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Article

Application of Emerging-State Actor Theory: Analysis of Intervention & Containment Policies using the ISIS Case

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Abstract: This paper builds upon a theory of emerging-state actors using ISIS as a case study. This paper seeks to apply the theory in analyzing intervention & containment policies to use against emerging-state actors, using ISIS as the case study. Two baseline scenarios are used for evaluation – one replicating the historical foreign intervention against ISIS and a counter-factual where no foreign intervention occurred. Eleven contemporary military policies were tested against these baseline in isolation, combination, at different timing windows and under hypothetical "best case" conditions as well as operationally constrained. Insights of these tests include the influence of ethnographic envelopes, timing windows. Finally, a policy based on emerging-state actor theory is tested performing substantially better across primary measures than other policies or the historical baseline. This is compared against a falsified-policy designed to disprove that emerging-state actor theory contributed to the benefits. This paper's contributions are a practical application of system dynamics simulations and systems-thinking to current problems, generate insights into the dynamics of emerging-state actors and intervention strategies, and demonstrate utility for future application of the underlying simulation in other scenarios involving non-state actor irregular conflict including terrorism, insurgents, or emerging-state actors.

Keywords: ISIS, ISIL, DAESH, insurgency, conflict, security, non-state actor, emerging-state actor, intervention, policy analysis

This paper was previously published as a conference paper. The simulation model and findings have been substantially revised with since then.[1]

1. Introduction

The rapid rise of ISIS and its staying power created great uncertainty in terms of regional stability. Although its predecessor Al-Queda in Iraq presented a strong threat via a traditional insurgency, ISIS appeared to operate in an entirely different manner. In a very short period it managed to capture two-thirds of Iraq and a third of Syria. Even when confronted with a multi-party intervention by regional and global powers such as Iran, Russia and the United States; ISIS showed remarkable staying power. Previous research on the theory of emerging-state actors has proposed that ISIS is one such case of these actors.[1] And that an emerging-state actor functions differently than a classical insurgency and may be resilient to counter-insurgency strategies. The question policymakers must answer is how to confront, contain and or mitigate the growth and risk of emerging-state actors such as ISIS.

This paper leverages a robust simulation called the Emerging-State Actor Model (E-SAM) to examine ISIS as an emerging-state actor and uses that model to examine a portfolio of policy options under realistic conditions.[1] First a review of the performance of ISIS is provided, followed by a literature review of articles detailing system dynamic simulation models for evaluating insurgencies. Next an overview of emerging-state actor theory is provided leveraging a causal loop diagram. Third, an overview of the E-SAM model structure is provided (full details may be found in Appendices A-D). Two baseline scenarios are constructed using E-SAM. The first

replicates the baseline historical case where ISIS was confronted by multiple local and foreign interventions, eventually losing most if not all their territory and fighters. The second baseline is a counter-factual that assumes no such foreign intervention occurred. These allow a policy space for evaluation of intervention options. An intervention option that performs better than the baseline historical may have promise while one that performs worse than the counter-factual is clearly ineffective. Next, contemporary solutions proposed at the time of ISIS's rise are tested in a hypothetical 'best-case' (absent operational constraints) are against the baseline scenarios performance followed by a discussion of insights generated from these tests. Then, the policies are tested in a combined portfolio, and at different timing intervals. Finally, an intervention policy designed leveraging emerging-state actor theory and systems thinking is created, and tested against previous policies, the baseline scenarios, and a falsified version of itself to ensure that any benefits are the result of emerging-state actor theory and not some other dynamic. The paper finishes with a conclusion that summarizes the insights, discusses weaknesses and identifies future opportunities.

2. Detailed Problem Description

About a year after the US invasion of Iraq in 2003 AQI emerged as a potent threat to stability operations. AQI never governed openly in the territory it influenced, instead conducting a classic guerilla insurgency. The strength of AQI peaked in 2006 before declining as the result of three circumstances: a troop surge of US Forces, a Sunni-Shia civil war that AQI helped spark and the indigenous resistance to AQI growing out of the Anbar Awakening. From 2008-2012 the organization almost declined to the point of non-existence.

However, in 2013, the Islamic State of Iraq and Syria (ISIS) took control of Ar-Raqqah, a medium sized city in eastern Syria with an estimated 13,200 combatants. (See Appendix A for details on all scenario data.) By late 2014 ISIS had grown to between 50,000-80,000 combatants, taken control of nearly 30% of the territory in Syria and Iraq and threatened regional stability. It took three years of conflict including with local State Actors (Iraq & Syria), indigenous opposition groups and a multi-lateral, albeit uncoordinated, international intervention to defeat ISIS territory. Even after its losses in Iraq and Syria ISIS remains a global-insurgency capable of engaging in terrorist acts and threatening stability through its affiliates in over a dozen countries. What policies would've limited, or stopped altogether, ISIS's growth? Once it was established what policies would remain effective for containing it?

3. Literature Review

Although the literature on insurgencies is extensive, in 2009 Kilcullen argued that Cartesian or reductionist quantitative analysis to model insurgencies may not be the best approach and that instead complexity theory and systems theory approaches may be more practical. There are only a handful of quantitative system dynamic efforts dealing with insurgencies or irregular warfare in the manner described by Kilcullen in terms of policy analysis. Most efforts are generic in nature rather than applied to a specific problem case. An early examination of the conditions which give a rise to internal violence in developing economies was conducted by Khalid Saeed in 1983. The paper analyzed how social and political factors determined long term growth. Instability in the form of dissidence and subversive activities were modeled, but not explicitly as a violent insurgency or in a specific geography with parameters initialized to represent an actual conflict.[4] Later work by Saeed specifically focused on how insurgencies can arise when the state responds to political dissidence by allocating more resources to control than economic growth.[5, p. 790] Although his focus was on economic conditions which can create this behavior, the feedback loop of state-actor response to grievances can subsume many types of grievances. However, Saeed's social groupings were highly aggregated. Lt. Col. Renzi in 2006 emphasized the need to provide local texture to these groups, advocating ethnographic intelligence a human terrain which shares "indigenous forms of association, local means of organization, and traditional methods of

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mobilization… or latent forms of social organization" to hostile organizations.[6] In 2010 Turnley et. al. specifically modeled an irregular warfare environment to provide a computational representation of the interdependence between kinetic and non-kinetic aspects of battlefield. This approach focused not on individual actors but on groups representing different sets of socially constructed norms. Turnley's model aggregates three groups: Foreign Fighters, Coalition (which may represent both foreign and domestic government forces) and Local Population and models the dynamics between them. This focus highlights the interaction of latent structure as it is affected by kinetic activity but does not model a specific organization of an insurgency in the context of a set of local conditions.[7]

In 2011 Anderson used actual data from the Anglo-Irish War of 1919-1921 to model insurgency and counterinsurgency theories indicating potential gaps in the theory when compared to simulation results. This represents an applied application of quantitative modeling to a specific conflict. However, the insurgency of the Anglo-Irish War represents a 'classical' insurgency that differs significantly from ISIS's behavior as an emerging-state actor.[8] As well Anderson specifically did not model financial funding, a key element in explaining ISIS's growth and vector in limiting it. Finally, Anderson's model is largely built on the theories and perspectives of Counterinsurgency (U.S. Army Field Manual 3-24 also referred to as FM 3-24) which precedes the rise of ISIS as a force that can operates both openly and clandestinely. The focus on intelligence gathering implicitly indicates an insurgency operating in a guerilla or unconventional manner, as the IRA did. However, the Anglo-Irish and the IRA was never able to seize and hold territory this approach may not best represent the dynamics of a true emerging-state actor.[8]

In 2013 Saeed et. al. developed a generic structure to model political conflict which could include insurgencies.[9] Aimed at understanding a question of political-economy and decision making of what drove Farmers to become Bandits or Soldiers, the model like Turnley focuses on decision making and choices of the population, rather than the explicit structure of how an insurgency like ISIS might operate.

In 2014 Aamir presented a paper on modeling terrorist organizations using existing system dynamic models of business entities. This approach was built off a basis of literature that indicated parallels between the managerial challenges of the firm as being like those of terrorist organizations. This approach divided into sectors the "functions" of a terrorist or insurgent activity including Territory/Capital Management, Financial Resources, Population Support, Supply Management, Human Resources, and Attacks and Agency. However, the models Aamir used were from existing system dynamics literature on business models, built generically, rather than aiming to model the performance of any one insurgent group.[10]

Research by this author beginning in 2014 proposed a new theory of irregular conflict, termed "emerging-state actor" using the case of ISIS. It stated that emerging-state actors "uses methods of irregular warfare to capture territory to influence populations ("coercive power"), which it then attempts to govern in furtherance of its objective to become a functioning state ("legitimate power")."[1] This research included a robust simulation model named E-SAM that allows testing of theoretical propositions in a synthetic environment as well as interventions in an irregular conflict environment between state and non-state actor. This paper will contribute an application of that theory in the case of ISIS. Finally, this paper contributes synthetic tests of a variety of interventions to demonstrate how intervention strategies designed with emerging-state actor theory in mind may have higher utility in certain circumstances than traditional interventions.

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4. The Emerging-State Actor Theory

This paper adopts the dynamic hypothesis that ISIS is an emerging-state actor which differs significantly from a classical insurgency. A causal loop diagram of the theory is provided in Figure 1.[1]

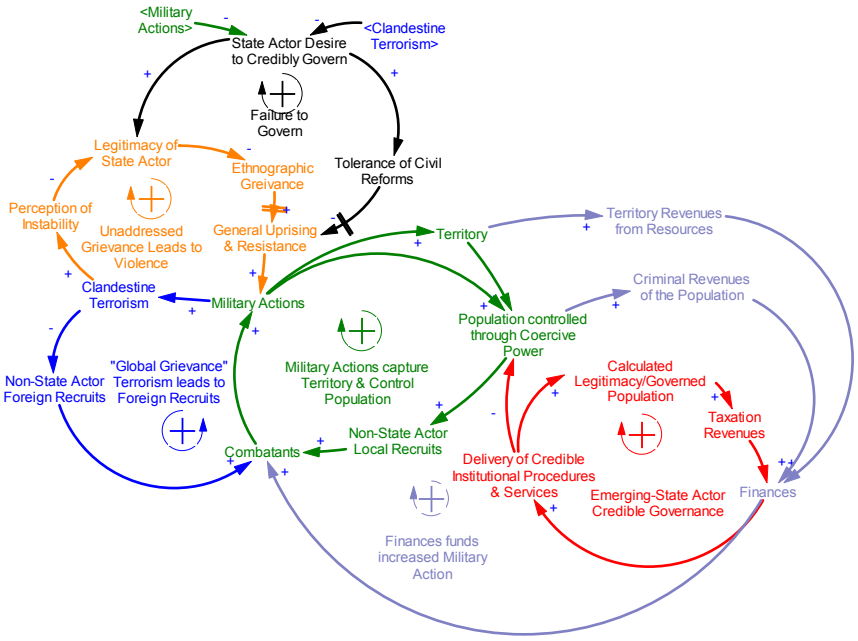

Figure 1. Emerging-State Actor Theory Causal Loop Diagram

Emerging-state actor theory as expressed in this diagram can be summarized as an emerging-state actor uses methods of irregular warfare to capture territory to influence populations ("coercive power"), which it then attempts to govern in furtherance of its objective to become a functioning state ("legitimate power"). Several propositions arise from this theory.[1]

1. A failure of governance by the state-actor and inability to tolerate civil reforms decreases legitimacy, increases grievance and leads to general uprising and resistance.

2. This resistance manifests first in the form of clandestine terrorism which increases the perception of instability, further decreasing the legitimacy of the state. Likewise, violent acts reduce incentives of the State Actor to credibly govern the ethnographic group from within which these actions emerge.

3. Local grievances bring combatants and a non-state actor either emerges or is drawn into conflict.

4. The non-state actor uses combatants and finances to conduct military actions.

5. As the non-state actor gains controlled population begins extracting coercive revenues through criminal activities and recruiting locally from within the controlled population.

6. Within its territory, the non-state actor attempts to monopolize the use of force, taxation, control of movement, and regulation of the economy. By operating in a sovereign manner, the non-state actor shifts to an emerging state actor.

7. Coercive revenues & territorial revenues are used to finance governing mechanisms which can begin building legitimacy to shift the controlled population into a governed population.

8. As the emerging-state actor gains a governed population, it also gains taxation revenue and increases its draw of non-local foreign recruits by propagandizing its non-local grievances, which may or may not align to local grievances.

9. The loops complete into a positive feedback loop of exponential growth. More combatants mean more military actions, which means more territory and access to controlled populations, which can begin to be governed, fueling finances, which fund more combatants and military actions.

Negative loops limit the growth, the most immediate and pressing is the "Resistance & Uprising" loop. As ISIS controls more population, it requires more forces to garrison that population and prevent uprisings against their rule, this reduces the number of Combatants available to gain more territory. Another negative feedback loop, "Descent into Factions" has its precedence in ISIS's own emergence within the Al-Queda global franchisee network splitting in 2013. Growth and size of any entity may lead to disagreements over both policy and personality, and if those factions are significant enough it may break the emerging state actor apart. The Dynastic Cycle begins with the corruption and abuse of arbitrary power available to a state, like that described by Katouzian's theory of arbitrary state and society.[11] The negative feedback loops of Descent into Factions and the Dynastic Cycle have a significant delay function and therefore may develop well after emerging-state actor has established itself. As modeled by Langarudi, the Katouzian dynastic cycle can take decades to manifest.[11]

5. E-SAM and Baseline Scenarios in ISIS Case

The Emerging-State Actor Model (E-SAM) is a system dynamics simulation model created to replicate conflict conditions for a variety of environments. The model is created in two sections: a strategic architecture of both the state government named the "Green Actor" and ISIS, named the "Red Actor." The strategic architecture identifies the resources and capabilities that determine performance at any point in time. The second section is a World Model within which these two Actors compete against one another over control of a variety of ethnographic groups and with varying degrees of foreign intervention. Sub-systems representing the constants, parameters, information flow, and leadership decisions, behaviors and side-choosing of ethnographic groups, as well as the influence of other resource levels, all combine to affect the rates of change. Reinforcing and balancing feedback interactions between these resources can be used to explain the dynamics of strategic performance. This aggregate strategic architecture is depicted in Figure 2. [1]

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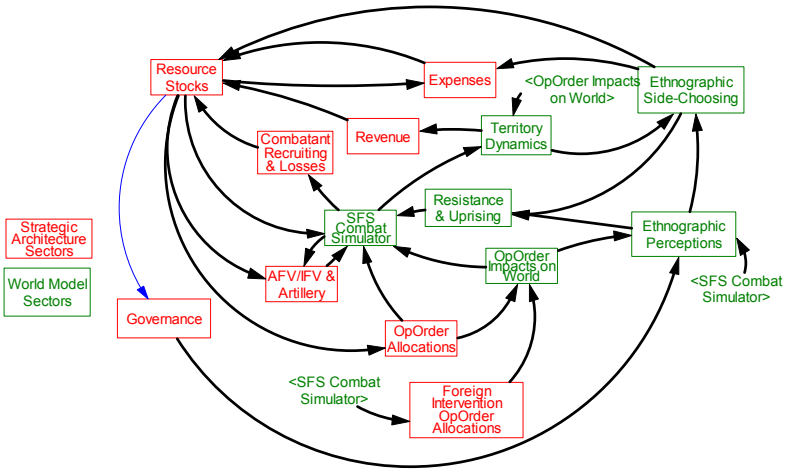

Figure 2. E-SAM Strategic Architecture & World Model Sectors

Two baseline scenarios were created. Both seek to replicate the conditions in Syria and Iraq beginning in 2010, the grievances of the Arab Sunni's that led to the rise and expansion of ISIS. The Baseline Historical scenario then includes the significant foreign interventions that occurred beginning in 2014. The Baseline without Intervention takes a counter-factual that this intervention never occurred and projects what might have occurred with ISIS absent foreign involvement. Through behavior tests the Historical Baseline was found to suitable replicate ISIS's behavior (see Appendix C: Validation & Confidence Tests). Comparing it against the Baseline without Intervention allows a reasonable comparison of what might have happened had foreign actors not intervened in the conflict.

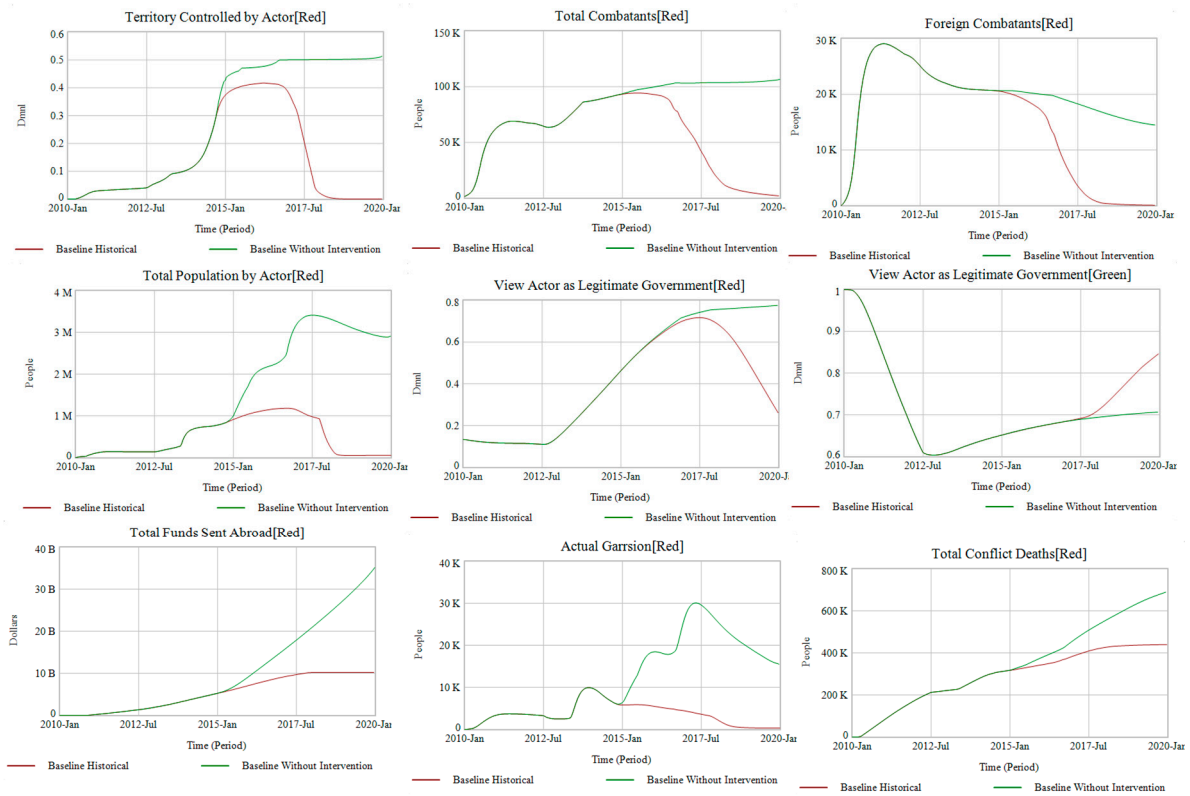

Figure 3. Dashboard of Performance Both Scenarios

We know what happened in the historical case – under the weight of ever-increasing local and foreign opposition ISIS's territorial holdings collapsed leading to the sizeable reduction of its forces. In the

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counter-factual however ISIS, without foreign intervention, ISIS can continue gaining territory against the combined governments of Iraq and Syria. However, as predicted by the emerging-state actor theory above the growth in ISIS's controlled population requires ever more garrisoning troops and sparks more local opposition. This plus the movement of ISIS across the ethnographic envelope from Sunni Arab areas into regions more populated by Shia Arabs and Sunni Kurds prevents ISIS from gaining the same kind of local support. These tensions reach an equilibrium point in the model around ~50% of all of Iraq & Syria (somewhere between Kobani and Aleppo in Syria and with most of Anbar in Iraq). At this point there are nearly 3M underneath ISIS's rule from a conflict that has created nearly 500,000 casualties. ISIS has a force under-arms of nearly 100,000. Most worrisome, ISIS continues generating free cash flow measured in the billions of dollars from oil-sales that, in the E-SAM model, is sent abroad to fund overseas efforts to pursue a growth-strategy through acquisition of a global network to both compete with Al-Queda and other state-actors world-wide.

This Baseline without Intervention will be the baseline environment used to test policies for intervention and containment. The results can then be compared against the Historical Baseline to see if they perform better or worse than what we know from the historical record.

6. 'Best Case' Tests of Policies in Isolation

During the period of initial conflict with ISIS many policy ideas were floated for consideration on how to contain or reverse ISIS's growth. The policy of doing nothing and hoping ISIS would collapse on its own is subsumed within the Baseline without Intervention. Seven remaining policies are listed below. Politically unviable policies are excluded– so a full-scale ground invasion by US forces for example is not included.

1. Use airpower to attack ISIS's oil production (BPD) to decrease revenue to ISIS Finances.
2. Convince allies not to pay ransom for ISIS hostages to decrease revenue to ISIS Finances.
3. Embed military advisers and personnel to improve the fighting quality of forces opposing ISIS.
4. Return military advisers to Iraq to train and oversee counter-terrorism operations against ISIS.
5. Work to reduce the effectiveness of foreign recruiting for ISIS.
6. Supply forces opposing ISIS with advanced military equipment to improve their capabilities.
7. Leverage close air support missions to aid opposing forces engaged in combat with ISIS.

These policies are first evaluated in a "hypothetical best case" scenario. These policies are tested without realistic operational constraints and begin at the earliest plausible intervention time given ISIS's history. Normal deployment times for Blue Personnel deploying to a country are six months, for these tests that will be reduced to one month. Also, no Blue Personnel will be involved in the logistics, administration & headquarters components (T3R) of a deployment. Meaning that 100% of foreign troops are allocated to the policy recommended. Although this may be applicable in some cases of Special Forces operating out of local bases with a light logistical footprint, it is highly unrealistic for a major deployment of forces. Finally, these tests begin in 2103, when ISIS split from

Al-Queda's branch in Syria and capture of Ar-Raqqah. Currently, they were just one of dozens if not hundreds of rebel groups within the Syrian Civil War and not noteworthy other than their legacy reaching back to AQI and recent tensions with Al-Queda.

All of these are unrealistic assumptions for real-world constraints but are useful to determine if these polices could ever be successful. The "best case" results can then be compared against both the Baseline without Intervention and Historical Baseline results to examine efficacy. If even a 'best case' scenario does not perform better than the baseline, it is unlikely to do so when realistic operational constraints and an implementation time table is placed upon it. The hypothetical tests involve arbitrarily setting parameters in the model to the values indicated in Table 1.

Table 1. Hypothetical Best-Case Policy Tests Summary

Proposition Tested	Hypothetical Best Case	Subsystem & Formulation
Policy 1. Use airpower to attack ISIS's oil production (BPD) to decrease revenue to ISIS Finances.	At 2013 sever link to oil production from captured territory.	Add to command script: :Time=12 Territory Conditions Price per Resource Unit[Red]=0
Policy 2. Convince allies not to pay ransom for ISIS hostages to decrease revenue to ISIS Finances.	At 2010 sever link to Ransom Revenue creation.	Set variables as follow: "Estimated Ransom per Period" to $0
Policy 3. Embed military trainers to improve the fighting quality of forces opposing ISIS in combat-roles. 3a = 10,000 3b = 25,000 3c = 50,000	Increase Green Force Morale from .875 to 2.875 (1 = Normal) Increase Green Force Average Experience: 3a 2.75 yrs 3b 3.5 yrs 3c 4.25 yrs	Set variables: Deployment Time[Green]=.33 Blue or Purple T3R Average=0 Add to command script: :Time=12.01 Blue or Purple Intervention Size[Green]= 10000(3a) 25000(3b) 50000(3c) Blue or Purple OpOrder Embedded Combat Advisers[Green]=1 :Time=13.01 Blue or Purple Intervention Size[Green]=0
Policy 4. Return military advisers to Iraq to train and oversee counter-terrorism operations against ISIS in non-combat roles. 4a = 5,000 4b = 10,000 4c = 15,000		Set variables: Deployment Time[Green]=.33 Blue or Purple T3R Average=0 Add to command script: :Time=12.01 Blue or Purple Intervention Size[Green]= 5000(4a) 10000(4b) 15000(4c)

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		Blue or Purple OpOrder Training Local Actor Security Forces [Green]=1 :Time=13.01 Blue or Purple Intervention Size[Green]=0
Policy 5. Reduce the effectiveness of foreign recruiting for ISIS.	5A: Foreign Recruiting reduced by 50% 5B: Foreign Recruiting Reduced by 100%	Set Variable to: NORMAL FOREIGN RECRUITS INSPIRED PER TERRORIST ATTACK[Green] =26 (Normal) 5A = 13 5B = 0
Policy 6. Leverage close air support missions to aid opposing forces engaged in combat with ISIS.	Target *Effect of Ground Support Campaign[Green]* 7a= 10% 7b = 50%	Set variables: Deployment Time[Green]=.33 Blue or Purple T3R Average=0 Add to command script: :Time=12.01 Blue or Purple Intervention Size[Green]= 1080 (6a) 5670(6b) Blue or Purple OpOrder Airpower[Green]=1 Blue or Purple Airpower Targeting Combatants[Green]=1 :Time=13.01 Blue or Purple Intervention Size[Green]=0

In the above tests "non-combat roles" are deployments that by structure of the model will not result in fatalities from conflict for Blue Personnel. "Combat roles" however are included in the combat simulation and will suffer casualties proportionate to their relative proportion in the overall force, and the allocation of that force by the Green Actor at a given time. The results of these tests are summarized in Table 1 across nine factors. The maximum and ending values of three Primary Measures of Effectiveness: Total Territory[Red], Total Combatants[Red], and Total Population[Red] as well as Total Intervention Size, Blue Combatant Losses, and Total Conflict Deaths are compared in Table 2.

Table 2: Hypothetical Best Case Results

Experiment	% Territory MAX	Total Pop [Red] MAX	Total Comb. [Red] MAX	% Territory Controlled at End [Red]	Total Pop. by Actor at End [Red]	Total Comb. at End [Red]	Total Intervention Size	Blue Comb. Losses [Green]	Total Conflict Deaths
Baseline Historical	42%	1.2M	94k	0%	53k	1,880	108,100	5,751	440k

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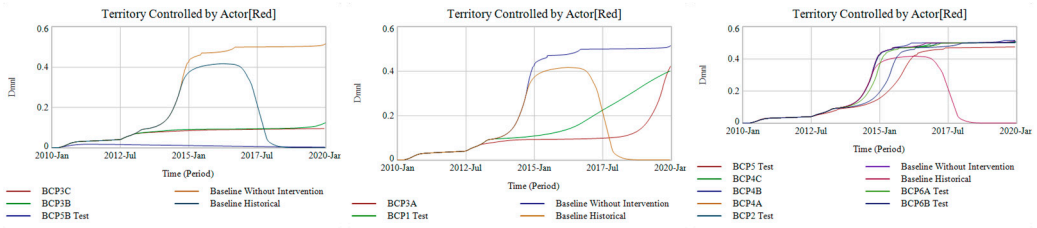
Baseline without Intervention	52%	3.4M	107k	52%	2.9M	107k	-	-	692k
BCP1	40%	1.3M	80k	40%	1.28M	21,250	-	-	363k
BCP2	51%	3.3M	106k	51%	2.8M	106k	-	-	692k
BCP3A	42%	1.1M	95k	42%	1.1M	95k	10,000	6,463	451k
BCP3B	12%	1M	88k	12%	1M	84k	25,000	16,140	458k
BCP3C	10%	900k	86k	10%	878K	76k	50,000	29,860	441k
BCP4A	52%	3.4M	107k	52%	3M	107k	5,000	-	691k
BCP4B	52%	3.6M	106k	52%	3.4M	106k	10,000	-	691k
BCP4C	51%	3.3M	107k	51%	2.8M	107k	15,000	-	694k
BCP5A	48%	2.1M	76k	48%	1.9M	75k	-		51k9k
BCP5B	2%	101K	1.6k	0%	3.3k	-	-		226k
BCP6A	50%	105k	3.3M	50%	2.8M	105k	1,080		688k
BCP6B	50%	108k	3.2M	50%	2.9M	102k	5,670		663k

The outcome of the best-case policies range widely but can be classified into three broad categories of behavior patterns. These behavior pattern clusters are illustrated in Figure 6 which charts the Territory Controlled by Actor.



(a) **(b)** **(c)**

Figure 4. Pct of Territory Controlled in Select Policy Scenarios

Group (a) policies are those that significantly contain ISIS from "breaking out" after implementation, either eliminating ISIS or containing it at a much smaller level. Group (b) policies create initial barriers to ISIS that are eventually overcome allowing ISIS to break-out much later in the scenario. Group

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(c) policies show little substantive improvement just slightly shifting the time it takes ISIS to break out and being unable to reverse the breakout when it occurs. The policies are listed by the group they belong too in Table 3 below.

Table 3: Best Case Policies by Outcome

Best Case Policies that Contain ISIS	Best Case Policies that Delay the Breakout	Best Case Policies with Minimal Effect
BCP3B: Deploy 25,000 Combat Advisors.	BCP1: Eliminate ISIS's oil production 100%.	BCP2: Eliminate 100% of Ransom Payments.
BCP3C Deploy 50,000 Combat Advisors.	BCP3A: Deploy 10,000 Combat Advisors.	BCP4A-C: Deploy military advisers for counter-terrorism training.
BCP5B: Eliminate ISIS foreign recruiting by 100%.		BCP5A: Eliminate ISIS foreign recruiting by 50%.
		BCP6A&B: Combat airpower in support of local ground forces.

A greater discussion is merited on the seemingly "successful" policies. Firstly, even though eliminating Foreign Recruiting at 100% completely contained ISIS, this is a hypothetical best case. That even a 50% reduction in foreign recruits had almost no appreciable effect calls into question how a realistic policy would fare.

Deploying combat advisers to fight side-by-side with local troops showed success in containing ISIS territorially if there were enough advisers and losses could be sustained. Deploying 25,000-50,000 troops (BCP3B & 3C) successfully contained ISIS – but at the high cost of 15,000-30,000 foreign becoming casualties. Though modeling domestic reactions to such a loss of US servicemembers is beyond the boundaries of the E-SAM, it calls into question whether such a policy would be supported in the long run. A smaller contingent of only 10,000 deployed advisers (BCP3A) didn't have sufficient manpower to sustain containment of ISIS. As their casualties mounted to nearly 66% of the deployed force – ISIS "broke out" in the simulation and was able to rapidly gain territory. Additionally – even though ISIS was contained territorially, it still managed to amass over 75,000 Combatants under arms in both the interventions where their territory was contained. The reason why this occurred is that even though ISIS was contained, they were contained within their inner ethnographic envelope; a human terrain favorable to its success and growth.

Importance of Ethnographic Envelopes

This exercise serves to illustrate the general challenges facing policy planners in containing a threat by ISIS. Many of the polices fail simply because, even by 2013, ISIS was well established in terms of revenue streams and interior resources feeding its strategic architecture. Policies that attempt to change this from afar fail to account that by the time ISIS has become an emerging-state actor seizing territory – most of what it needs is found within that territory itself. Which means that to contain or reverse this expansion requires going into that territory itself. And even if ISIS is contained, if where they are contained represents a favorable human terrain, they can still gain combatants, funds and grow in strength.

This dynamic of "ethnographic envelopes" is key to many policy tests and illustrates the importance of the underlying ethnographic human terrain as envisioned by Renzi. E-SAM

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simulates as many ethnographic groups as desired, and in both the baseline scenarios there are three groups represented: Arab Sunni, Arab Shia and Kurdish Sunni. The ethnographic envelop can be notionally thought of as the composition of the population between these three ethnographies. This is represented notionally in Figure 5 which is a chart of the population size by ethnography based on the % of Territory ISIS conquers as it follows its Theatre Strategy (see Appendix B for discussion on Theatre Strategies.)

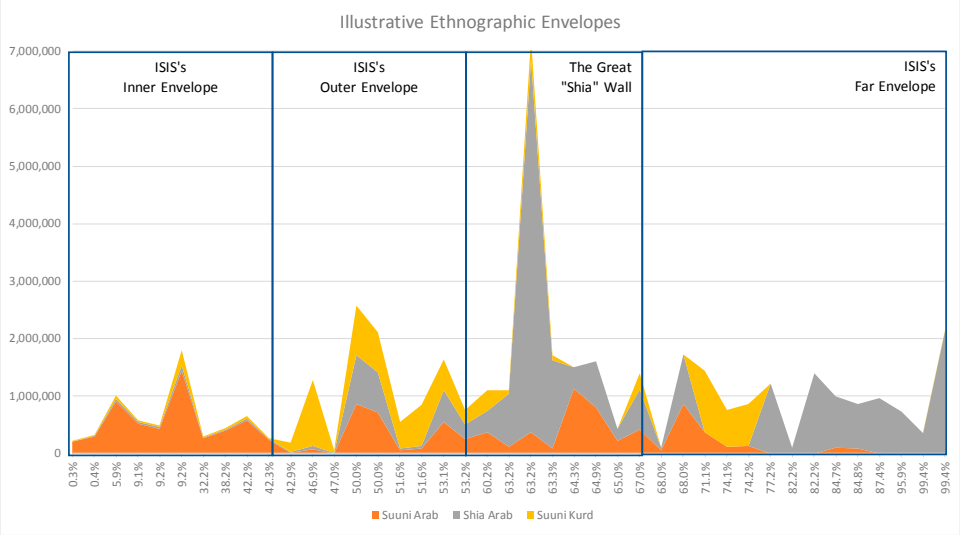

Figure 5.Ethnographic Envelopes in Syria & Iraq

The graph charts population on the Y-Axis and the percentage of overall territory ISIS has conquered along the X-Axis. In a stacked-area are the three ethnographic groups by their representative population in that area. Note the populations are not cumulative. The chart is divided notionally into four regions, or "ethnographic envelopes." These are labeled as the inner envelope, the outer envelope, the "Great Shia Wall" and the far envelope.

By the premise of the design of E-SAM the Arab Sunni will generally be more favorably disposed to ISIS than the Iraq or Syrian government. The Actual Desire to Credibly Govern for Sunni Arabs is set to only .75 for the Green Actor, while it is set to 1 for the Red Actor. Likewise, it is the Green actor's suppression of the Sunni Arab which creates the conditions of grievance within which ISIS will thrive. Conversely, Shia Arab are more generally disposed to favor Green than they are Red. The Kurdish Sunni are somewhere in the middle, not disposed to either Green or Red. Although this is not universally true of every individual of these ethnographic groups it's a plausible aggregation of the underlying realities leading into the conflict with ISIS.

As depicted in Figure 5, the inner envelope for ISIS is that terrain which consists almost entirely of their most favorable ethnographic group, the Sunni Arab including the large population center of Mosul at 9.2%. The outer envelope is an increasingly mixed region Kurdish Sunni, Shia Arab and Sunni Arab populations with large expanses of uninhabited deserts. ISIS can (and does) quickly expand over these areas gaining territory, but not much in terms of population. But like a wave losing strength as it rolls up the beach, the mixed ethnographic nature means ISIS is less able to recruit, tax and must spend more combatants to garrison these areas. The "Great Shia Wall" acts like a sea-wall on the beach representing an enormous impediment to ISIS expansion. Containing the large

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metropolitan areas of Damascus and Baghdad, these are densely populated urban centers consisting mainly of Shia Arab unfavorable to ISIS. Beyond the "wall" is a far envelope which generally consists of Shia Arab populations unfavorable to ISIS.

At this point it's important to note that these "envelopes" are not programmed into the simulation explicitly. The ethnographic distribution, terrain type and other factors of space are built into the scenario – but ISIS does not suffer any other penalty in those areas other than that represented by these factors. But these factors, when combined depending on the circumstances of ISIS, can create endogenous effects as have already been seen in the policy testing of a hypothetical best-case scenario and important to understand before analyzing operational scenarios. The policy of embedding combat advisers for example (BCP3A-3C) differ substantially in the territorial reach of ISIS. Policies BCP3B/C halt ISIS at ~12% and 10% respectively. While Policy BCP3A fails to prevent a breakout and ISIS advances to take 42% of the overall territory. This isn't as much of a difference as it seems, as depicted in Figure 6 below which is an enlarged version of the chart in Figure 5.

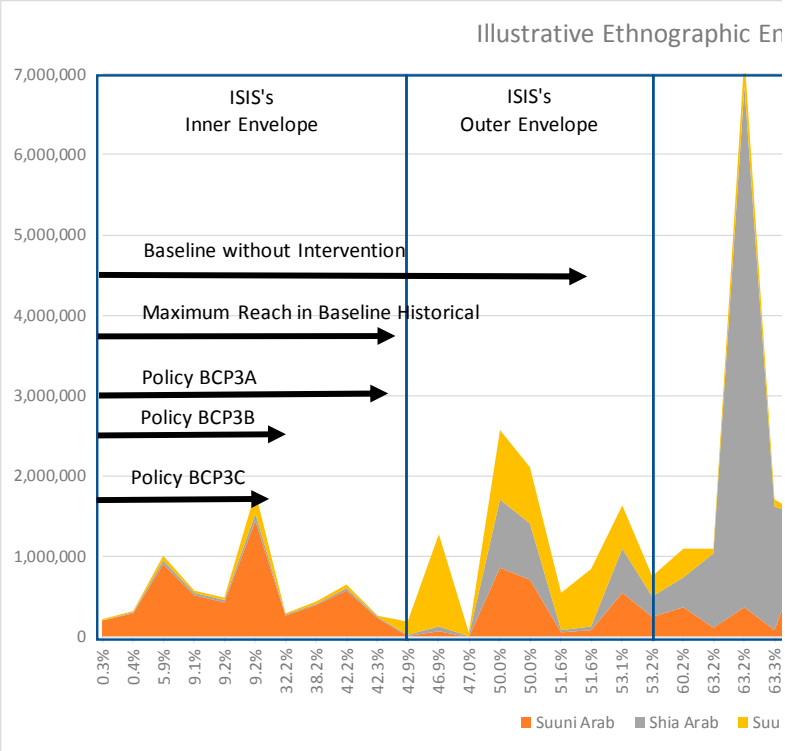

Figure 6. Focus on Inner Ethnographic Envelope with ISIS Expansion Overlain

The largest expansion is the Baseline without Intervention, which reaches and holds in the outer envelope at around ~52% of the territory. This is where the population has already begun significantly shifting to Kurdish Sunni and Arab Shia. The Baseline Historical had a maximum reach equal to Policy BCP3A, or ~42%. But in the historical baseline simulation that expansion is turned back by a large foreign intervention whereas the much smaller intervention of BCP3A simply holds it to that extent. Policies BCP3B and C hold ISIS's growth to within the inner envelope. ISIS has conquered Mosul – but not gained much further. But even as ISIS's territorial growth is slowed their combatants and strength continue to rise. ISIS performs better over time if it is "contained" to areas within its inner ethnographic envelope.

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This slowing effect of crossing from the inner to the outer ethnographic envelope can be most clearly seen in the Actual Garrison of ISIS across four scenarios as shown in Figure 7.

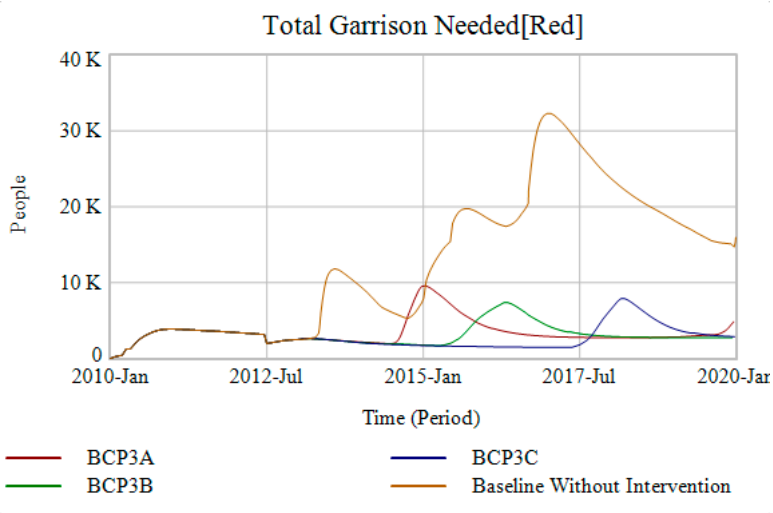

Figure 7. Total Garrison Needed in Relation to Ethnographic Envelopes

The BCP3A-C scenarios, all which limit ISIS to within its inner ethnographic envelope have significantly less *Total Garrison Required* commitments than the Baseline without Intervention scenario.

8. Course of Action Analysis under Operational Constraints

The best case hypothetical scenarios are useful from the standpoint of distinguishing policies that might not have utility even under best conditions versus those that have promise. With those insights a more powerful form of analysis that can be done within E-SAM is on simulated courses of action (COA). Each COA represents a portfolio of policy options, implemented at various timing windows, and with operational constraints that are realistic. We know that Policy 2, attacking ISIS oil infrastructure limited ISIS's growth in a hypothetical best-case scenario, but this policy assumed a 100% successful destruction of ISIS's nascent oil infrastructure in 2013, well before ISIS was considered a serious national security threat. However, at the point the US began its air campaign against ISIS during the Anbar offensive of 2014, would combining additional policies with targeting oil production via an air campaign have resulted in reversing or containing ISIS's growth? Or will it result in the dynamic of keeping ISIS within its inner ethnographic envelope, but not destroyed, and thus ultimately performing better?

Table 4: Overview of Courses of Action

COA Element	Operational Case	Subsystem & Formulation
Deploy airpower to destroy ISIS's oil production then switch to support ground combat.	In June 2014 begin	Add to command script: :Time=12 Territory Conditions Price per Resource Unit[Red]=0
Deploy 10,000 embedded combat advisers to improve the fighting quality of forces opposing ISIS in combat-roles.	Increase Green Force Morale from .875 to 2.875 (1 = Normal)	Set variables: Deployment Time[Green]=.33 Blue or Purple T3R Average=0

	Increase Green Force Average Experience: 3a 2.75 yrs 3b 3.5 yrs 3c 4.25 yrs	Add to command script: :Time=12.01 Blue or Purple Intervention Size[Green]= 10000(3a) 25000(3b) 50000(3c) Blue or Purple OpOrder Embedded Combat Advisers[Green]=1 :Time=13.01 Blue or Purple Intervention Size[Green]=0
Deploy 5,000 military advisers to Iraq to train and oversee counter-terrorism operations against ISIS in non-combat roles.		Set variables: Deployment Time[Green]=.33 Blue or Purple T3R Average=0 Add to command script: :Time=12.01 Blue or Purple Intervention Size[Green]= 5000(4a) 10000(4b) 15000(4c) Blue or Purple OpOrder Training Local Actor Security Forces [Green]=1 :Time=13.01 Blue or Purple Intervention Size[Green]=0
Reduce foreign recruiting by 25%.		

This COA, unlike the best-case scenarios, is operationally constrained. It will take ~6months for US forces to deploy and arrive to full strength in the theatre. Likewise, normal tooth-to-tail ratios for logistics, administration and headquarters will be 'taxed' upon the deployed force. This means that to achieve 15,000 troops able to perform missions, 45,000 overall troops are deployed. Many of this total force will be in support roles related to the deployment itself, and not directly advancing the mission of embedding combat advisors, training host nation security capability or supporting the air campaign. Furthermore, troops will be replaced if they become casualties.

The intervention date is set at June of 2014 – the actual point in which US military intervention began with an air campaign against ISIS. This COA is further constrained by how much US airpower can be projected in a sustained fashion into the theatre. An air campaign can range in its intensity. The historic actual rate for the campaign against ISIS was originally 10 sorties/day with occasional ten-fold increases up to nearly 100 sorties/day at time. The height of US airpower operational tempo in recent history is 500 sorties/day which will be used a theoretical maximum sustained operational tempo for extended operations. In this COA airstrikes will focus 100% on destroying ISIS's oil, and only then switch to ground support missions. An air strike targeting a modular oil refinery removes only 300-500 BPD of production. How many air strikes are needed to significantly impact ISIS's oil production? And would that level of airpower detract from the ability to provide close

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ground support? Table 5 lists the airpower options for COA1 now established and the personnel required will be added to each scenario.

Table 5: Portfolio Policy Analysis Air Campaign Parameters

Scenario	Squadrons & Blue Personnel Required	Strikes vs. Oil Production until Destroyed	Combat Effectiveness increase from Ground Support Airpower after Oil Destroyed
COA1-A	.41 Squadrons or ~330 additional personnel including T3R	10sorties/day	1%
COA1-B	4 Squadrons or ~3500 additional personnel including T3R	100sorties/day	10%
COA1-C	21 Squadrons or 17,000 additional personnel including T3R	500sorties/day	50%

Air strikes will target ISIS oil production 100% until it is destroyed, and then shift into a Ground Support role. This is based off the knowledge that eliminating ISIS's oil revenue was a key factor in reducing its growth under the hypothetical best-case scenario. We can now compare COA1-A, B & C against both the Historical Baseline intervention and the counterfactual Baseline without Intervention across a dashboard of primary measures of effectiveness. First, the three COA's will be compared against the same factors as in Table 2 in Table 6.

Table 6: Comparison of COA's vs. Baseline Scenarios

Experiment	% Territory MAX	Total Pop[Red] MAX	Total Combatants [Red] MAX	% Territory Controlled at End [Red]	Total Population by Actor at End [Red]	Total Combatants at End [Red]	Total Intervention Size	Blue Combatant Losses[Green]	Total Conflict Deaths
Baseline Historical	42%	1.2M	94k	0%	53k	1,880	108,100	5,751	440k

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Baseline without Intervention	52%	3.415 M	107k	52%	2.9M	107k	-	-	692k
COA1A	34%	1.1M	98k	31%	1.1M	32k	43,170	29,580	403k
COA1B	33%	1.1M	97k	30%	1.1M	27k	46,410	30,460	406k
COA1C	28%	1M	93k	24%	991k	9k	68,850	25,660	438k

The COA's demonstrate the capability to significantly reduce the territorial size and strength of ISIS over time. Unlike the operational best cases the Total Combatants of ISIS are all significantly reduced by the end of the scenario runs. But this reduction comes at a very high cost with large intervention sizes and correspondingly high casualties. Furthermore, even under the best COA nearly a third of Syria & Iraq remains under ISIS control six years after the intervention. ISIS is not by any stretch defeated to the same extent as was observed in the Historical Baseline. Admittedly that intervention consisted of far more combatants joining from the various countries. Reviewing a performance dashboard in Figure 8 view shows the behaviors over time of interest that reflect this challenge.

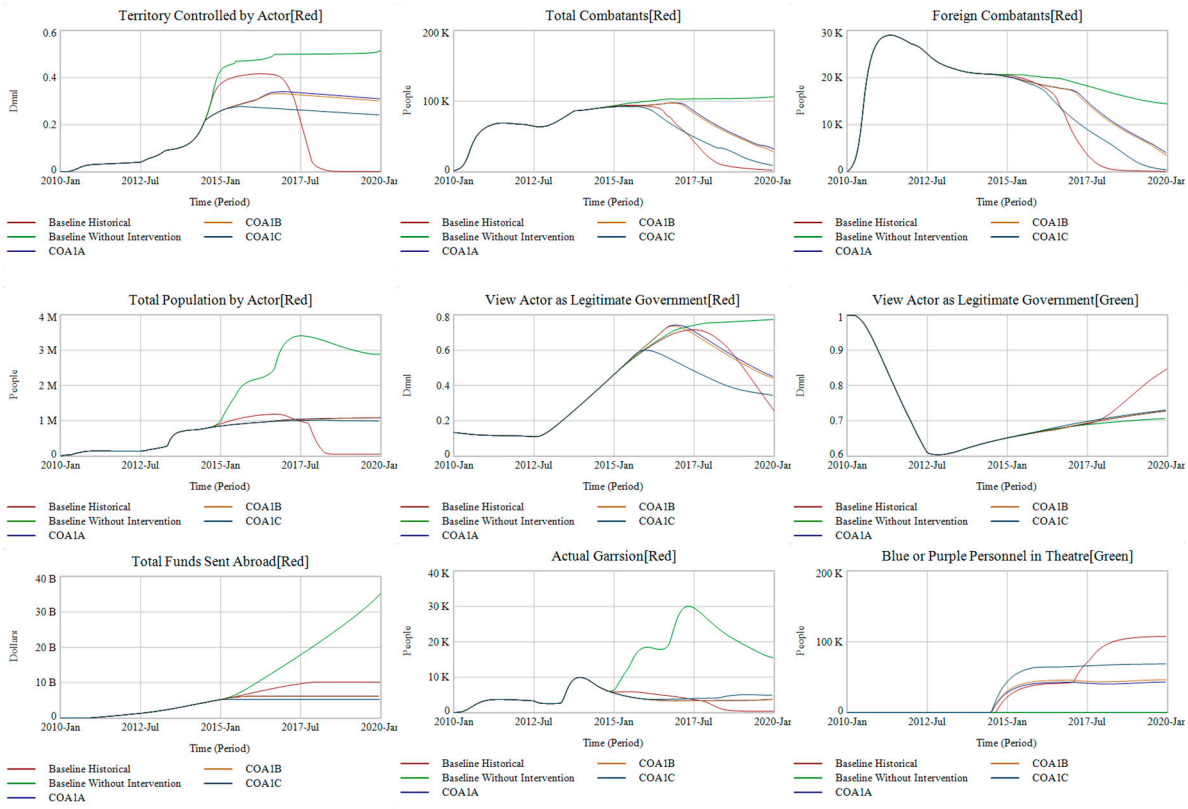

Figure 8. Portfolio Analysis with Operational Constraints Implemented at 2014.5

In narrative, the air campaign in COA1A and & B were insufficient to quickly destroy ISIS's oil production. They take between 1.5-2 years respectively to complete the task and shift to supporting ground combat. Only COA1C, sustaining a 500 sortie/day tempo can both destroy the oil production and then subsequently shift to support the ground war with air strikes quickly. ISIS's

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ability to send money abroad is capped with the destruction of their oil capacity – but not before sending billions abroad. The Blue ground forces providing embedded combat advisors and counter terrorism training are having an impact – but their exposure to combat results in continual casualty rates. In summary, the results are better, but not great than the hypothetical best cases. Besides realistic operational constraints why do a combination of effective policies perform little better than any one single policy? The reason is fourfold: keeping ISIS within its inner ethnographic envelope, timing of the interventions, failing to improve the perceived legitimacy of the Green Actor, and the diminishing returns of combat actions. As ethnographic envelopes have been discussed above focus will turn now to the latter three: perceived legitimacy, timing, and diminishing returns of combat actions.

Policy-Timing

First on timing. Most of the feedback loops activated early in the causal loop diagram depicted in Figure 1 are positive in nature, creating a path-dependent system. Once ISIS goes down the path of becoming an emerging-state actor it is increasingly difficult to break from this trajectory as time moves on prior to the negative loops activating. Earlier interventions with an emerging-state actor like ISIS have far greater effect than later interventions, even if the later interventions are significantly larger. These intervention windows exist prior to the significant acquisition of territory that grants ISIS access to exploitable resources and population to control and then seek to govern. This prevents the reinforcing feedback loops from activating that are highlighted in Figure 1. To illustrate the importance of timing the same portfolio of policies in COA1A, a very light air campaign, is moved back to the start time of the "hypothetical best case" in the beginning of 2013. This is relabeled COA1A-Early and compared against COA1C which represents an intensive air campaign and nearly twice the number of soldiers deployed.

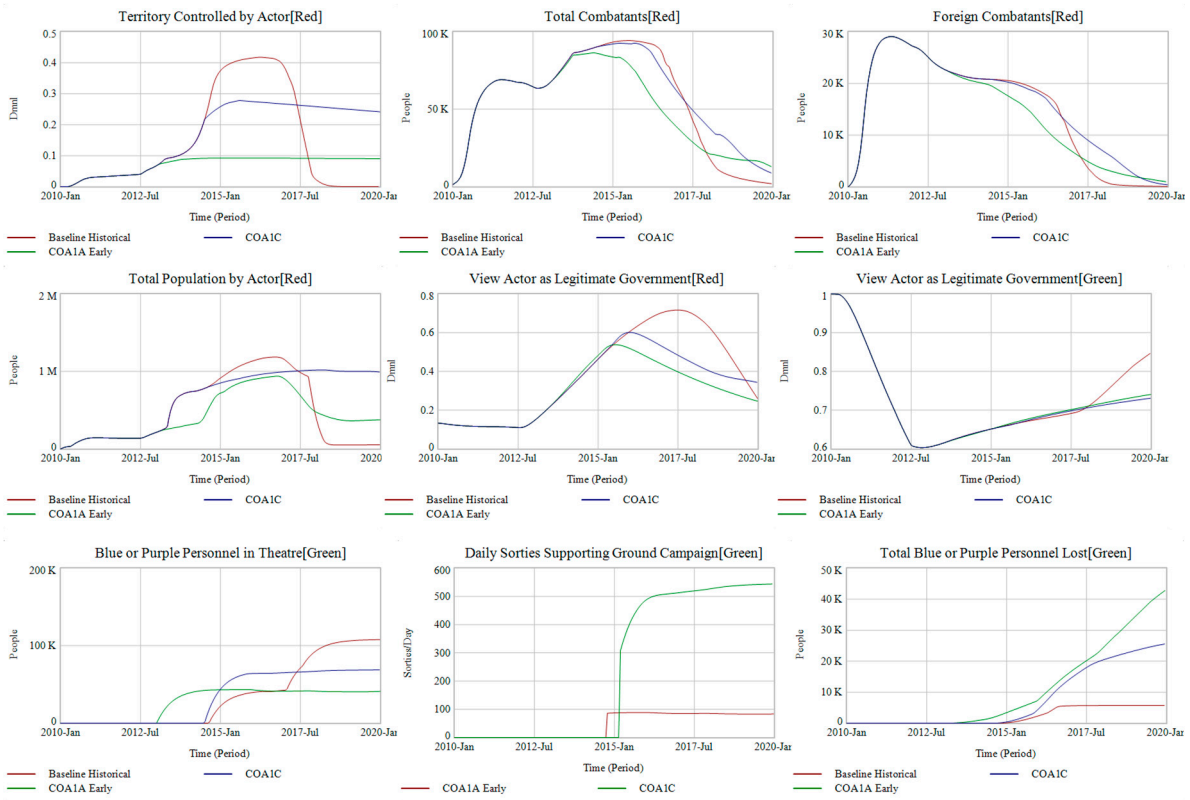

Figure 9. Comparison of Significant Air Campaign at 2013 vs. Intensive Air Campaign at 2014.5

Note that the bottom charts in the dashboard have been altered to display more detailed information. This shows how much smaller of an intervention COA1-A Early is compared to the

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Historical Baseline or COA1-C. Only ~40k deployed versus ~75k in COA1-C and ~108k in the historical example. Also, the daily sorties supporting the ground campaign are less than 1/5th of the more intensive. Yet reviewing the other charts shows COA1-A Early performs just as well, if not better in some cases, then the much larger intervention option. The takeaway of this insight is not to attack-early-and-often. It's not always clear of course when a local actor will end up becoming a global threat. But it does show the power of earlier, targeted smaller interventions aimed to prevent an actor from gaining a foothold. This is based on ensuring the positive feedback loops aren't activated to support ISIS's growth. The earlier the intervention, the smaller ISIS's oil production footprint which means it can be destroyed more quickly. This simultaneously reduces the inflow of cash for expansion while also allowing the intervention to switch to ground support earlier. The earlier ground support prevents ISIS from gaining more territory. As ISIS cannot gain territory it cannot gain more oil resources, populations to recruit from and thus new combatants or other benefits. This is reflected in the sharply weaker performance of ISIS. Timing therefore is crucial for policy consideration, and the earlier the better with an opponent who seeks to gain power through territorial conquest as an emerging-state actor like ISIS would.

Diminishing Returns of Combat Actions

A second challenge to the set of policies is the nature of diminishing returns in combat. Two of the three policies in COA1 are aimed at improving combat effectiveness of Green against Red, either by embedding combat advisers or providing close air support. However, a single ISIS combatant can only be killed, captured or wounded once regardless of how many policies are improving combat effectiveness. This presents the problem of diminishing returns when combining options which all support a military solution, the more resources applied the less return for each marginal resource gained. This is made doubly so by the logistical footprint of the Blue intervention forces that take nearly seven logistics, administration & headquarters personnel (T3R) for every three combatants engaging in military actions. Since it's not possible to alter the diminishing returns impact, reducing the T3R can lessen the steepness of decline.

Perceived Legitimacy of Green Actor

The third challenge illuminated by COA1 is that it only focuses on military solutions to the conflict, ignoring that key ethnographic groups are unable to coalesce around the legitimacy of the Green Actor. Experiments into the emerging-state actor theory demonstrated that when Red was unwilling to credibly govern at least 50% of its controlled population, it suffered precipitous declines in material support. Comparing the Red and Green Actor Legitimacy in Figure 10 below demonstrates that the Red Actor exceeds this threshold before dropping back below, and the Green Actor never fully recovers its own legitimacy. Because emerging-state actors attempt to govern openly, where insurgencies do not, this contest of legitimacy as perceived by ethnographic actors is crucial between the Green and Red actors. The two are compared in Figure 10.

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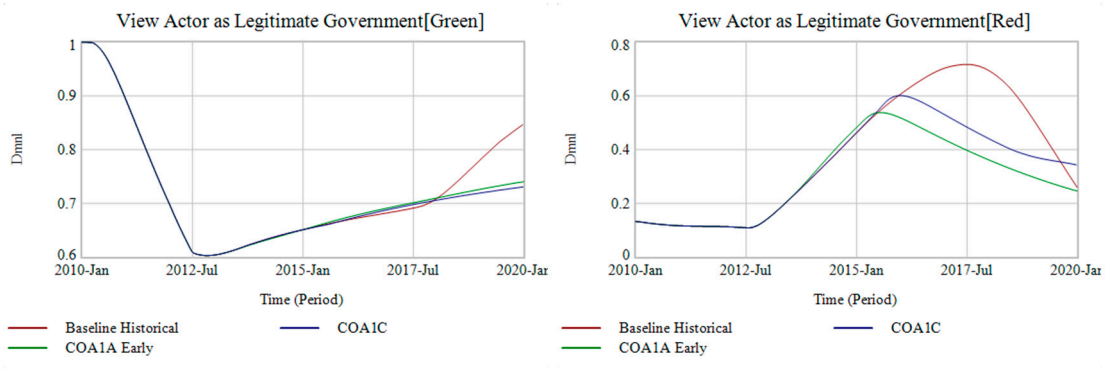

Figure 10. Comparison of Legitimacy between Green and Red Actor

Although designed for ISIS in Iraq & Syria another way to consider the outcome presented by COA1A-C's outcomes is to compare it to the Afghanistan war. In both scenarios a large US intervention force varying between 45,000-75,000 soldiers (excluding surges) focused primarily on building local military capability while trying to destroy the Taliban's main source of funding. Opium instead of oil. But progress on the military front was never matched by progress on credible governance and legitimacy in the eyes of key tribal groups. When the US withdrew its combat forces from Afghanistan in 2014, the Taliban was able to return to power building outward from its undefeated core.

Incremental Knowledge Gain

To this point several insights have been identified from the limited exploration of an intervention policy space. Because an emerging state actor relies on few exogenous factors for its success there are only limited avenues to "harm" an actor like ISIS from outside the territory it operates in. The ethnographic envelope or human terrain an emerging-state actor operates in is just as important to understand as the physical terrain. If contained, yet on a favorable ethnographic envelope, ISIS can maintain its position. There are diminishing returns of combat power and more important than the number of troops might be when they are employed. Earlier interventions require less resources to be successful than later interventions. Finally, while considering military options the perceived legitimacy of both the Green and Red actor relative to one another is crucial. It is entirely possible to militarily defeat an emerging-state actor but still end up with a failed state due to lack of strong ethnographic support to the state actor.

9. Applying Emerging-State Actor Theory to Craft an Intervention

The incremental knowledge gained from experiments on momentum solutions can be enhanced through systems thinking and leveraging the emerging-state actor theory expressed in feedback form in Figure 1. Examining the causal-loop structure of an emerging-state actor offers some ideas of how to craft an intervention that may have more success than already discussed. Originally proposed at a conference presentation in Delft, Netherlands 2016 this second course-of-action (COA2) consisted of two phases of intervention.[13] The overall deployment is limited to only 15,000 Blue personnel, to avoid the diminishing returns effect illustrated above. Phase I also takes advantage of timing-windows, deploying 5,000 troops in 2013. Although this is prior to ISIS's global recognition as an

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emerging-state actor, they certainly were active in clandestine terrorist activities, as were many other groups in the area. For this reason, the goal of this deployment is not military confrontation, but to create legitimacy for the Green actor and undercut the grievances feedback loop that fuels the Red actor as depicted in Figure 11 and indicated in Saeed's work.[5, p. 790]

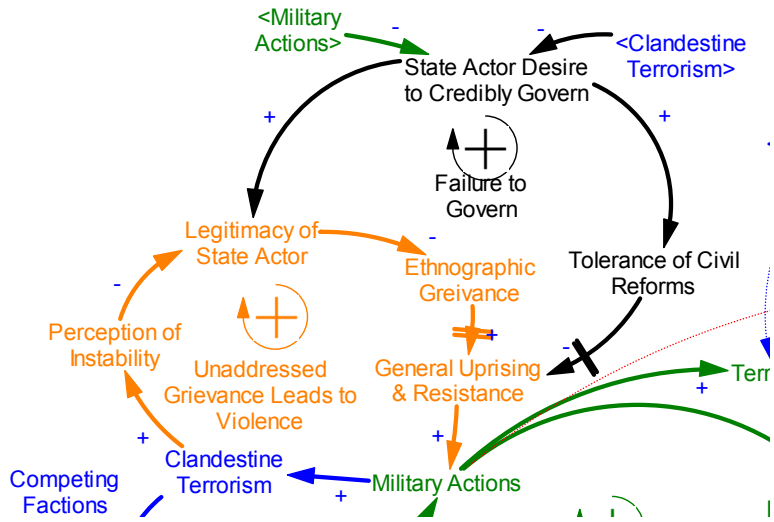

Figure 11. Zoomed in Section of Emerging-State Actor CLD

The black and orange loops in Figure 11 are both positive-feedback, meaning they can operate in vicious or virtuous modes creating exponential behavior for or against a desired outcome. The Phase I intervention is intended to switch these two loops from vicious to virtuous for the Green Actor while turning them from virtuous to vicious to the Red Actor. This will be accomplished through a variety of means including requiring the Green Actor to marginally increase its Desire to Credibly Govern Arab Sunni's and Kurdish Sunni's. As well operational orders of Blue and Green personnel to conduct Armed Civil Affairs (provision of services through military means) as well as communications through Information Operations & Propaganda. Against Red, Blue airpower are not focused on destroying oil production, but rather attacking the mechanisms of governance itself. The goal is not to reduce revenue, but to reverse the flow of accumulating legitimacy which move population out of the Coerced to Calculated Legitimacy to Governed stocks in the simulation model.[1] This is based on the theoretical assumption that an emerging-state actor benefits over an insurgency by openly governing the territory it holds; and that were it not for this governing it would face internal resistance it would have to allocate more garrisoning troops to match. This might mean targeting ISIS governing buildings, public works efforts – even the execution scaffolding and plazas. Anywhere ISIS uses the institutions of governance to create credible processes that fuel the transition from coercion to legitimacy.

The other focus of Phase I troops is to improve the host-nation security capability to counter terrorism, thus protecting the population and reducing the overall violence level – which also leads to increased legitimacy of the state actor through the blue loop which connects to orange. A secondary mission is to train Green to operate with a smaller logistical footprint, the percentage of personnel that are involved in logistics, administration and headquarters personnel known as "T3R." The goal of these Phase I efforts is to undercut Red's ability to govern within its own territory, reducing its legitimacy, requiring greater efforts of coercive power as it expands outside its inner-

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ethnographic envelope. This will create conditions for an internal uprising within its borders. Meanwhile the increased legitimacy of Green should result in lower Garrison requirements of restive populations, decreased defections and thus more troops available to confront Red. The importance of this lighter Phase I deployment is that if ISIS doesn't materialize as the kind of threat anticipated, then the military deployment has been limited in size and focused on delivering outcomes that would be beneficial to Green all the same. Greater legitimacy and reduced violence through terrorism. This Phase makes several key assumptions, but for this hypothetical synthetic experiment the premise is assumed that Green, under threat from Red, will make some concessions in return for US support.

Phase II of the intervention adds 10,000 additional troops. The aim is to pin ISIS on its outer-ethnographic envelope, in unfavorable human terrain, and keep it there while the internal uprising occurs – confronting ISIS from both sides. Blue troops will directly embed with Green forces engaging in combat. Additionally, Green and Blue work together to raise local forces from within the ethnographic populations. This allows Arab Sunni forces to fight in their own ethnographic envelope, Kurdish Sunni in their favorable human terrain etc. These efforts would be analogous to the creation of the Shia popular mobilization forces (PMF) and the Kurdish Syrian Democratic Forces (SDF) which are heavily represented in the Baseline Historical intervention. This simply expands that concept to the Arab Sunnis.

To ensure that any benefits observed aren't just a result of exploiting the timing-window, a second portfolio of policies will be constructed as a policy-falsification termed COA2B. This policy is designed to prove that emerging-state actor theory played no role in any observed benefits. COA2B deploys all 15,000 Blue Personnel at the same earlier time, 2013, as COA2A. It does not however include any efforts related to emerging-state actor theory to increase Green legitimacy, decrease Red's legitimacy or raise local forces. Instead it mirrors more traditional counterinsurgency interventions. All personnel in COA2B will be split between embedded combat advisers, counter-terrorism training to protect the population and airpower support. If benefits are shown to both COA2A and 2B then it will not be clear if the benefits were derived specifically from incorporating the emerging-state actor theory. If COA2A however shows a higher utility than COA2B there is at least some confidence that the specific strategies arrived at from emerging-state actor theory have contributed to that benefit. The two COA's and their specific operational orders for both Green and Blue are found in Table 7.

Table 7: Emerging-State Actor COA and Falsification COA Components

COA Element	Subsystem & Formulation
COA2A-Phase I: Blue deploys 5,000 personnel with a focus on security training, helping Green lower its logistical burden, bolstering legitimacy of Green and using airpower to target governance of Red. Require Green to make token effort to increase credible governance to Arab Sunni and Kurdish Sunni, increase security of	:Time=12 Blue or Purple Intervention Size[Green]=5000 Blue or Purple OpOrder Training Local Actor Security Forces[Green]=.6 Blue or Purple Airpower Targeting Government Capacity[Green]=.2 Blue or Purple OpOrder Information Operations[Green]=.2 OpOrder Combatting Terrorism[Green]=0.25 OpOrder Prison Duty[Green]=.3

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prisons holding detained ISIS, and bolster Green legitimacy.	OpOrder Armed Civil Affairs[Green]=.2 OpOrder Propaganda[Green]=.1 Actual Desire to Credibly Govern[Arab Sunni,Green]=.8 Actual Desire to Credibly Govern[Kurdish Sunni,Green]=.8
COA2A-Phase II: Blue deploys 10,000 additional personnel and shifts to providing embed combat advisers, additional airpower. Green & Blue to work together to raise indigenous local forces from within the ethnographic groups that have a lower logistical footprint than Green. Green shifts to taking more direct lead in conventional military activities and Blue picks up legitimacy building activities through Armed Civil Affairs.	:Time=18.557 OpOrder Armed Civil Affairs[Green]=0 OpOrder Propaganda[Green]=0 OpOrder Prison Duty[Green]=.2 Blue or Purple T3R Average[Green]=.55 Blue or Purple Intervention Size[Green]=15000 Blue or Purple OpOrder Embedded Combat Advisers[Green]=.1 Blue or Purple Armed Civil Affairs[Green]=.1 Blue or Purple OpOrder Training Local Actor Security Forces[Green]=.27 Blue or Purple OpOrder Airpower[Green]=.43 Blue or Purple Airpower Targeting Government Capacity[Green]=1 OpOrder Recruiting[Arab Sunni,Green]=.05 OpOrder Recruiting[Kurdish Sunni,Green]=.05 OpOrder Recruiting[Arab Shia,Green]=.1 OpOrder Conventional Warfare[Green]=0.3 Green or Red T3R Average[Green]=.25
COA2B: Blue deploys 15,000 split between improving host-nation security forces, embedded combat advisers and airpower.	:Time=12 Blue or Purple Intervention Size[Green]=15000 OpOrder Propaganda[Green]=0 OpOrder Prison Duty[Green]=.2 Blue or Purple Intervention Size[Green]=15000 Blue or Purple OpOrder Embedded Combat Advisers[Green]=.3 Blue or Purple OpOrder Training Local Actor Security Forces[Green]=.27 Blue or Purple OpOrder Airpower[Green]=.43 Blue or Purple Airpower Targeting Government Capacity[Green]=1

587

588 With the two synthetic experiments executed the results of COA2A and COA2B are numerically
589 compared against COA1A-C and the Baseline Historical in Table 8.
590

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591 **Table 8: Numerical Comparison of Emerging-State Actor Intervention vs. Others**

Experiment	% Territory MAX	Total Pop[Red] MAX	Total Combatants [Red] MAX	% Territory Controlled at End [Red]	Total Population by Actor at End [Red]	Total Combatants at End [Red]	Total Intervention Size	Blue Combatant Losses[Green]	Total Conflict Deaths
Baseline Historical	42%	1.2M	94k	0%	53k	1,880	108,100	5,751	440k
COA1A	34%	1.1M	98k	31%	1.1m	32k	43,170	29,580	403k
COA1B	33%	1.1M	97k	30%	1.1m	27k	46,410	30,460	406k
COA1C	28%	1M	93k	24%	991k	9k	68,850	25,660	438k
COA2A	***31%***	***1M***	***88k***	***26%***	***1M***	***573***	***15,000***	***454***	***542k***
COA2B	***45%***	***1.7M***	***102k***	***45%***	***1.7M***	***102k***	***15,000***	***1,720***	***488k***

592

593 The approach incorporating emerging-state actor theory (COA2A) demonstrates significant
594 effectiveness in reducing Total Combatants and Total Population for ISIS to levels lower than even
595 the Baseline Historical. The policy-falsification approach (COA2B) on the other hand fails to deliver
596 a successful intervention, resulting instead in the worst performance out of all considered COA's. By
597 examining the behavior patterns of COA2A compared to COA2B and the Baseline Historical it
598 becomes clear however that COA2B would be considered, at first, the superior option. This is
599 achieved by recreating the dashboard of primary and secondary measures of effectiveness and
600 comparing the behavior modes of the Baseline Historical and COA2A and COA2B in Figure 12 below.
601

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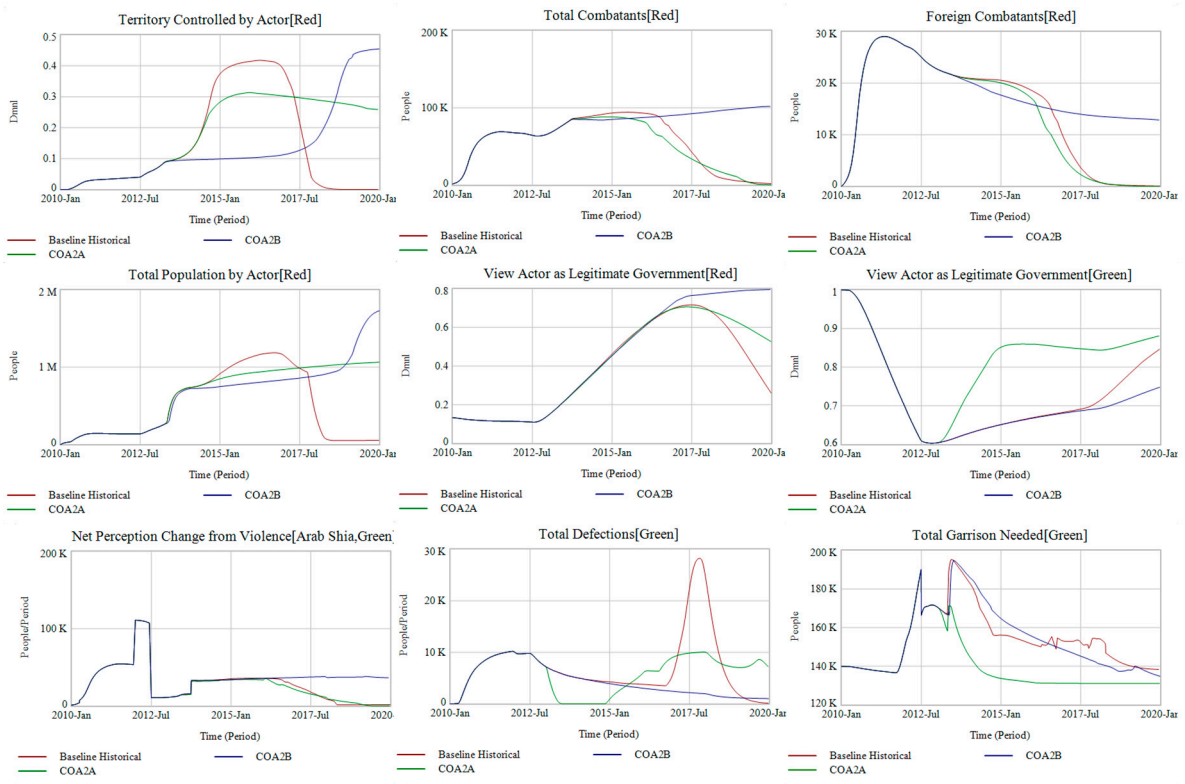

Figure 12. Dashboard Comparing COA2A, COA2B & Baseline Historical

What the dashboard reveals is that, initially, COA2B appears to be the more successful path. On the first row of graphs from the point of intervention in 2013 through 2017, COA2B successfully contains Territory Controlled, Total Combatants and Foreign Combatants for ISIS better than any other COA. Commanders on the ground could be forgiven for thinking that this approach is superior. But those performances are only in the manifest, or visible, system. The latent system, what isn't visible, is depicted in the 2nd and 3rd rows and demonstrates why COA2B follows a "better-before-worse" behavior pattern of early promise leading to later failure. By not improving the legitimacy of the Green actor or reducing the legitimacy of the Red actor COA2B allows several dynamics to emerge. Because Green isn't a credible government to Arab Sunni's or Kurdish Sunni's Total Garrison is higher to secure existing populations, even while Total Defections are also higher. COA2A on the other hand, focusing on legitimacy improvement in Phase I has created conditions for lower defections and less garrison required. This means Green in COA2A has more troops available to confront ISIS than COA2B. The consequences of this latent system emerge shortly after 2017, four years after the initial deployment. ISIS can affect a break-through territorially while consistently increasing its combatant force towards the 100k mark. Even though Defections are less at this point for COA2B, it's because there's little left to defect from the Arab Sunni and Kurdish Sunni forces, nor has there been a recruiting effort of these critical ethnographic groups to replace losses as in COA2A. A common proposal is that state-actors should be willing to accept the reality of political reconciliation with competing non-state actors to end a conflict. What these results indicate however is that a state-actor should also seek political reconciliation with its own people which might cut off the grievance feedback loop which creates the competing non-state actors support base.

This doesn't mean COA2A isn't without its own surprise behavior or tradeoffs. Surprisingly, a focus on legitimacy building activities and containment of violence in Phase I resulted in ISIS never

progressing outside its inner ethnographic envelope. Another surprise was that the internal uprising against ISIS never significantly materialized, perhaps because it was contained within its inner-ethnographic envelope. This makes the subsequent reversal harder as ISIS can move within a more favorable human terrain. A clear tradeoff is that COA2A takes longer to execute than the Baseline Historical. Because of this and the airpower targeting priorities, ISIS's oil production is left untouched for longer. This results in more funds sent abroad by ISIS in COA2A relative to the Baseline Historical. Finally, COA2A has significantly more Total Conflict Deaths even as it's loss of Blue personnel is the least of all. However, those increase of deaths come from military, rather than civilian sources as shown in Table 8 which breaks down fatalities among Green, Red and Civilian sources for each scenario.

Table 9: Casualty Rate all Sources

Experiment	Civilian Casualties	Green Casualties	Red Casualties	Unaligned Local Opposition Fighters
Baseline Historical	249,900	83,750	30,650	27,210
Baseline without Intervention	478,400	177,300	79,450	5,623
COA1A	239,700	105,700	39,010	18,810
COA1B	239,700	106,400	40,210	19,370
COA1C	242,700	115,000	51,780	28,080
COA2A	239,900	199,500	95,460	7,165
COA2B	282,700	164,300	33,030	8403

In this context it's clear that the civilian casualties remain roughly the same as other versions, and less than the alternate intervention with COA2B. However, as there are more Green combatants engaging with ISIS, there is a higher casualty count among Green fighters. Likewise, as the Red Actor is reduced to near-zero, ISIS has more casualties as well. This may call into question the sustained support for such a policy that was having high death totals among its combatant forces.

10. Conclusion

Simulation enables testing policies for intervention against emerging-state actors in a synthetic environment without the real-world risks of inherent in such activities. By modeling the ISIS case across two baseline scenarios the theory of emerging-state actor can be tested and evaluated against other contemporary policy solutions, the historical and counterfactual baseline cases, as well as a falsified version of itself. The first baseline scenario attempted to mirror the historical case of the multilateral intervention in Syria and Iraq. The second assumed the counterfactual of no foreign intervention. Contemporary policies were constructed of momentum solutions, in isolation and combination, tested both under ideal and operationally constrained scenarios then compared to these two baselines. Portfolios of interventions combined into a Course of Action (COA) ranged in size from 40,000-108,000 (the historical baseline estimate.) Evaluating these experiments identified some momentum solutions that failed to achieve any meaningful benefit and others that showed

promise. These experiments revealed key insights into the dynamics of intervention against these actors.

Two general characteristics of an emerging-state actor are the way in which they acquire territory and the human-landscape of which that territory consists of determines their performance. As an emerging-state actor ISIS differs from terrorist groups and insurgencies in that it acquires territory and governs openly. This presents a policy dilemma in planning effective interventions. Reducing or degrading ISIS's capabilities from abroad is made difficult because their resources are generated from within the territory they control. There are few levers to pull from outside this territory. Ethnographic envelopes, the composition of the human terrain, are also key to understanding how an emerging-state actor might react to an intervention. Policies that slow, but do not reverse, the growth of an emerging-state actor such as ISIS while they reside within their inner-ethnographic envelop allows them to benefit from more favorable conditions of recruitment, taxation and lower garrison requirements.

Dynamics of the interventions themselves also bear scrutiny. As proposed emerging-state actors operate in a path-dependent system benefitting from positive feedback loops. Policy timing is crucial as the earlier policies are implemented the more effect will be generated for comparatively less resources. Additionally, there are diminishing returns of purely combat actions that all seek, ultimately, to kill or wound ISIS fighters. Even a portfolio of such combat-focused policies may not have an aggregate effect equal to the sum of its parts.

A final intervention policy based on emerging-state actor theory was constructed incorporating the above insights. The goal was to intentionally target the positive feedback loops which govern an emerging-state actor's performance. The first phase of this proposal consisted of a smaller, earlier deployment focused on building state-actor legitimacy while decreasing non-state actor legitimacy deployed in 2013. Simultaneously it sought to cut the cycle of violence by improving counter-terrorism operations. The second phase consisted of the remainder of troops being deployed in mid-2014 to conduct combat operations within locally recruited ethnographic groups like the Syrian Democratic Forces (SDF) and Popular Mobilization Forces (PMF). This emerging-state actor informed intervention only consisted of ~15,000 troops but performed far better than interventions two-to-seven times as large in deployed personnel, reducing ISIS fighters to effectively zero. Compared to a falsified version of itself, which deployed 15,000 combatants entirely at an early stage but focusing on traditional counterinsurgency roles showed that the benefits of the emerging-state actor policy could not be explained by timing alone. The falsified version performed worse of all.

The emerging-state actor intervention did not come without its own consequences. Tradeoffs included a higher total conflict casualty count (military casualties not civilian) and an increased ability of ISIS to send more funds overseas. To ensure these results did not originate solely from timing-effects the entire 15,000 force was deployed beginning in 2013 in a purely military role. This intervention did not produce the same results, instead creating a better-before-worse behavior mode that appeared to stall ISIS for a time before it broke out and expanded to its largest size and territorial holdings of any intervention. Although responses to non-state actor typically favor military responses or diplomacy seeking political reconciliation, a third path appears to be focusing on political reconciliation between the state-actor and its own populace while using the military to contain the non-state actor and protect the population from harm. Leveraging these dynamic insights with systems thinking may result in an atypical intervention strategy that, at least within the boundaries of the model, appears to perform better at containing emerging-state actors like ISIS.

This paper also demonstrates the utility of a robust, scenario-based simulation model allows for policy testing and research on irregular conflict.

These findings have several weaknesses and could benefit from additional research. The entire premise of a synthetic policy experiment via a simulation requires certain premises, assumptions and abstractions that are represented in the design of the simulation. This is compounded by the nature of conflict which challenges empirical observation and robust data collection. These limitations are discussed throughout Appendix B: Discussion of Model Structure & Parameter Values. The policies selected for analysis were not comprehensive of all possible policies and combinations. As well, parameter values to represent the policies were arbitrarily selected in cases where detailed information might either not exist or be classified. Combinations of different policies, or tested with different parameters, could yield contrary results. Future work could cover a broader policy space with thousands of permutations rather than a handful. Generalizing the model to different scenarios – both in region and time – could yield additional insights into the contingencies within which intervention policies may find success or failure.

Supplementary Materials: The following are available online at www.mdpi.com/link(tbd) : Appendix A Model Documentation, Appendix B: Discussion of Model Structure & Parameter Values, Appendix C: Validation & Confidence Building Tests, Appendix D: Draft User's Manual for E-SAM. As well a zip file with the raw model, copies of all scripts, and all results outputs.

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Appendix A Model Documentation

This appendix includes an overview of model-structure by sector, the complete equations for the model, command scripts for the Baseline Historical and Baseline without Intervention scenarios, and all starting model values. It is sufficient to replicate the model in its entirety and recreate the experiments detailed in this paper.

Appendix B: Discussion of Model Structure & Parameterization

This appendix provides more detailed discussion of the structure, formulation and parametrization approach of select portions of the model. Due to length and other considerations it is available only upon request by contacting the author tbclancy@wpi.edu.

Appendix C: Validation & Confidence Building Tests

This appendix provides full documentation on validation and confidence building tests performed on the model. Included are boundary adequacy, structure assessment, dimensional consistency, parameter assessment, extreme condition, integration error, behavior reproduction, behavior anomaly, family member test, surprise behavior, sensitivity analysis, and system improvement tests.

Appendix D: User Manual for E-SAM

This appendix provides a stand-alone proposed user-manual for use of E-SAM in wargaming and military planning scenarios. It includes an overview of how to set the scenarios, determine Theatre Strategy, and execute Operational Orders. Also includes a glossary of term linked to current US military doctrine sources.

References

[1] T. Clancy, "Dynamics of ISIS - An Emerging State Actor," in 34th International Conference of the System Dynamics Society, Delft Netherlands, 2016.

[2] B. of P. A. Department of State. The Office of Website Management, "Country Reports on Terrorism," 27-Apr-2005. [Online]. Available: http://www.state.gov/j/ct/rls/crt/. [Accessed: 01-Jan-2015].

[3] Kilcullen, David, Counterinsurgency. Oxford; New York: Oxford University Press, 2010.

[4] K. Saeed, "Economic Growth and Political Instability in the Developing Countries: A System View," in Sessions Papers, Chestnut Hill, MA, 1983, pp. 455–468.

[5] K. Saeed, "Government support for economic agendas in developing countries: A behavioral model," World Dev., vol. 18, no. 6, pp. 785–801, Jun. 1990.

[6] F. Renzi, "Networks: Terra Incognita and the case for ethnographic intelligence.," Mil. Rev., vol. 2006, no. September-October, pp. 16–22.

[7] J. G. Turnley, Z. A. Henscheid, M. T. K. Koehler, S. K. Mulutzie, and B. F. Tivnan, "COIN 2.0 Formulation," MITRE Corporation, Bedford, MA, Dec. 2010.

[8] Anderson Jr., Edward J., "Modeling Insurgencies and Counterinsurgencies," Syst. Dyn. Rev., vol. 27, no. 2, pp. 111–141, Jun. 2011.

[9] K. Saeed, Pavlov, Oleg V., and S. Skorinko, Jeanine Alexander, "Farmers, bandits and soldiers: a generic system for addressing peace agendas," Syst. Dyn. Rev., vol. 29, no. 4, pp. 237–252, Dec. 2013.

[10] M. Aamir, "Applying Existing System Dynamics Business Formulations to Model Terror Organizations," in SAND 2014-2212 C, Cambridge, MA, 2014, p. 17.

[11] S. Langarudi and M. Radzicki, "A Simulation Model of Katouzian's Theory of Arbitrary State and Society," Forum Soc. Econ., vol. 47, no. 1, pp115-152

[13] T. Clancy, "Containing ISIS : Analysis of Intervention Policies," in 34th International Conference of the System Dynamics Society, Delft Netherlands, 2016.