MODELING ISIL: UNDERSTANDING THE DYNAMICS OF A MODERN TERRORIST NETWORK

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Abstract

The Islamic State of Iraq and the Levant (ISIL) grew out of the insurgency in Iraq and flourished in the vacuum left after the civil war in Syria and the withdrawal of U.S. forces from Iraq. Its support among Sunni Arabs sprang from their distrust of the Shia government in Iraq and the persecution of Sunni Iraqis after the U.S. withdrawal. Their violent tactics are widely televised as the conduct executions almost every day that become more and more brutal. Although they display the behavior and structure of a traditional insurgency, they also show characteristics of an emerging state actor, and have demonstrated their global reach through acts of violence across the globe. Additionally, their cyber presence on the web and social media enable them to reach thousands of disenfranchised Muslims across the global and potentially inspire acts of violence by ISIL followers. This paper reviews the relevant literature and presents a causal loop diagram to model the dynamic behavior behind ISIL's rise and continued support across the globe. It goes on to examine the potential impacts of several policy options to combat ISIL through the use of these causal loop diagrams.

Key Words

Islamic State, Insurgency Analysis, System Dynamics

Introduction

The Islamic State of Iraq and the Levant (ISIL), sometimes referred to as the Islamic State of Iraq and Syria (ISIS), is a violent extremist organization that rose to power in the aftermath of the civil war in Syria and the U.S. withdrawal from Iraq in 2011. The group and its leader Abu Bakr al-Baghdadi preach an extremist view of Islam and their increasingly violent and brutal tactics have spread across a large portion of Syria and Northern Iraq (Laub & Masters, 2014). ISIL presents a strategic risk to the entire Middle East region, threatens to destabilize the region, and has demonstrated the ability to plan and execute attacks well outside its area of influence.

ISIL traces its roots back to al Qaeda and most of their initial followers supported Abu Musab al-Zarqawi who led the insurgency in Iraq after the 2003 invasion by the United States (Laub & Masters, 2014). It gained support after the U.S. withdrew its forces from Iraq and the Shia led government under Maliki marginalized the Sunni minority and consolidated governmental power within a select group of Shia leaders. Additionally, the terrorist group gained support and fighters from the brutal civil war in Syria, where a majority of its fighters were trained and gained experience fighting against the pro-regime forces there (Wood, 2015). ISIL's leader al-Baghdadi, assumed power in 2010 and in July of 2015 he delivered a Ramadan sermon from the recently seized city of Mosul, Iraq announcing himself as the first caliph in generations (Wood, 2015). ISIL sought to increase its religious legitimacy with this act and truly become an emergent state actor versus a traditional insurgency. A majority of ISIL's funding comes from illegal activities, including extortion, crime, and smuggling, and in 2014 some estimates placed their monthly income at approximately $8 million (Laub & Masters, 2014). However, ISIL also demonstrates behavior similar to an emergent state actor and has developed schools, a legal system, and implemented Sharia Law from its headquarters in Raqqa, Syria (al-Tamimi, 2015).

By June of 2014, ISIL had gained territory in Syria and Northern Iraq that surpassed the United Kingdom in size (Wood, 2015). However, Iraqi security forces, Kurdish militia, and Syrian fighters, assisted by U.S. Special Forces, have begun to regain gain territory from ISIL. Most recently, fighting in

the Iraqi cities of Ramadi and Mosul resulted in significant losses for ISIL; however, they still remain a major threat to the region (Al-Marashi, 2016). Figure 1 presents a map of the ISIL held territory as of March 2017 to include the controlled areas, areas where they recently conducted attacks, and the areas that generally support their cause (Institute for the Study of War, 2017). As shown, their support comes from a very large area of Northern Iraq and they control major cities in Eastern Syria, to include their capital of Raqqa.
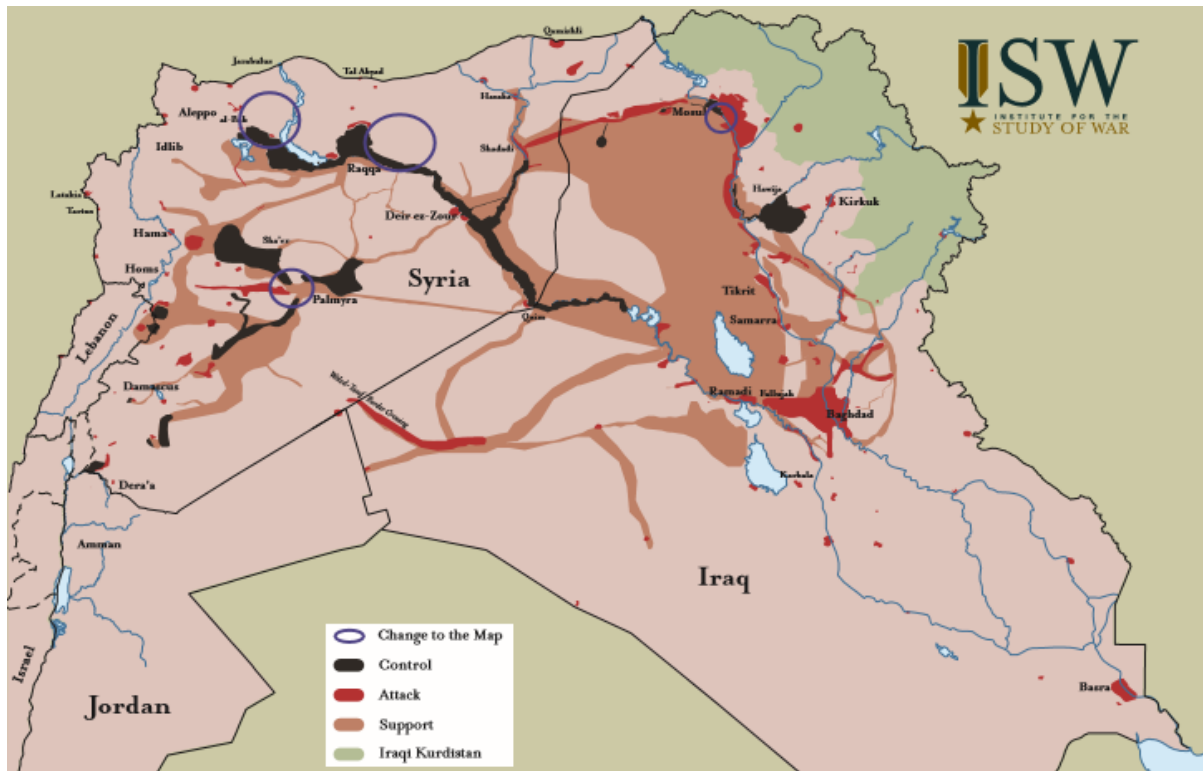

Figure 1: ISIL Territory, March 2017 (Institute for the Study of War, 2017)

One of the more barbaric aspects of ISIL are the brutal, graphic executions of prisoners that they display on the internet and social media to inspire both fear of the group and attract recruits to their cause. Their executions range from mass shootings to beheadings to drowning and burning prisoners alive in horrific acts of violence against anyone whom they deem a threat. Their targets have ranged from American journalists to Iraqi Christians to a Jordanian pilot who was shot down over their territory, each attack insights global outrage against the group. However, at the same time these acts build the reputation of ISIL as the true practitioner of their view of Sharia law and following the Islamic religion (Wood, 2015). However, these acts generally receive outrage from Muslim populations around the globe and most Islamic religious leaders have spoken out against ISIL and believe they are not practicing Islam.

Another interesting aspect of ISIL is the global reach of the terrorist organization and their ability to sponsor attacks abroad as well as inspire their supporters to conduct attacks on their own. One of the methods with which they do this are their recorded sermons and speeches on the internet that live well beyond the life of any individual members of ISIL. One such person, Anwar al-Awlaki, an American born member of al-Qaeda, continues to inspire members of ISIL and supporters of ISIL to conduct attacks years after the U.S. killed him in a drone strike (Scott, 2015). This type of internet presence and recruiting methods has resulted in several attacks across the globe including attacks within the United States in both California and Florida. Additionally, ISIL has been able to conduct sponsored attacks through cells in Europe to include the deadly Paris Attacks in November of 2015 and the bombing of the

Brussels airport in 2016. This ability to extend their reach beyond their geographic boarders separates them from most traditional insurgencies and increases the complex dynamics of the terrorist group.

Literature Review

The literature review section focuses on system dynamics as a method and the literature on insurgencies and counterinsurgencies. System dynamics provides a means to model an insurgency and potential policies for countering that insurgency or terrorist group. The review includes a brief background on system dynamics and focuses on the literature behind causal loop diagrams and stocks and flows. The insurgency portion of the literature review provides a base of knowledge for understanding how insurgencies operate and potential counter insurgency measures to combat them. Additionally, it examines several applications of system dynamics to the modeling and policy analysis of counterinsurgency operations.

System Dynamics

System Dynamics is a methodology to understand the dynamic behavior of systems by exposing the underlying systems structure and modeling the behavior over time to adjust individuals' mental models of the system. Forrester (1961) described the potential for system dynamics to assist decision makers understand the implications of their policies and help with level management problems. His book, World Dynamics, describes his model of the world that described the interrelations between population, capital investment, geographical space, natural resources, pollution, and food production (Forrester, 1971). Forrester's (1968) broad work describes a system as "a grouping of parts that operate together for a common purpose". He further classifies two types of systems: open systems, in which external variables affect the system, or closed systems where all variables are internal to the system (Forrester, 1961).The behavior of a system over time is the dynamics of a system and because of the system's underlying structure they are complex and non-linear in nature (Forrester, 1961). This complexity stems from feedback within the system, time delays between decisions and effects, and the learning process of the system (Sterman, 2000).

Applications of System Dynamics have provided insights across several domains; including corporate policy, infectious disease, commodity markets, and drug addiction, and commodity markets (Forrester, 1971). Companies and consultants have extensively used System Dynamics for managing large, complex projects with a great deal of success. One area where businesses utilize System Dynamics is in the development of corporate strategy and analysis of business decisions after a crisis or complex problem triggers these shifts in business strategy. System Dynamics assists in determining the root cause of the crisis and identifying potential consequences of alternative courses of action (Sterman, 2000). Recently, scholars and analysts have used system dynamics models to gaining an understanding of insurgencies and counter insurgencies (Anderson, 2009).

Causal Loop Diagrams

Causal loop diagrams, key element of system dynamics, are signed diagrams that represent the feedback structure within a system. Casual loops differ from discrete, event-oriented perspectives of individual causes and effects in that any cause is an effect in a closed system (Richardson, 1991). In System Dynamics, the causal loop diagrams indicate that one variable influences another through either physical or information flows. These diagrams describe the behavior of the system by talking through the loop to tell the story of the interactions within the system (Meadows, Randers, & Meadows, 2004).

There are two main types of individual feedback loops: reinforcing or positive loops and balancing or negative loops. Richardson (1991) describes a reinforcing feedback loop as a chain of cause and effect relationships that amplify a change in any one of the variables. A change to any variable in the loop in one direction propagates through the loop to change the original variable in the same direction. The positive loop designation does not necessarily indicate that the loop will have favorable results, quite

often the opposite occurs. Additional when transferred to a stock and flow model, these loops have the potential to grow exponentially (Meadows, Randers, & Meadows, 2004).

Balancing feedback loops work to diminish the effect of a change in a system and restore balance to a system (Richardson, 1991). In System Dynamics, balancing feedback loops bring a system back to a desired level or a level constrained by the system. Forrester (1968) provides a simple inventory control system an example of a first-order negative feedback loop; when inventories falls below a desired level, the order rate increases to increase inventories.   In this type of loop, the decrease to a variable propagates through the loop to increase the original variable.

In natural, human, or engineered systems information or material delays often exist which increase the dynamic complexity of these systems. In material delays conservation of matter applies, so no units will be lost during the delay, but the delay will cause the inflow to differ from the outflow, thus resulting in an accumulation (Forrester, 1961). Whereas in information delays, the information may lose value over time, so the accumulation of information may diminish over time as people make decisions based on old information (Forrester, Industrial Dynamics, 1961). These delays can have dramatic effects on a system's behavior over time and may cause a system to overshoot is goal when the feedback signal is delayed. If the system overshoots its natural limit, the delay may result in the eventual collapse of the system if the delay allows the system to continue to grow to a point where it causes irreversible damage (Meadows, Randers, & Meadows, 2004).

Stocks and Flows

Stocks and flows are the other major component of a system dynamics models that allow for the simulation of the system over time. A stock, general depicted as a box, is a measurable accumulation of material or information within a system. A flow feeds or emanates from a stock and is an instantaneous rate of change, either material or information, between stocks (Forrester, 1961). Mathematically, a model determines the value of a stock by taking the integral of the combined inflows and outflows given the initial conditions of the stock. A simple example of a stock and flow is a bathtub, in which faucet acts as an inflow and the drain as the outflow with the water being the stock inside the tub. When the inflow from the faucet exceeds the outflow of the drain the tub fills with water. Conversely, if the drain exceeds the water from the faucet, the bath tub begins to empty (Sterman, 2000).

Insurgencies

This portion of the literature review focuses on understanding insurgencies, terrorist groups, and the counter-insurgency operations aimed at containing and defeating these groups. It includes some background on insurgencies to better understand how these groups operate. Additionally, is provides a brief summary of the U.S. Army's recently updated manual on counter-insurgencies. Then, it discusses recent applications of system dynamics models of insurgencies. These models serve as a basis for developing specific feedback models of ISIL for this paper.

Background

The Army's Field Manual 3-24, Counterinsurgency, provides an overview of the structure and causes of insurgencies and presents counterinsurgency techniques to combat modern insurgencies (U.S. Army, 2006). This manual assists in understanding the dynamic behavior observed in an insurgency and the interaction between insurgent and pro-governement forces. Kilcullen (2004) describes an insurgency as a complex system that needs energy, in the form of acts of violence and grievances against the government, to sustain itself through several feedback structures. His work focuses on the rise of al Qaeda and the insurgencies in both Iraq and Afghanistan. FM 3-24 argues that the legitimacy of a nation is the underlying goal in any counterinsurgency and nation states attempt to gain legitimacy by improving their economic situation, essential services, and security. Additionally, they attempt to minimize the level of corruption and violence to a level that is culturally acceptable to the people of the nation (U.S. Army, 2006). This aligns with Kilcullen's perspective on understanding an insurgency's effectiveness as the level of corruption and acts of violence that are requirements for an insurgency's success (Kilcullen,

2004). Over time the legitimacy of both the insurgency and the government can change based on the population's perception of the security situation and the essential services delivered by the insurgency or government (U.S. Army, 2006).

System Dynamics Models of Insurgencies

There have been several efforts of applying system dynamics to the modeling of insurgency and counter-insurgency. One of the more prolific examples of modeling an insurgency was developed by PA consulting and published in the NY Times. Although the NY Times article focused on the presentation and use of PowerPoint, the model provided an excellent example of a causal loop diagram for an insurgency (Bumiller, 2010). Although the overall diagram was incredibly complex, the detailed breakdown of the components of the insurgency and security situation in Afghanistan provide excellent analysis of the system structure. More generalized insurgency and counter-insurgency models also provide a basis for understanding ISIL and the dynamic behavior of the terrorist group. Anderson (2009) built a system dynamics model of an insurgency that included both the recruitment aspect of an insurgency and the suppression aspect of a counter-insurgency.

Choucri, et al (2006) built a system dynamics model of state security that assists in the understanding of the dynamics behind an insurgency. Their model included structure behind the movement from the pro-government population to dissidents to insurgents. Additionally they modeled the potential for the insurgent population to be removed by a security force (Choucri, et al., 2006). Other work built upon these counter insurgency models to examine the effectiveness of reconstruction projects within a counter-insurgency. These reconstruction projects focused on building popular support for the government and decreasing the support for the insurgency (Enos, 2012). Additionally, Enos and Farr (2013) expanded on these previous works to understand the dynamics behind security and reconstruction efforts in a counter-insurgency. Their work also examined the potential benefits of investing resources in building partner capacity before a state fails and falls into an insurgency.

More recent work models the regional rise of ISIL and the dynamics behind the recruitment, financing, territory, and legitimacy of ISIL. This work differed from traditional insurgency models in that it focused on ISIL as an emerging state actor that not only works to delegitimize the nation state's government, but also become a recognized state as well (Clancy, 2016). Clancy's model focused on understanding the legitimacy behind ISIL's control of territory in Iraq and Syria. It models the amount of territory controlled by ISIL, size of the fighting force, finances, and the percentage of foreign fighters recruited by ISIL (Clancy, 2016). All of these factors are important for understanding the basis of ISIL in the region and this paper expands upon this work to understand the dynamics of ISIL's impact on a global basis.

Methodology

This section presents the methodology used to depict the underlying system structure and feedback mechanisms presence in ISIL and their operations. Causal loop diagrams provide the basis for understanding the underlying feedback structure of ISIL and help to explain the dynamic behavior of the group. This work does not go as far as to build a functioning model of ISIL, but it does provide some basic stock and flow structures for ISIL that provide a basis for future modeling efforts. The causal loop diagrams and stocks and flows serve as structure for the following section's analysis of potential policy options to combat ISIL.

System Structure

The overall system structure consists of at least five reinforcing and five balancing loops that create the dynamic behavior observed of ISIL and its followers. First, a basic reinforcing loop that models the terrorist groups acts of violence, recruits, and population depicts how the group builds its membership. This loop is balanced by a loop that depicts the fear and outrage against ISIL which decreases the support

for the group. The acts of violence also call for a traditional counter-insurgency against ISIL when their actions reach a tipping point with the global community. There are two other reinforcing loops that relatively new to traditional counter-insurgency models and those depict the social media and web presence of ISIL. These loops also encourage the global reach of ISIL and ISIL inspired groups to conduct attacks such as those seen in Paris, Florida, and California. The remainder of this section discusses each of these loops in greater detail.

Figure 2 depicts the basic insurgency recruitment and acts of violence feedback mechanism that is present in most insurgencies or terrorist groups (Anderson, 2009). Designated as R1, for the first reinforcing feedback loop, this loop begins with an *ISIL Population*, which conducts operations that result in *Acts of Violence*. These acts of violence add to the *ISIL Recruiting Message* which targets dissident populations within the geographical are to bring them into the group. The intent of these recruiting messages is to increase the number of *ISIL Recruits*, which after a training period become members of the *ISIL Population* and add to this stock of terrorists.

Figure 2: R1 - ISIL Recruitment

As evident in the Sunni-Awakening in Iraq, 2006-2008, insurgencies or terrorist groups run the risk of alienating their population when their acts of violence

Figure 3: B1 - Violence Blowback

increase to a point where the local population will not tolerate their actions. In Iraq, al-Qaeda of Iraq (AQI) experienced this in the Anbar province where their acts of terror in the region turned the local sheiks and tribes against them, leading to the success of the US led counterinsurgency and removal of AQI from Al Anbar (Doyle, 2011). Figure 3 presents the causal loop for this portion of the system that shows how terrorist acts of violence can blow-back against the insurgency in the long run. As the group increases their *Acts of Violence*, it also increas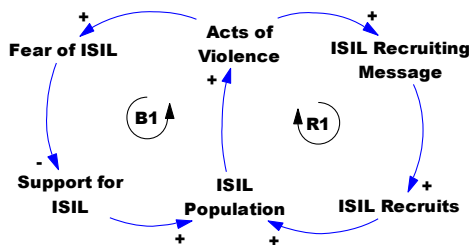es the *Fear of ISIL* in the local region. As insurgencies and terrorist groups rely on the local population to house, fund, and support them, this becomes a problem for most insurgencies (U.S. Army, 2006). If the local population fears ISIL to the point that they no longer align with the group, the Support for ISIL will decrease and without this support the group cannot support the *ISIL Population* stock.

The next diagram describes the traditional counter insurgency feedback that is present in the majority of counter-insurgency operations. The Acts of Violence trigger a Desire to Defeat ISIL through the use of counter-insurgency tactics (Anderson, 2009). As insurgencies are non-state actors, some of the tradition means outside of force, like embargos or sanctions, are not as effective at countering an insurgency (Enos & Farr, State Security Dynamics and the Impact of Intervention to Build Country Capacity, 2013). As depicted in Figure 4, this loop begins as the *ISIL Population* conducts *Acts of Violence* within the region. At some point, this will trigger a *Desire to Defeat ISIL* within local, regional, and
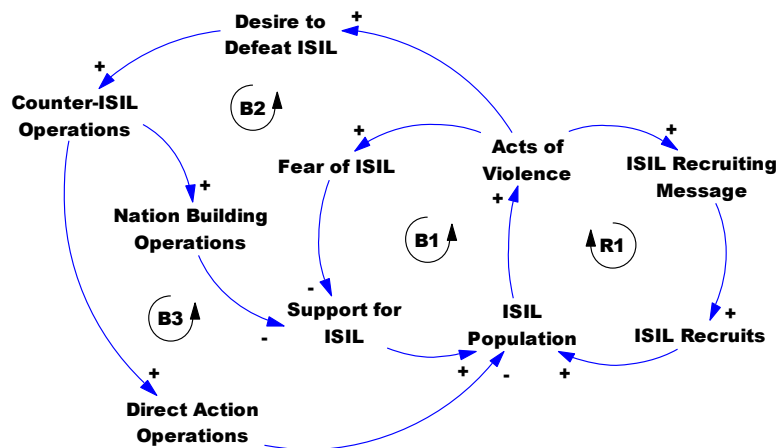

Figure 4: B2 & B3 - Counterinsurgency

eventually global governments that will eventually increase the number of *Counter-ISIL Operations*. These operations generally come in two forms, direct military action against the insurgency or nation building to decrease support for the group. *Direct Action Operations* target individuals or parts of the terrorist organization through the use of military force and intend to directly decrease the *ISIL Population* (Anderson, 2009). Whereas, *Nation Building Operations* indirectly decrease the *ISIL Population* by first decreasing the *Support for ISIL*, which in turn decreases the *ISIL Population* variable (Enos, 2012).

An interesting aspect of ISIL is their use of social media to propagate their message and attract new recruits from across the globe to join their cause. They have become very adept at using social media sites to target disenfranchised individuals and recruit them to their cause in Iraq and Syria (Farwell, 2014). For this reinforcing feedback loop, as the *ISIL Recruiting Message* increase, it in turn increases the *ISIL Social Media Presence*. With an increased presence on social media, the group is able to attract new members globally and increase the *ISIL Recruits*

Figure 5: R2 - ISIL Social Media

within Iraq and Syria for training. As Figure 5 depicts, this eventually leads to an increase in the *ISIL Population*, more *Acts of Violence*, and eventually more material for the *ISIL Recruiting Message* which helps grow the terrorist group. It is estimated that tens of thousands of recruits from France, the United Kingdom, Belgium, German, and the United States have entered the Islamic State to become part of the terrorist organization (Wood, 2015).
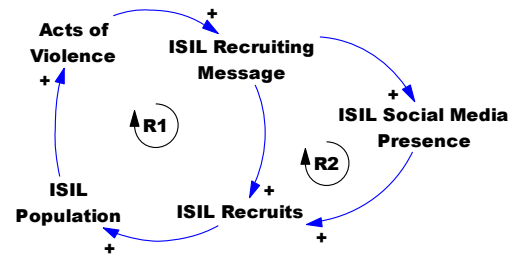
One aspect of the fight against ISIL that sets it apart from tradition insurgencies is the movement of ISIL into the cyberspace domain through the use of social media and the internet. Figure 6 presents several of the reinforcing and balancing loops that help to explain the dynamics of operating against an insurgency in the cyber domain. First, the loop designated as R3 depicts how the *ISIL Videos* increase the *ISIL Social Media Presence*, thus resulting in more *ISIL Recruits*. These recruits then join the *ISIL Population* and conduct additional *Acts of Violence*, resulting in more video content for social media. These videos also increase the *ISIL Web Presence* which in turn increases the *ISIL Recruits* in another reinforcing feedback loop to increase the *ISIL Population*. However, these *Acts of Violence*, especially the barbaric nature of the videotaped executions, increase the *Desire to Defeat ISIL* which results in additional *Counter-ISIL Operations*. In this case, a new aspect of a counter-insurgency is added to the model through *Cyber Operations* which are aimed at decreasing the *ISIL Web Presence*. In this balancing feedback mechanism, there is a significant delay from the time content is posted until it can be countered.
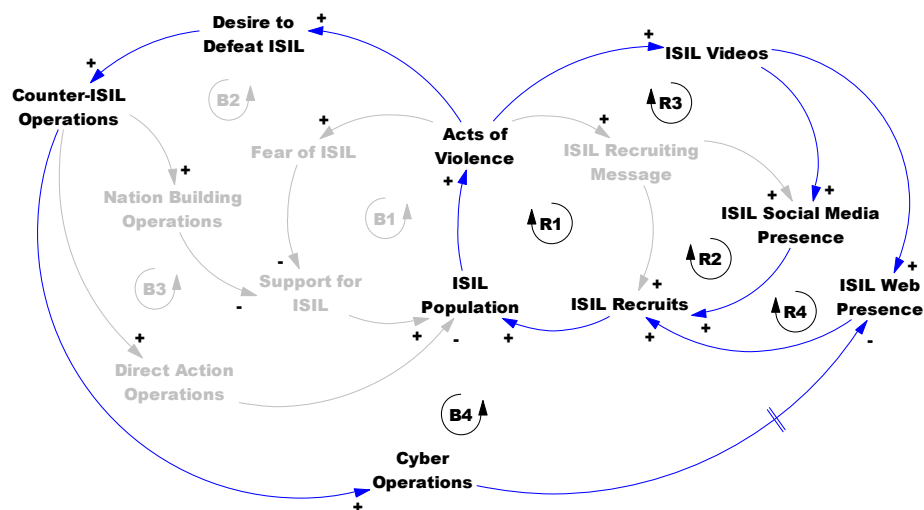

Figure 6: R3, R4, and B4, ISIL Cyberspace Domain

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ISIL ability to reach well beyond its geographic boundaries is another aspect of the terror group that makes it unique from some other historical insurgencies. Similar to al-Qaeda, ISIL sponsors terrorist cells across the globe capable of operating independently to carry out attacks. ISIL conducted a major attack in Paris in November of 2015 in a coordinated attack across the city in which 130 people were killed. Additionally, in March of 2016, ISIL cells conducted attacks across Brussels which included suicide bombers at the airport and a train station (Callimachi, 2016). These acts are examples of ISIL's ability to strike terror across the globe. In this loop, the *ISIL Population* increases the *ISIL Sponsored Attacks Abroad*, which in turn create more *Acts of Violence* credited to the group. This increases the recruiting and brings additional people into the *ISIL Population* in a reinforcing feedback loop. However, by extending their reach beyond their geographic boundaries, they also trigger a balancing feedback loop as these attacks increase the *Global Outrage Against ISIL*. Figure 7 presents this feedback loop and shows how the *Global Outrage Against ISIL* increases the *Desire to Defeat ISIL* and calls for additional Counter-ISIL Operations to include direct action, cyber operations, and nation building.
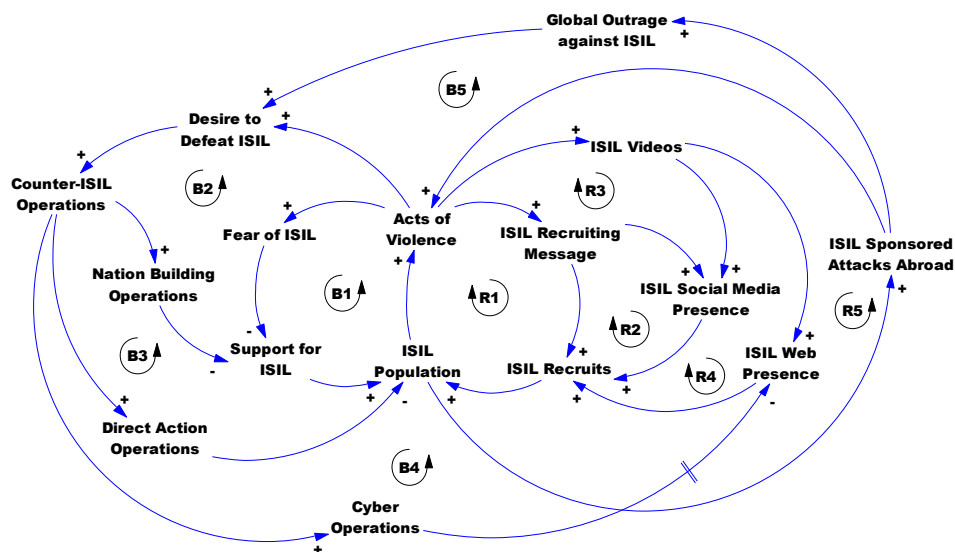

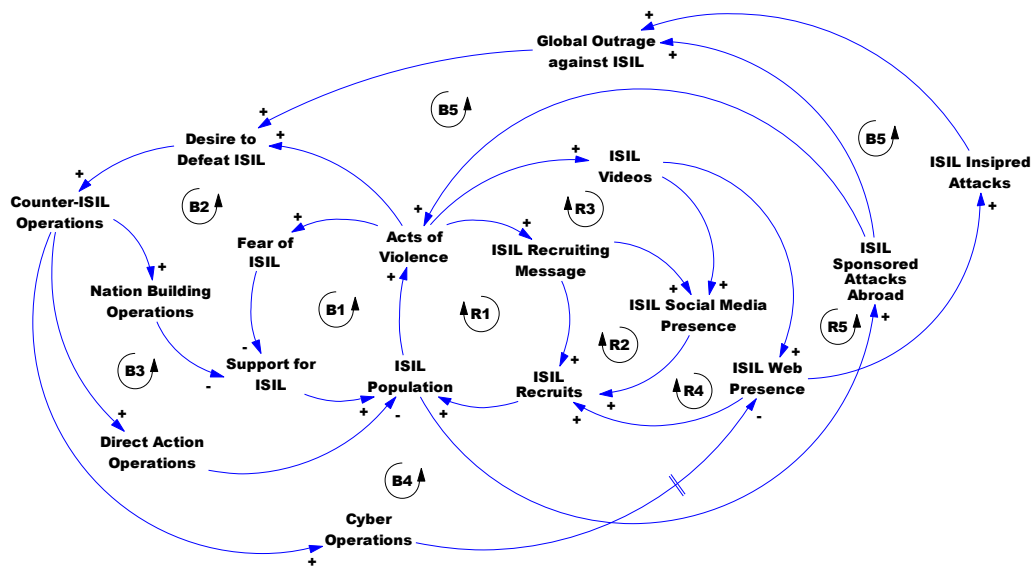**Figure 7: R5 and B5 ISIL Sponsored Attacks Abroad**

Figure 8: B6 ISIL Inspired Attacks

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In addition to the sponsored attacks, ISIL has also inspired attacks across the globe by disenfranchised Muslims who pledge allegiance to the group, but are not actually part of the terror group. Figure 8 depicts how the *ISIL Web Presence* increases the number of *ISIL Inspired Attacks*, but this only adds to the *Global Outrage Against ISIL*. Although these inspired attacks may increase recruitment for ISIL, it is likely that they will create balancing feedback as the *Desire to Defeat ISIL* is increased with these attacks, resulting in additional *Counter-ISIL Operations*. In the San Bernardino attack a husband and wife who had pledged allegiance to ISIL killed 14 people at a business gathering prior to being killed by police in gun battle in the streets (Almasy, Lah, & Moya, 2015). In Orlando a shooter who pledged allegiance to ISIL gunned down 49 people in a nightclub and wounded another 53 before being killed by Police as they raided the nightclub (Ellis, Fantz, Karimi, & McLaughlin, 2016). These individual incidences demonstrate another danger aspect of ISIL and their ability to not only plan attacks across the globe, but also inspire others to conduct similar acts of violence.

Stocks and Flows

This portion of the methodology begins to develop the stock and flow structure as building blocks for a functioning model of the ISIL terrorist group and their operations. It focuses on three aspects of the insurgency group and builds on previous work to create three stock and flow models. The first model is the regional insurgency recruitment model, which models the *ISIL Population* as described in reinforcing loop one. The second stock and flow model depicts the *ISIL Web Presence* and some of the difficulties in combating this part of the terrorist group.

In the first stock and flow model, the basic insurgency model includes the *Pro-Government Population* which has the potential to become part of the *Dissident Population* if the level of security and support from the government decreases. Figure 9 presents this stock and flow model which would be used as a building block for a more detailed model of ISIL and their activities. Additionally, the *Dissident Population* could return as the government increases its legitimacy by providing basic needs for the population. However, through the *ISIL Recruiting Message*, which targets the *Dissident Population*, ISIL is able to gain recruits into their organization. After a training period, they become part of the *ISIL Population*, capable of carrying out *Acts of Violence* against the government and pro-government forces. However, this violence increases the *Desire to Defeat ISIL* and thus increases the *Direct Action Operations* with remove terrorists by killing or capturing members of ISIL.
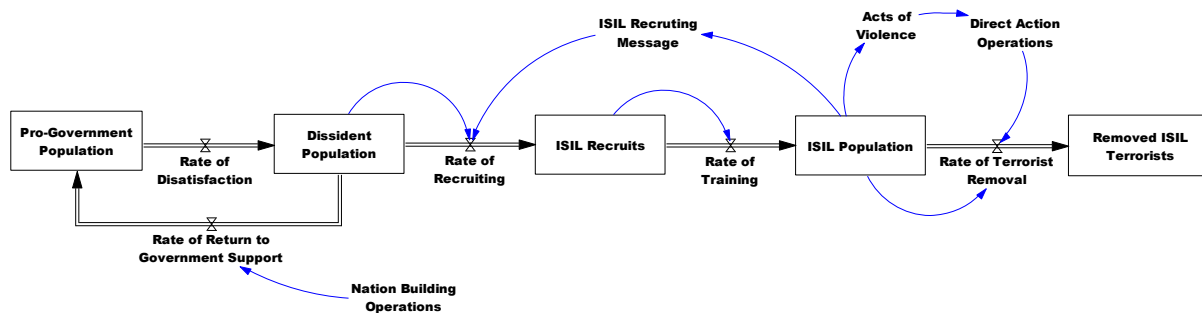

Figure 9: Basic ISIL Recruitment Model

One of the unique aspects of ISIL is its web presence and the use of both the internet and social media to attract recruits from across the globe. Figure 10 presents the overall structure of the cyber domain for ISIL. First, the Acts of Violence often result in ISIL Videos, which include both offensive operations on the ground and the execution of prisoners by ISIL operatives. These videos then become part of the active ISIL Web Presence that is used to recruit additional members to the organization. After a period of time, as with any web content, some of the presence becomes inactive; however, the possibility to access this content remains. Only through the use of aggressive Cyber Operations can the pro-government forces hope to remove the ISIL Web Presence. Similar to the removal of the terrorists

themselves, the web content could also be removed. However, there are several challenges associated with his aspect of a Counter-ISIL Operations. First there is a large time delay between the time a video is posted and when it can be targeted. Also, it may be difficult to fully remove the presence form the internet as the content may exist on several different servers and even individual nodes of the internet.
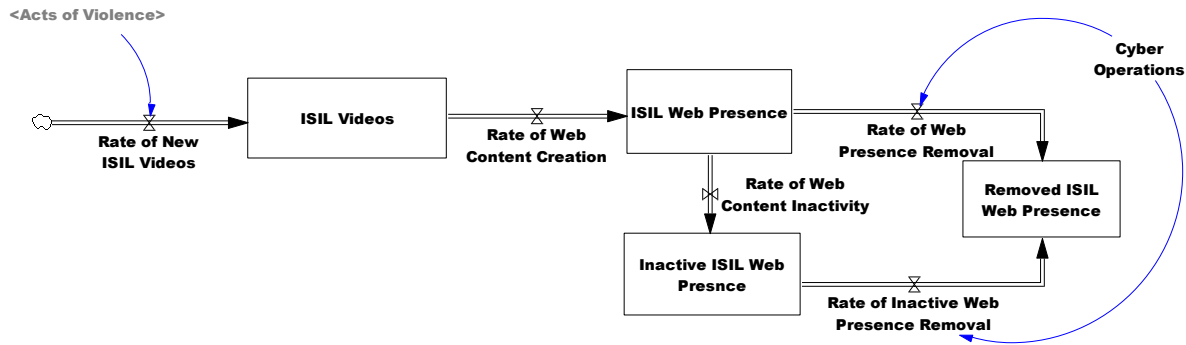

Figure 10: ISIL Cyberdomain Presence

Analysis

This section uses the causal loops developed to determine the potential impact of several different policy options to combat ISIL on a global front. The first policy is to treat ISIL like a traditional insurgency and focus efforts on defeating ISIL on the ground in Iraq and Syria. The second policy looks at the possibility of pursuing an approached based on capacity and nation building within Iraq and Syria to gain support for the governments of those nations and pull support away from ISIL. The third approach focuses on attacking ISIL in the cyber domain to degrade their message on the internet and remove their presence from social media. Finally, an approach that combines a heavy direct action counter insurgency and cyber operations is examined.

The first approach follows traditional counter-insurgency tactics and attempts to decrease the *ISIL Population* through *Direct Action Operations*. These would be targeted operations against individual leadership of ISIL or attacking strongholds of ISIL members across Iraq and Syria. By directly attacking the *ISIL Population*, the pro-government forces hope to stop the *Acts of Violence* by taking advantage of the balancing aspects of the counter-insurgency feedback loop, designated as B3 in the previous figures. However, they would have to combat the other reinforcing feedback loops present that support the growth of ISIL in order to reach a tipping point where this approach would result in the collapse of ISIL.

The second approach indirectly targets the *ISIL Population* through the use of *Nation Building Operations* depicted in loop B2. In this approach the *Counter-ISIL Operations* would focus on the humanitarian side of counter-insurgency in order to decrease the *Support for ISIL*. As Killcullen (2004) points out, the lifeblood of an insurgency is the support that it receives from the local population. With a decrease in *Support for ISIL*, the *ISIL Population* would not be able to sustain itself and would eventually die out. However, this assumes that ISIL would not look elsewhere for support or potentially turn their brutal tactics against the population to a point where they fear and support ISIL more than the pro-government forces.

However, both of these approaches focus on the regional threat posed by ISIL in Iraq and Syria and do not address the global reach of the organization. In the third policy takes a cyber approach to combating ISIL in the cyber domain to directly target the *ISIL Web Presence* and *ISIL Social Media Presence*. Through an increase in *Cyber Operations*, pro-government forces would decrease the *ISIL Web Presence* as feedback loop B4 indicates. However, there are several problems with this type of approach. First, the delay between ISIL developing web content and the counter-ISIL forces being able to find, target, and remove this content. Additionally, it is incredibly difficult to truly remove web content

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as it might exist in multiple places. Take for example the sermons of Anwar al-Awlaki, which exist ten years after his death and continue to inspire attacks (Scott, 2015).

The final approach looks to use the entire spectrum of *Counter-ISIL Operations* in order to take advantage of all of the balancing feedback loops in the model. Pro-government forces must participate in *Direct Action Operations* to remove key leadership of ISIL and retake the territory seized by ISIL in Iraq and Syria and return it to the rightful control of these states. At the same time, forces must work on *Nation Building Operations*, as the security situation dictates, in order to decrease the *Support of ISIL* in the local geographical regions. Finally, by incorporating a robust, offensive cyber war against ISIL, the Cyber Operations would be able to decrease the *ISIL Social Media Presence* and *ISIL Web Presence* in order to decrease the global reach of the organization. This is the only method to deal with both the regional aspects of ISIL and the *ISIL Inspired Attacks* across the globe. The other aspect of this policy is that it cannot end with the defeat of ISIL, as another group may rise in its place. The *Nation Building Operations* must continue until both Syria and Iraq are fully capable of stability in the region and preventing the next al Qaeda or ISIL from emerging.

Conclusion and Future Work

The purpose of this paper is to present a basic understanding of the system structure behind the terrorist group ISIL. It focuses on understanding the feedback mechanisms that exist in ISIL that result in the dynamic behavior observed and presents some of the differences between ISIL and a traditional insurgency. It goes on to create a few stock and flow diagrams that will be the building blocks for future work to develop a functioning system dynamics model of the terrorist group. As described, it examines several potential policy options at a high level using the causal loops developed as part of the analysis of ISIL's structure. Based on the analysis of these loops, it is likely that only a combined cyber and direct action approach will truly remove ISIL as a global threat.

There is still much future work to be done in order to make this a truly useful model of ISIL and serve as a base model for modern insurgencies. Although it moves beyond tradition insurgency models by incorporating the social media and internet aspects of a modern insurgency it does not have a function model of the terrorist group and its actions. Future work should include building a system dynamics model of ISIL, calibrating this model to know data about the size of the group, territory it claims, and acts of violence. The model could then be used to better understand how the group has been able to attract so many foreign fighters to its ranks and inspire acts of terror across the globe. With a calibrated model, more detailed policy analysis would be possible and a more solid recommendation could be made for how to combat ISIL on all fronts.

It is widely accepted that ISIL must be removed from the globe as it threatens the security of world; however, there are several different approaches that may defeat ISIL. It is important to understand the potential unintended consequences from this action. Is it possible to defeat ISIL and remove their message from the globe? Or will the actions of a few nations in an effort to defeat ISIL just create an even worse enemy of the world? Hopefully, through the use of system dynamics modeling, these questions can be answered and more information will assist decision makers understand the consequences of their actions or inactions.

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