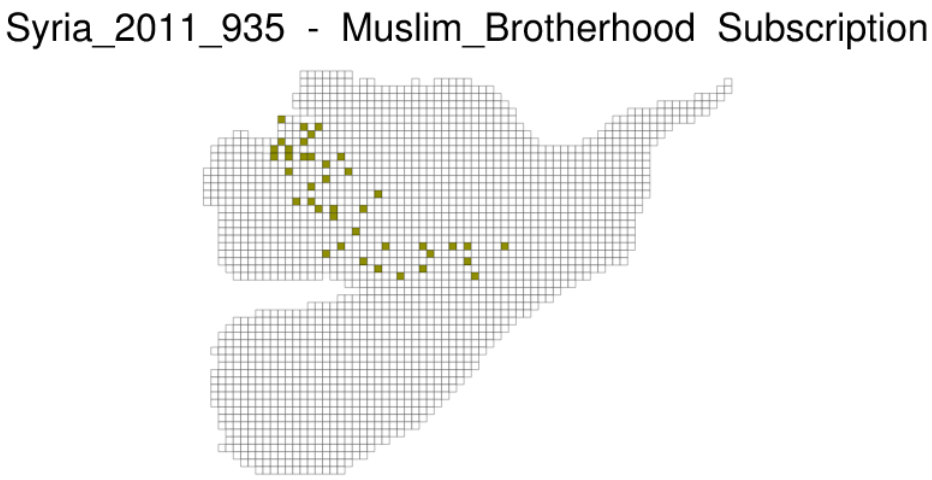
The Syrian Social Nationalist Party (SSNP) is a pro-government political party in Syria, which has become increasingly relevant.[5] Although not mentioned in his reports, our estimates for SSNP subscription come from a SME Interview with Steven Heydemann on 11/30/15.



[4] https://en.wikipedia.org/wiki/National_Defence_Forces_(Syria)
[5] https://en.wikipedia.org/wiki/Syrian_Social_Nationalist_Party

Muslim Brotherhood

We wanted to include the Muslim Brotherhood in our model even though it doesn't seem to have gained much influence since the start of the civil war.[6] Lister treats it as a significant element. Wikipedia claims MB historically had influence in Idlib and esp. Hama, but was explicitly rejected by protesters in Daraa c. 2011, which is primarily where our seeding estimates are drawn from (landscape 935).



KDP-S

The Kurdistan Democratic Party of Syria is not currently seeded in our model, but has been identified by our SME to include in the model (landscape 935). He does admit, however, that it is less powerful than other Kurdish groups like the YPG.[7]

Free Syrian Army

The Free Syrian Army was established in July of 2011 and is introduced into the model via a punctuation script. Specifically, an area around Aleppo loses the Syria State, Syria Military, and Hezbollah identities and receives the Free Syrian Army identity and zone and is made a permanent core. (The identity is not initialized.)

Southern Front

The Southern Front was established in February 2014, although it may be debatable whether a rebel zone should exist in the southern province of Dar'a prior to that date. During that month,

[6] https://en.wikipedia.org/wiki/Muslim_Brotherhood_of_Syria
[7] https://en.wikipedia.org/wiki/Kurdistan_Democratic_Party_of_Syria

the punctuation introduces both the Southern Front identity and zone and is made a permanent core. (The identity is not initialized.)

Islamic Front

The Islamic Front was established in November 2013. In a updated punctuation, the Islamic Front is now operationalized much different, but during the same timestep in November 2013. According to Lister, the Islamic Front existed in 12 of 14 governorates and consisted of 55,000 fighters. In order to operationalize that, we activated 10% of all Sunni, non-state, non-military, non-JN, non-IS agents in the whole country except for Tartus and Latakia on the Islamic Front identity, and then randomized those agents.

Al Nusra Front

Al Nusra or Jabhat Al Nusra was formed in January 2012 as an Al Qaeda in Iraq (AQI) offshoot. This identity is not initialized, but the punctuation script introduces an identity and zone to the Idlib district, creating a core region there for the new identity.

Hezbollah

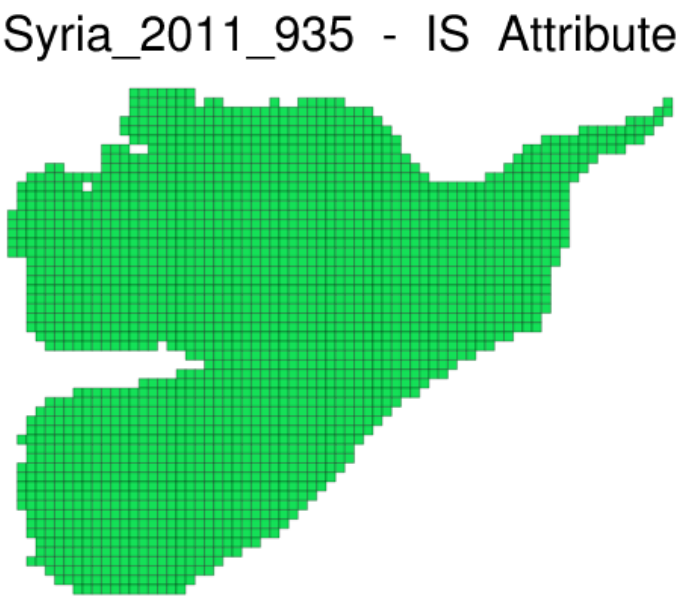
Hezbollah's active role in the Syrian conflict began around May of 2013. Our punctuation introduces the identity into all Syria State agents in Zabadani, An Nabk, and Al Qusayr districts. The punctuation also turns 10% of those agents into elites. This translates into an average of 25 points of aggregate influence during that punctuation in experiment 855. (The identity is not initialized.)

YPG

We introduce the YPG identity and DPH zone in September 2012 when the YPG officially declared war against Assad. Although this identity is not initialized, it probably should be. The associated Kurdish core is created in Qamishlo City.

Islamic State

The Islamic State zone and identity are introduced in April 2013, which is when ISIS announced a merger with Al Nusra (which was strongly declined) and the entrance into the Syrian Civil War. The identity is put into Rakkah City, which is in turn made the core of the ISIS political zone. (The identity is not initialized.)



Globalizing/Business/Corruption

The globalizing, business, and corruption identities are currently seeded quite naively according to influence levels. There was a small error in the seeding of these identities among influentials in landscape 935, but future versions will be corrected. We might consider increasing some of these identities in oil-producing regions or areas where we expect collusion between state and non-state entities. We would expect the overall sizes of these groups to be relatively small, however, so this might not be "low-hanging fruit."

We seeded 3.9% of basic agents with the globalizing identity, which is the percentage of the country's GDP that is Foreign Direct Investment.[8]

Syrian National

The Syrian National identity is tough to define, and so might be an identity we eventually drop. The idea is that people who would like to maintain Syria above other identities may identify as Syrian National. In landscape 935, 10% of basic agents are subscribed to this identity.

Poor

According to the World Bank, prior to 2010 the poverty rate was about 30%, so we seed basics at that rate of subscription (landscape 935).[9] In past models, we have sometimes reduced the influence level of those in extreme poverty, which we might consider here.

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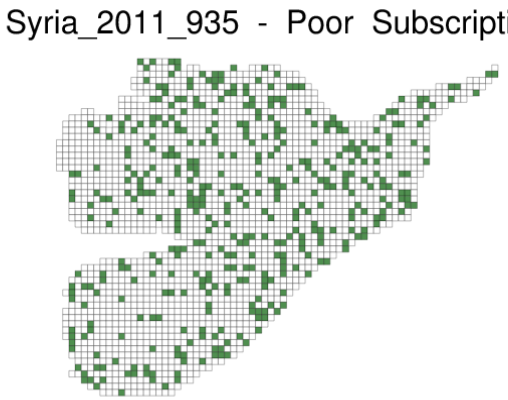
[8]

[9] http://data.worldbank.org/country/syrian-arab-republic



Thickness Seeding

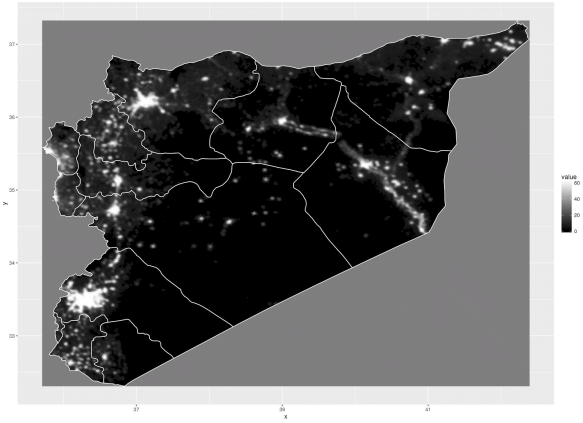
Ethnic, religious, and tribal identities in our model are seeded initially as attributes, meaning that agents have the attribute are eligible to subscribe to the identity. All agents that have the Shia attribute are eligible to subscribe to the Shia identity, and all agents with the Sunni attribute are ineligible to subscribe to the Shia identity. Once all of the ethnic, religious, and tribal identities are seeded according to our data, we subscribe a certain percentage of each group to the identity. Each of these identities is given a score based on expert input and our own research. Below we show the thickness score (10% - 100% of the agents with the attribute get the identity) for each ethnic and religious identity. All tribal groups are given a thickness of 100%.

Group Type	Group Names	Thickness Score
Ethnic	Arab	30%
	Kurd	80%
	Turkmen	70%
	Druze	80%
Religious	Sunni	40%
	Shia	70%
	Yazidi	100%
	Alawite	100%
	Christian	100%

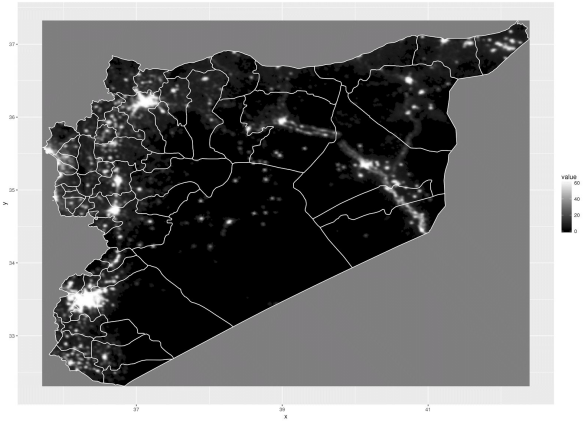
Influential Seeding

In order to seed influentials in our current model (landscape 935), we have chosen to use NOAA's Night Lights data.[10] More specifically, we are using data from the Defense Meteorological Satellite Program (DMSP) that captures cloud-free composites of the entire world at a resolution of 30 arc second grids (about 30 meters). We then capture two zonal statistic values for each governorate in the country, the log of the mean value and the percentage of the governorate that had light values above the 95th percential of the whole country. We then normalized the log of the mean to the maximum value (Damascus Governorate) and multiplied that value by a normalizing factor of .25. This leads to an average of 13% of agents becoming InfluentialA's across all governorates. We then used the 95th percentile data to seed InfluentialC's directly, but gave Damascus a manual value of .25, about standard for a capital region.

Below we show the raw night lights data and the administrative district overlay. We are currently using the first administrative districts (left) but we could choose to move to the second administrative districts to improve granularity.



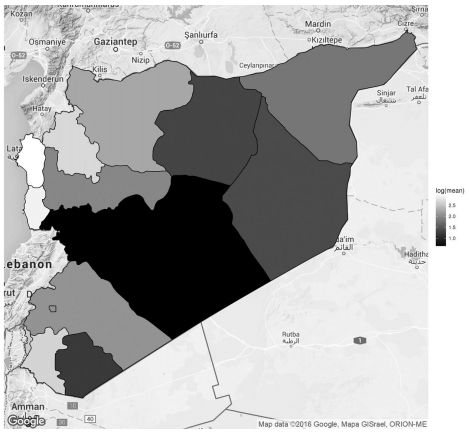
Raw night lights and first administrative level



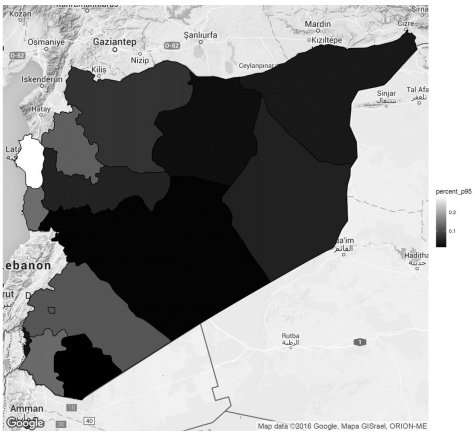
Raw night lights and second administrative level (not used)

Below we show maps of the actual values that go into our model (landscape 935). Note that while Damascus should be white in both of these images, it's small size caused problems for the usual map visualization.

[10] For more information, see http://ngdc.noaa.gov/eog/dmsp/downloadV4composites.html

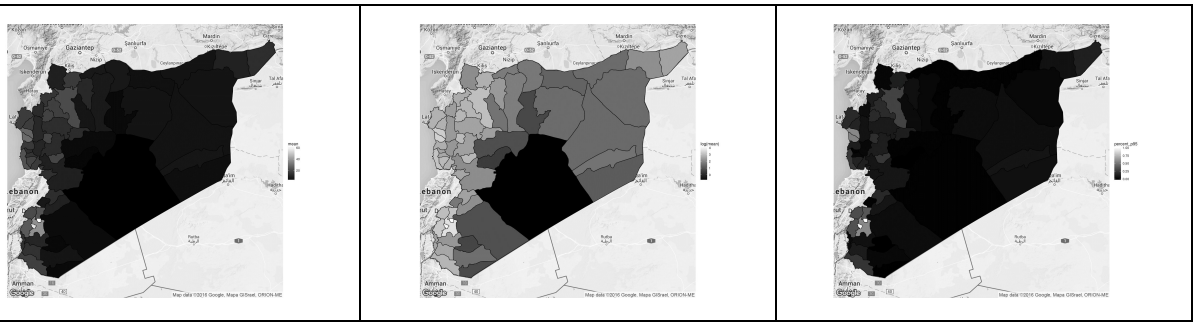


Log of mean, used for InfluentialA and InfluentialB seeding



Percentage above 95th percentile, used for InfluentialC seeding

As of landscape 937, we are using the second administrative district data (mean, log of mean, 95th percentile). See below for visualizations.



Tribal Influential Seeding (June 27th, 2016) - There may be a problem with our night lights seeding strategy above. Although this is a good proxy for urban density and economic activity, it does not help us identify where strong tribal elites networks may exist. In order to tackle this problem, we discussed taking a two-pronged approach to seeding the elite networks in our model. First, we plan to take an “outside-in” approach, using data from night lights and general research to seed elite placement in all districts in the model. The second, complementary, approach will be “inside-out”, where Ian will take Lister (and perhaps other sources) and specifically denote percentages of elites in rural areas, especially tribal regions. We will then have an opportunity to compare the two models against each other to see the differences the two operationalizations might make. This approach has not yet been used as of landscape 935.

Networks

Our model (landscape 935) includes elite listening rules for the Syria State, IS, Al Nusra Front, Islamic Front, Free Syrian Army, Southern Front, KDP-S, and YPG.

It's clear that each of those networks is directly associated with an identity. When an elite agent activates on one of those identities, then the agent switches to that network and listening to others within that network. This means that an agent's network can change over time. In addition, most elites will be initialized in the Syria State network.

Territorial Zones

In our model, authority is measured by tracking which agents have joined (or been captured by) a particular state or statelet. All of these zones are added via punctuations, and each zone receives a "core" that cannot disappear. This political authority is locally defined, fluid, and in constant competition with other zones. Agents determine their place within each zone of authority by using the Dynamic Political Hierarchy (DPH) module, which classifies identities and agents into five categories: Dominant, Incumbent, Regime, System, and Non-system. The largest identity within a zone is first labeled as *dominant*. Next *incumbents* are identified as those groups comprised predominantly of agents aligned with the dominant group via overlapping subscribed identities (affiliations included in their repertoire of identities). Put more simply, at the incumbent level are those groups that are most closely aligned with the dominant group. *Regime* groups are those aligned with incumbent groups, *system* groups are those aligned with regime groups, and *non-system* groups are not aligned with any groups within their zone of authority. Once the DPH calculation is complete, all agents are able to politically mobilize in different ways via either **lobby** (dominant/incumbent groups), **protest** (regime groups), and **violence** (dominant/system/non-system groups.)[11]

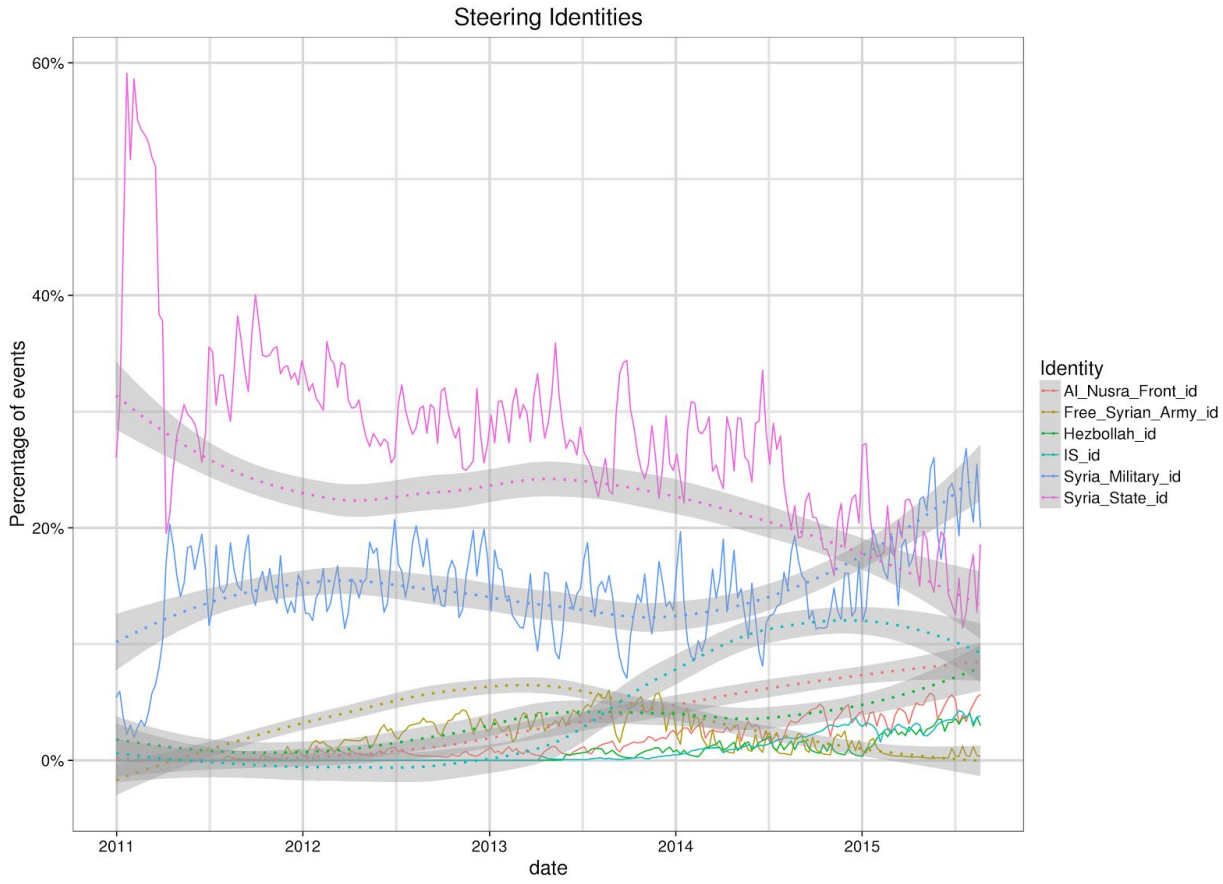
All agents start out in the regime zone, and then punctuation scripts add new zones over time. There are currently **six** of these territorial zones of authority in our model, namely Assad's Syria, Free Syrian Army, Al Nusra Front, Kurdistan, ISIS, and the Southern Front (as of landscape 935). This is different than our Syraq model, where there were four zones: Assad, Rebels, ISIS, and Kurds. We think that given the lower-level of granularity of our modeling task, it is appropriate to include explicit zones for other rebel groups. Groups that do not have zones (but perhaps should) include the Islamic Front, Hezbollah, and the National Defense Forces.

Steering

In order to update the model over time, we extract ICEWS event data for "steering" the model. The way we are currently doing this is by counting up the proportion of events per week carried out by different groups within the country. Our list for Syria includes events carried out by the Government sector (not including Local, Provincial, or Police), the Military sector (and "Military Personnel - Special (Syria)" actor), Al Nusra Front, Free Syrian Army, Hezbollah, and Islamic State (IS). This data gives us a time series of proportion of events carried out by each group, which we think is a good analogue to the number of agents in our model that should be

[11] Lustick, Ian S., et al. "From theory to simulation: the dynamic political hierarchy in country virtualisation models." *Journal of Experimental & Theoretical Artificial Intelligence* 24.3 (2012): 279-299.

activated on a particular identity during a given timestep. The Syria State and Syria Military identities are kept at their current values, but the other four groups are doubled in size.



In the visual above, we can see a comparison of the results from [experiment 855] and the steering input data. The solid line represents the model output, and the dotted line with error bars represents the steering input data. We can see a large jump in the military identity and drop in the state identity at the beginning of the civil war. Over time we've seen more military activity and less state activity. In addition, we can see the rise and fall of several rebel groups. We have found that even given these steering rules, certain identities do not match the steering data well. For example, the Free Syrian Army never quite reaches the peak we expect, and the Syrian state is always larger than it should be. This is a problem and can likely be solved using some different model initialization strategies.

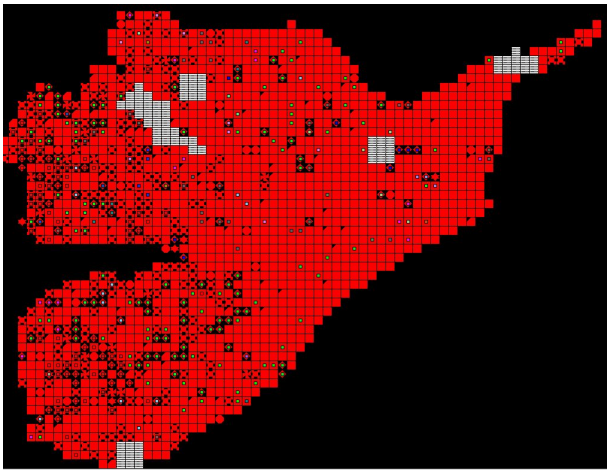
Punctuations

In experiment 855, there are currently nine punctuation scripts. Details on the operationalizations for each script can be found in "/ExperimentationSystem/data/SyriaData/Punctuations - 2016-06-27/". Here is a brief description of each event.

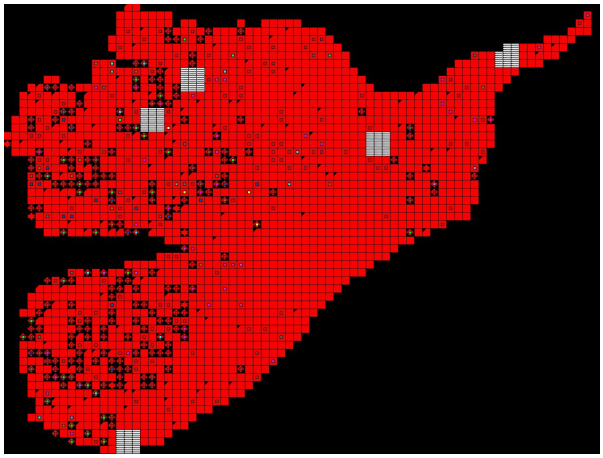
For the revolution punctuation, a special dataset is used with the state activity between 2012 and 2013. The value “1-(SyriaState*2)” is removed from agents in each governorate.

	Date	Timestep	Event
1	2011-03-18	12	Start of revolution
2	2011-07-29	31	Formation of FSA
3	2012-01-20	56	Formation of Al Nusra Front
4	2012-09-07	89	Kurdish Zone Creation
5	2012-11-02	97	Formation of National Defense Forces
6	2013-04-05	119	Formation of ISIS
7	2013-05-24	126	Introduction of Hezbollah
8	2014-09-14	142	US does not attack after red-line is crossed (added after experiment 857)
9	2013-11-22	152	Formation of Islamic Front
10	2014-02-14	164	Formation of Southern Front

Old (landscape 933)



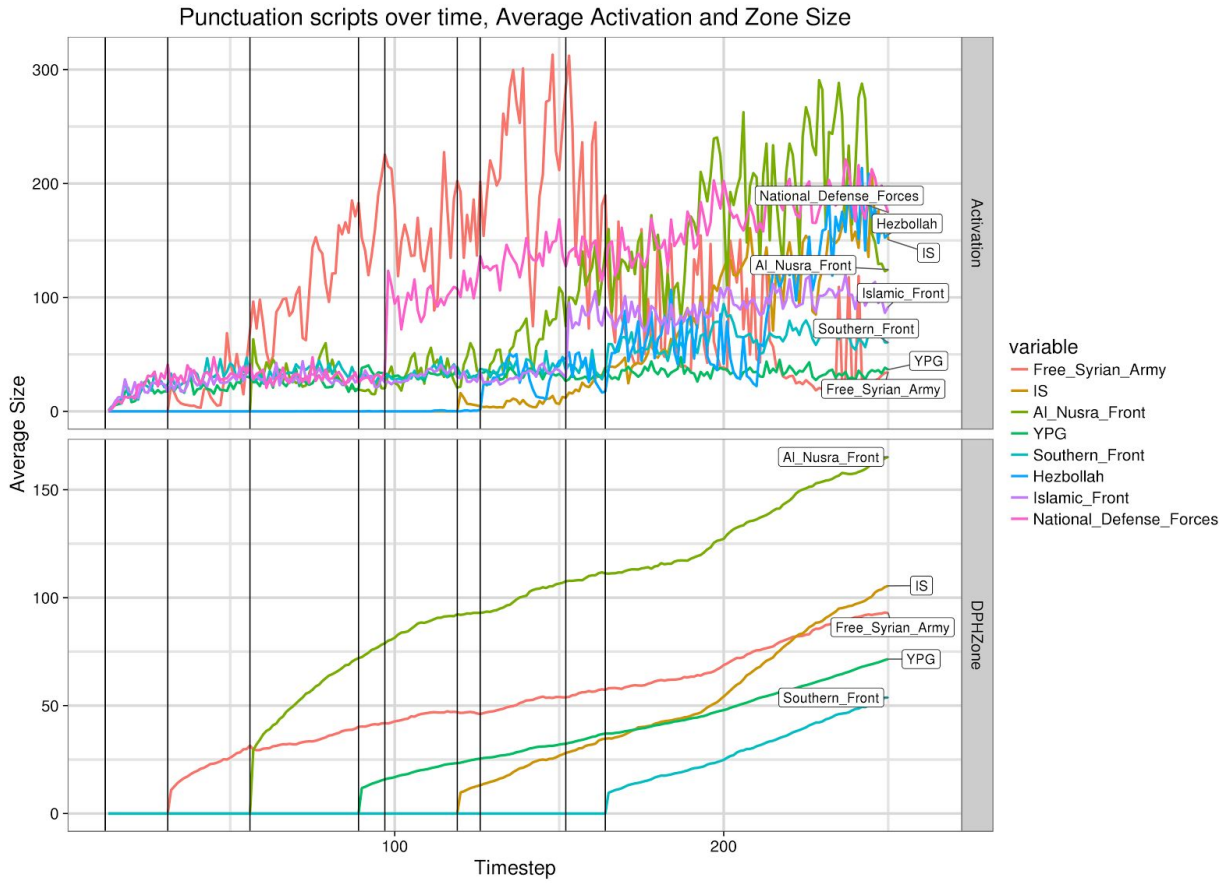
New (landscape 937)



This figure shows the “core” regions for each of the territorial punctuations. The left image shows the old cores for Landscape 933 and the right shows the new cores for Landscape 937.

And in the visual below, we show preliminary results from the effect of those punctuation scripts on the model output. The top panel shows the identity activation of the punctuation groups, and the bottom panel shows the DPH Zone size of each group (excluding Syria State). In the top panel, we can see the groups that some groups start with small levels of activation after the revolution, even though they are not initialized. This is likely because of the strong drop in State activation during the first punctuation. During the second punctuation, we can see the introduction of the Free Syrian Army identity and zone. The third punctuation shows the formation of Al Nusra Front identity and zone.The fourth shows the formation of the YPG, and

the fifth shows a large increase in the National Defense Forces activation (although they are not associated with a zone.) The sixth is the creation of ISIS, and the seventh is the introduction of the Hezbollah identity (no zone associated). The eighth shows the formation of the Islamic Front (no zone) and lastly the Southern Front zone and identity are formed during the last punctuation.



Subject Matter Expertise

We have received two reports from Subject Matter Experts during the Syraq model building process, from Wayne White and Steven Heydemann. Although these are about both Iraq and Syria, with an emphasis on ISIS, revisiting these reports might be useful.

Model Dynamics

In addition to the new civilian atrocity variable measurements, we have also included some new model dynamics based on the previous Netlogo models. In particular, a new function was added to PS-I to called *checkDPHZone_version2* which is based on the *check-dphZone* function in the

“GPM 71-Syraq6b-Steering” Netlogo model. This function does not allow for DPH Zone Genesis, but does allow agents to switch DPH zones.

Agents that border at least one other DPH Zone go through the following process:

Default values:

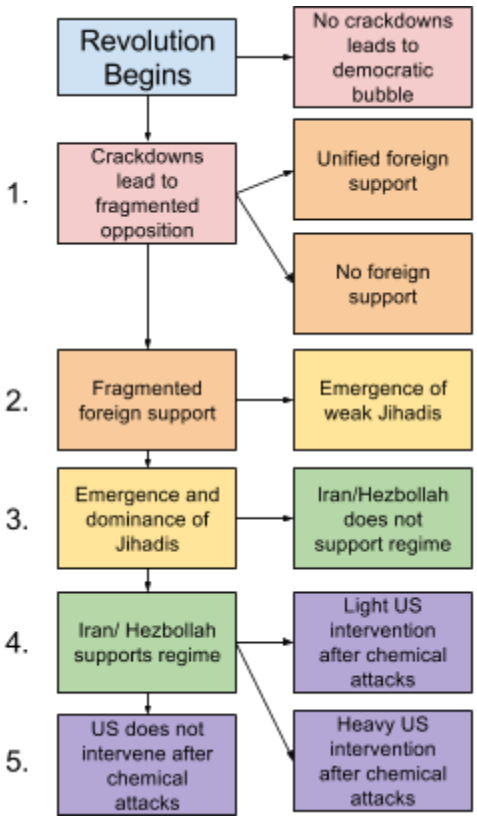
- *dphZoneSwitchFactor:* 0
- *DPHSwitchAttackPenalty*: 8000/10000
- *DPHRationalityBonus:* 1000/10000

1. Choose the zone with the most agents (besides your own). (this is slightly different than Netlogo, which chooses a random zone from the choices.)
2. Initialize the likelihood of switching as the *dphZoneSwitchFactor* out of a maximum of 10000.
3. Add a bonus if an agent was just victimized, increasing its likelihood of changing by *DPHSwitchAttackPenalty*.
4. Add the reinforcement bonus, which means that more agents reinforcing your own zone within a distance of one lowers your likelihood of switching. As of experiment 855 this calculation has been updated. ((dphZoneTensionMax - dphZoneReinforcementCount) * 500)
    a. Old code: (((2*dphZoneTensionMax)-8) * 500) This was incorrect for agents on a border or near more than one DPH Zone. It has since been corrected, but the function has the same name.
5. Add the rationality bonus, which increases the probability if the agent’s DPH level would be higher in its new hypothetical zone. (((alt_DPH_sub - DPH_sub) * *DPHRationalityBonus*)
6. Take the final probability and test whether to change. If the probability is less than zero, do not change.

Counterfactuals

For a full report on the counterfactuals and outcomes, see our Syria Atrocities Modeling Report - Phase II.

- Democratic Bubble - 2010-12-(4) - Time 0 (Lack of Steering)
- Unified Western Support - 2011-07-(4) - Time 31
- Weak Extremists - 2012-01-(3) - Time 56
- No Iranian Offensive - 2013-05-(4) - Time 126
- US Retaliation Against Assad - 2013-09-(2) - Time 142



July 2011

July 2012

April 2013 (January 2012 for JN)

May 2013

September 2013