Terror Contagion Hypothesis Exploratory Model
Supplementary Materials v0.7

Contents

A-1 INTRODUCTION

The Terror Contagion Model is an exploratory early stage system dynamic simulation model of the Terror Contagion Hypothesis[1].

PURPOSE

The terror contagion simulation is not designed to simulate terrorism in general. Instead, it is developed to simulate the novel terror contagion hypothesis. We do this to build confidence and greater understanding of the novel terror contagion hypothesis. Although the simulation is in the early stages of development, it roughly replicate patterns of growth and decline of violent ideologies observed in the historical record. The model is designed to conduct experiments on contingencies of key propositions of the hypothesis and policy formulations. Although in the supplementary materials we only simulate a generic terror contagion, the simulation can be parameterized with the known characteristics of at-risk population and corresponding violent ideology.

A-1.1 General Capabilities of Terror Contagion Model

The Terror Contagion Model operates by importing a "profile" and then running the model. A profile consists of the initial stock values and parameter specific values of either a generic or researched violent ideology. This includes success rates, average fatality rates, factors related to the at-risk population, and the extent to which this violent ideology is, or is not, supported by non-state actors in the ungoverned space. Additionally, profiles contain policy response options so that a specific policy can be tested against a specific violent ideology. In the base runs these profiles are constructed as generic, using average values determined from prior research across a continuum of terrorist behavior identified in both US and WEUR[2].

A-1.2 Realism versus Precision

The analysis generated from these capabilities is intended to be *realistic* even if it is not always *precise.* By *realistic* it is meant that the causal interactions of the elements of structure within the model that generate behavior, that over time the behavior is reasonable, and the results familiar enough in behavior shapes to be observed historically. Parameter values represent what is known from sources or modeler judgement on plausible values. All sectors dynamically interact with one another allowing for propagation of 2nd and 3rd order effects. What is meant about not being *precise* is that the parameter values are left as they were found in evidence or estimated by prudent means. They are not further subjected to 'fitting' with exogenous factors that may produce slightly more accurate results, but at the cost of creating inaccurate or implausible structural methods. The goal is for the model to represent known, or suspected, real-world phenomena and minimize mathematical fitting which may produce a more accurate result, but it is not clear what a mathematical adjustment represents in the real world.

This being said, the behavior of the Terror Contagion Model, for an early-stage model for exploration and understanding, is able to realistically and plausible behave under a wide variety of circumstances.

A-1.3 Structural & Formulation Calibration

This is not to say calibration wasn't performed. Where model behavior differed significantly from historical behavior – calibration was accomplished by structural changes in the model itself. By

improving the model based on these assessment, "calibration" was achieved with more and more realistic behavior without having to resort to parameter modification based on numerically computed payoff scenarios.

The purpose of this approach, valuing vividly explicit structure generating realistic behavior over numerical precision is to ensure that the model can generate many plausible behaviors – and not just the single behavior historically observed. This is especially important for the desire of the Terror Contagion Model to be effective in analyzing a wide range of different violent ideologies across different regions. For example, we know how Columbine created a cascading string of replication attempts over the years. The model endogenously creates a similar rapid expansion in the baseline scenario – but the timing of incidents is different from found in the real world. "Fitting" the model via calibration to ensure that specific school shooting replication attempts occurred at the same time as the Columbine inspired ones may be more *precise* to the historical mode, but such a model may no longer be able to create an endogenously generated behavior mode where Columbine *doesn't* inspire replication, or a policy intervention effectively keeps the contagion from occurring. The causal mechanism by which Columbine fails to spark a contagion is more important to research, policy analysis and operational planning than a numerical fitting which ensures what we already know to be true appears in the baseline scenario.

It is the breadth of potential scenario outcomes that the Terror Contagion Model can generate which makes it ideal to analyze a variety of policy options, including the choice of *not* undertaking a specific action. For researchers it is the ability to remove key components of a known environment and ask, "but for this would this have happened." Because the focus is on *realism* versus *precision* these results should be taken as reasonable approximations of what is likely to happen to behavior over time, given the values of the parameters and underlying assumptions of the model as described in this section – but not necessarily indicative of precise timing down to the day.

A-2 REVIEW OF REFERENCE MODES AND CAUSAL LOOP STRUCTURES

The Terror Contagion Model is designed to replicate the Causal Loop Diagram of the Terror Contagion Hypothesis. These

A-2.1 Historical Time Series Behavior

Our analysis of ~4,600 terrorist incidents identified several growth reference modes[2] of terrorist incidents depicted in Figure 1. These include completed and uncompleted attempts, measured in per-capita of 1M population and classified by Violent Ideology.

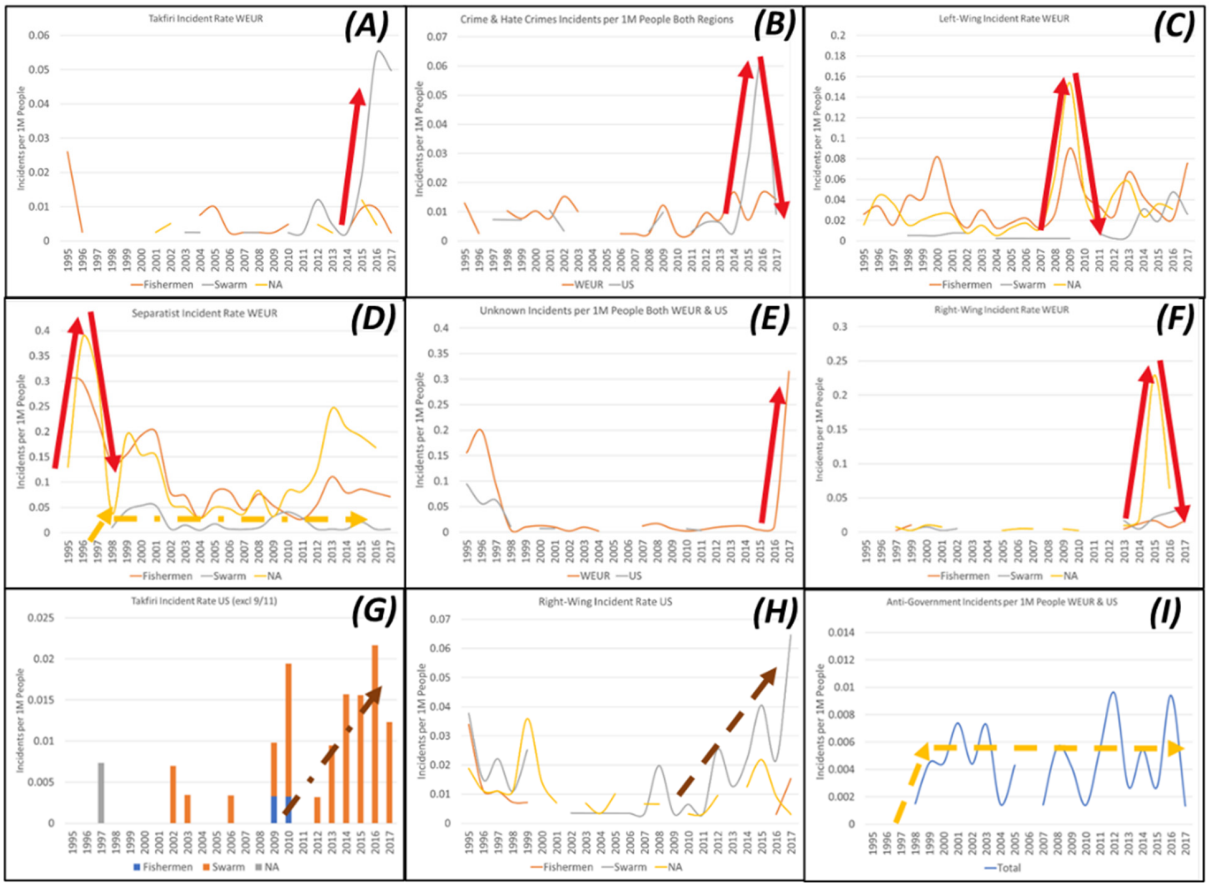


Figure 1: Select Violent Radicalization Growth Modes over Historical Time Series Behavior

A-2.2 Violent Radicalization Growth Modes Subsuming Historical Time Series Behavior

In Figure 2, we collected and abstracted these historical patterns into a single reference mode depicting the multiple ways incidents can grow. We assume an Equilibrium pattern in the historical (left side) portion of the chart. Violence may be occurring, so the line is not at zero. But radical violence is but it is indistinguishable from normal criminal patterns. At the vertical bar in the chart, the first mass-violent terrorist incident within a given violent ideology and template method occurs. We term this the "seed event. And it is from the seed event that the five reference mode growth patterns occur. Either a continuation of Equilibrium (EQ), Failure to Growth (F2G), Struggle to Grow (S2G), Contagion (CONT), or Strong Contagion (CONT+). To these five we add two modes reflecting "Hoped" and "Feared" outcomes. The gray Hoped and Feared reference modes are useful in evaluating policy options which may result in a behavior not represented by the aggregated historical modes. In the Hope scenario, radical violence decreases from pre-seed levels. In the Feared outcome, radical violence increases and finds a new equilibrium at a higher level than before where it sustains. This also reflects that the simulation is capable of generating, and sustaining, new equilibrium.

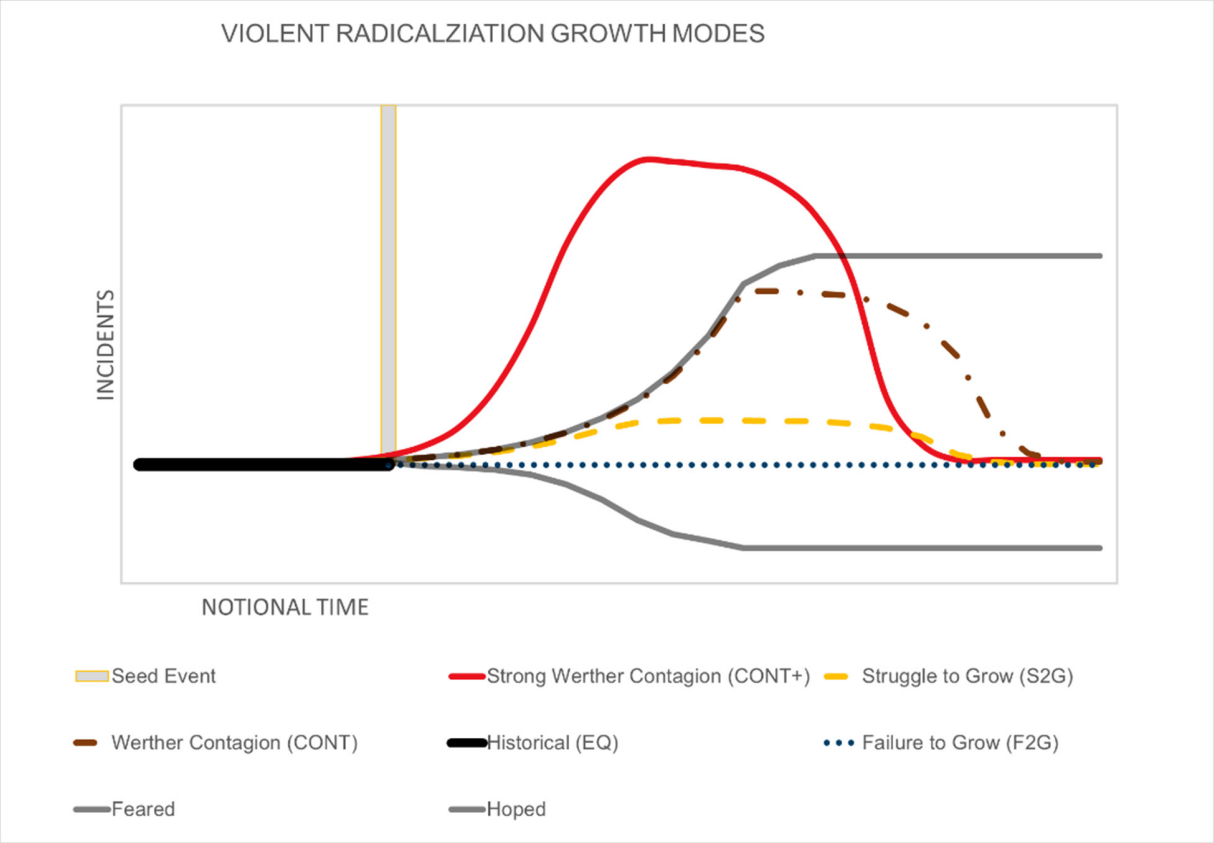


Figure 2: Terror Contagion Reference Modes.

A-2.3 Terror Contagion CLD

Synthesizing expert theories we developed a Causal Loop Diagram (CLD) system structure of violent radicalization that we believe can generate these reference modes and this is displayed in Figure 3[1].

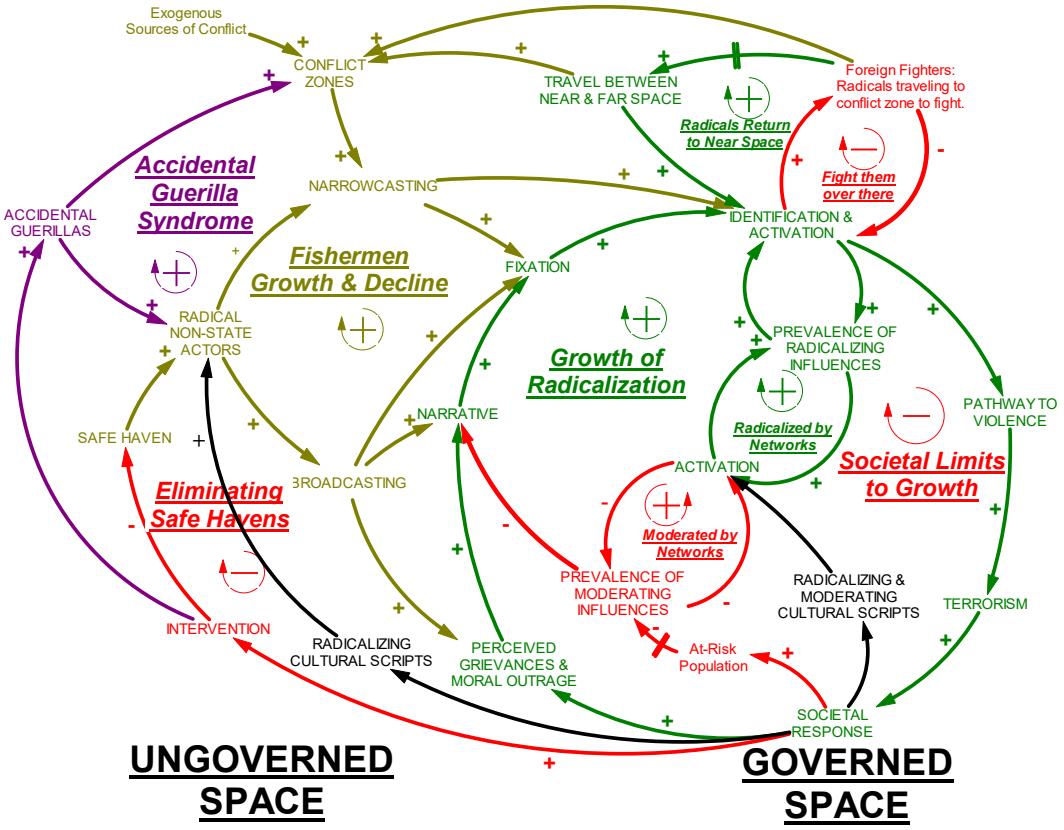


Figure 3: Terror Contagion System Structure.

A-2.4 System Hierarchy CLD View

After creating the "flat" CLD view we used a system hierarchy to associate the causal mechanisms within different levels of system behavior as depicted in Figure 4 [1].

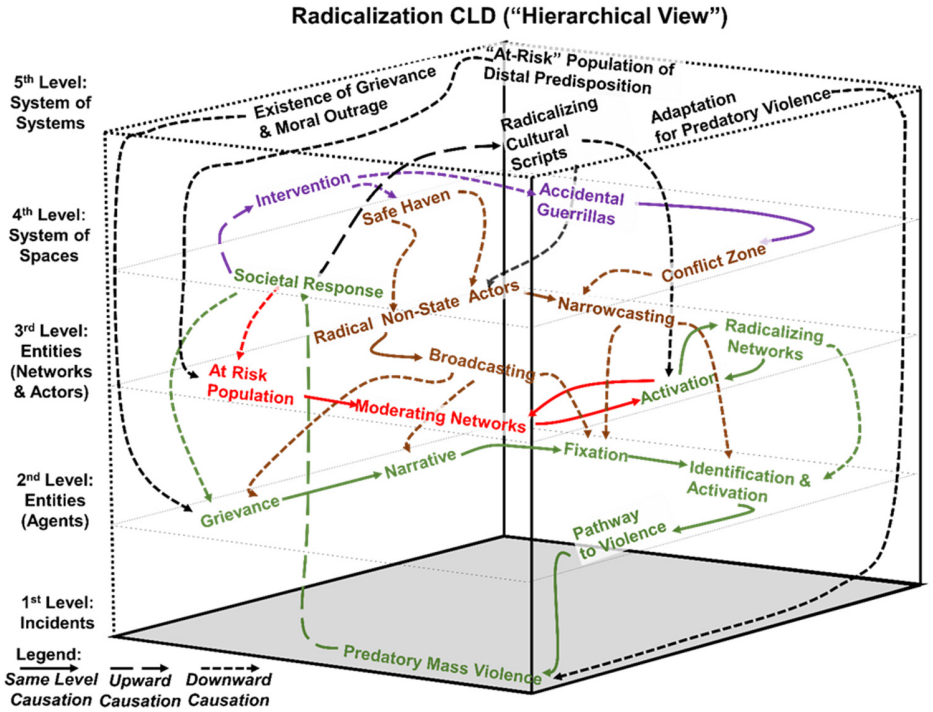


Figure 4: Hierarchical View of Violent Radicalization System Structure.

A-2.5 Terror Contagion Root Causes CLD

Using system science and testing system hierarchy levels we identified a subset of root causes operating at the highest level of system structure and this is depicted in Figure 5 [1].

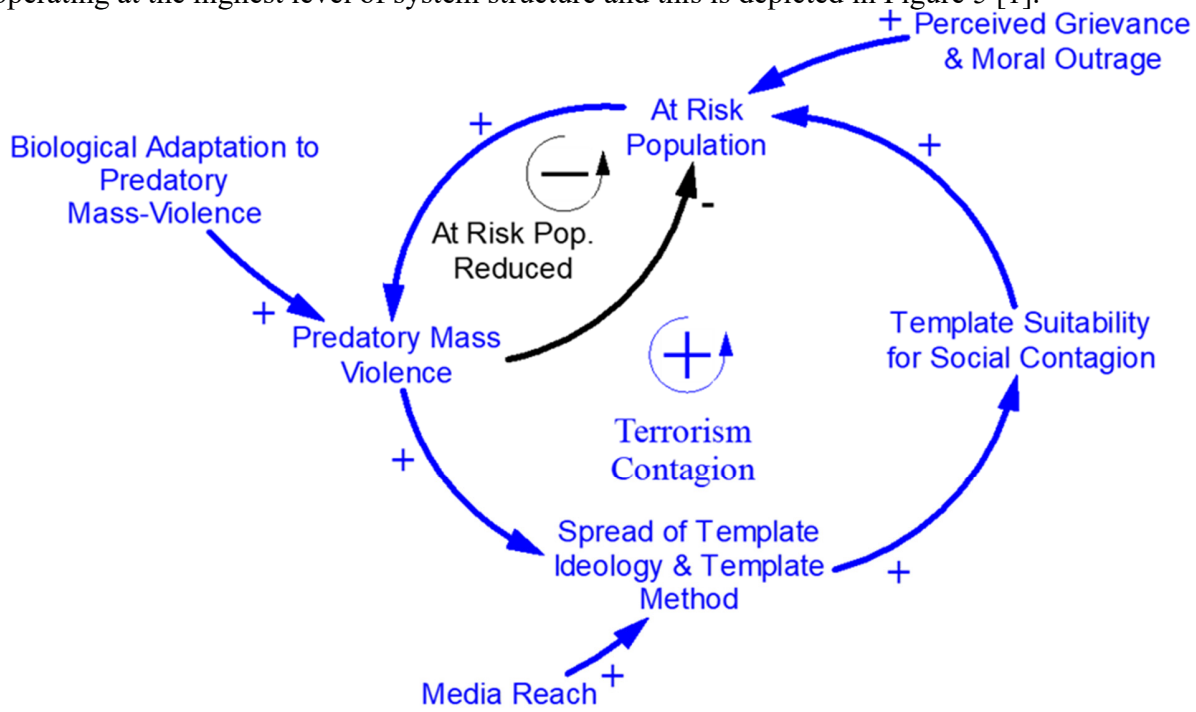


Figure 5: Terror Contagion Root Causes CLD

A-3 Glossary of Terms

Accidental Guerilla Syndrome

The Accidental Guerilla syndrome occurs where military intervention into the ungoverned space causes occupants of that area (for whom it is the 'near space' in their perspective) to oppose the foreign actors[3, p. 38]. Visibly violent interventions allow radical non-state actors to "paint themselves as defenders of local people against external influence" and also triggers a balanced opposition response where locals tend to ally with "closer against more distant relatives, with local against external actors" [3, p. 38]. The strength of the accidental guerilla reaction weakens with "slower, less violent, more locally based, or lower in profile" interventions [3, p. 38]. This is because accidental guerillas emerge not in support of a radical ideology, but in support of local interests or "because they are alienated by heavy-handed actions of the intervening force [3, p. 38].

Antiterrorism

We use the Joint DoD definition of antiterrorism as "defensive measures used to reduce the vulnerability of individuals and property to terrorist acts, to include rapid containment by local military and civilian forces.[4, p. 17] We locate these measures as creating impact once a violent radical has gone out the door and begun a terrorist incident.

See also antiterrorism, counterterrorism, counter radicalization, and deradicalization.

At-Risk Population

At-risk population to identify a generic population drawn from any region, culture, exposure to violent ideology, or specific circumstance. Recent research supports this generic approach. TRAP-18, a risk-assessment tool, identifies individuals within this at-risk population on the pathway to predatory mass-violence. The tool consists of eighteen generic indicators, ten distal characteristics, and eight proximal behaviors. These indicators are generic, rather than ideologically based, robust across populations including Islamic terrorists, extreme right-wing terrorists, and single-issue terrorists for all but four TRAP-18 indicators [5, p. 6] [1]..

Behavior Mode: CONT, Contagion

A terror contagion (CONT) is the baseline and default reference mode of the terror contagion hypothesis. It simulates a scenario where after a seed event, conditions are sufficient to generate and sustain the wave-based pattern of a contagion over time.

Behavior Mode: CONT+, Strong Contagion

A strong contagion (CONT)+ is an amplified contagion pattern where the contingent values of the system are favorable enough to cause a normal contagion to produce significantly more incidents and fatalities than a Contagion (CONT.)

Behavior Mode: EQ, Equilibrium

A baseline behavior mode wherein any terrorism conducted by violent radicals is indistinguishable from everyday criminal violence. By definition the EQ base mode does not contain a seed event. So, when policy interventions can return a contagion behavior mode to EQ levels, despite a seed event and other contingencies, that is a useful indicator of policy strength.

Behavior Mode: F2G, Failure to Grow

A behavior mode where after an initial seed event, the terror contagion struggles to distinguish itself in behavior or numerical incidents from the Equilibrium (EQ) behavior mode.

Behavior Mode: S2G, Struggle to Grow

A behavior mode where after an initial seed event the terror contagion grows in adoption but does not generate or display wave like behaviors.

Broadcasting

Broadcasting is the broad dissemination of cultural scripts from the ungoverned space into the governed space, satisfying the first criteria of a cultural script contagion. These cultural scripts fuel violent ideologies facilitating the early development of radicalization. Shared examples of ungoverned space suffering of an in-group at the outgroup's hands increase perceived grievance & moral outrage while also contextualizing the grievance into the Narrative. With a dedicated information office's productivity, the non-state actor can also provide a continuous stream of new content and facilitating fixation [6, p. 5830].

Causal Class

Complex systems consist of classes that can be organized vertically in ascending levels of hierarchy. This is a hierarchy of classes rather than ranks within classes. Consider a business example where we identify classes by the nature of the entity within the class. Workers and managers would be in the same class of entities called “people”, even if their ranks differed within that class. However, the company itself is a different class of entities than people and operates at a higher order of structural hierarchy. Likewise the markets within which the company operates and even the economy within which the market exists are themselves separate classes of entities from companies or people and operate at higher levels of structural hierarchy[1].

Causal Hierarchy

Causal hierarchies are arranged wherein “each lower level underlies what happens at higher levels” and each “different level of the hierarchy function according to laws of behavior appropriate to that level...describable only in terms of language suited to that level” [7, p. 127]. Bottom-up structural causation is when a lower-level hierarchy *causes* change at a higher-level system – the worker influences the company, influencing the market, which influences the economy. Top-down causation is when a higher-level action *causes* changes in the lower levels. An economic downturn constrains the market; the constrained market causes the company to furlough the worker. Root causes of complex systems tend to be a small collection of the partial simultaneous causes that operate either in a bottom-up or top-down mechanism, without which no other causes could manifest[1].

Causal Rank

The ascending order of ranks by causal type within causal class, where the Material or Physical Cause is the lowest rank of a class and the Final Cause or Teleos is the highest rank in a class[1].

Causality Type

To determine order of causation within a class we leverage recent work by Ellis on adapting original Aristotelean terms to more current terms and examples. Presented in Table 1 the four causes rise in ascending order from material to final causes and are taken from Falcon [8] unless otherwise noted. We use an illustrative example of a house being built.

Table 1: Causal Type, Rank and Meanings

Causal Type	Aristotelean Term	Current Term [7, p. 132]	Example: Why was a house built?
1	Material Cause	Physical Cause	The physical or material causes the actors use for a thing to happen. E.g., A house was built because the workers hired by the contractors' hammered nails into wood to raise a frame.
2	Formal Cause	Immediate Cause	The actors or actions which directly cause the thing to happen. E.g., A house was built because a general contractor hired workers to follow the architects plans.
3	Efficient Cause	Contextual Cause	The cause which determines the form of the act from among all the potential forms that could still fulfill the ultimate cause. E.g., A specific kind of house was built because an architect designed plans for it to be built in that way.
4	Final Cause	Teleos	The ultimate cause of why something is done, without which, it never would happen. E.g., a house was built to have a home to live in.

Combating Terrorism

We use combating terrorism as the umbrella term within which "actions, including antiterrorism and counterterrorism, [are] taken to oppose terrorism throughout the competition continuum[4, p. 39]."

Conflict Zone

We define a conflict zone as an area of active conventional or irregular military conflict. In contrast, the non-state actor located in this zone may be a participant in the conflict or simply exploiting state weakness. Safe havens and conflict zones can coexist because, despite the local military conflict, sovereign state actors still have difficulty reaching and disrupting non-state actor efforts.

Contingencies

Contingencies are the value or level of a proposition of the terror contagion system structure. Contingent values are used to evaluate the strength of a proposition and whether it is truly a root cause or not. Contingent values can also create channels within the system that define latent boundaries only within which manifestations can emerge. For example the given contingencies of an At-Risk population that is too small in number may create a channel within which the only manifestation of the terror contagion hypothesis that can occur is when it is bolstered by non-state actors operating in an ungoverned safe haven and casting cultural scripts into the governed space[9], [1]..

See also channel, manifestation, and propositions.

Counter Radicalization

Counter radicalization efforts target populations of at-risk people and the communities they operate within, seeking to break the cycle prior to individuals becoming radicalized and then at risk of activating onto the pathway to violence which leads to a terrorism incident.

See also antiterrorism, counterterrorism, and deradicalization.

Counterterrorism

We use the Joint DoD definition of counterterrorism as "activities and operations taken to neutralize terrorists and their organizations and networks to render them incapable" of committing terrorist acts[4, p. 52]. We locate these interventions on the pathway to violence once a radical has activated but before they have gone out the door to begin a terrorism incident.

See also antiterrorism, counter radicalization, and deradicalization.

Crimes & Hate-Crimes

Incidents are motivated by racial, gender, religious, or other animus that do not already fall within another category. Includes incidents that do not fall into an ideological motivation other than to "send a message" to a broader audience, including school-mass shootings, church arsons, and anthrax letters where intent on signaling is unclear hate-crime related[2].

*Violent Ideology: **Left-Wing***

Anarchist, communist, anti-trade, anti-capitalism, anti-austerity/bailout, environmentalist, animal rights, anti-research[2].

Cultural Script Contagion

Cultural script contagions are well known to further social contagions of self-harm in suicide [10], [11] as well as affective and predatory violence [12], [13], [14]. These cultural script contagions consist of three mechanics in the literature to which we have added a fourth from TRAP-18. First, the cultural script itself is broadcast in a *one-to-many* way resulting in broad distribution across the population[15]. Second, the general population receiving the script is filtered by *similarity bias* to those who see themselves in the script's originator or content [16]. Third, the subset population is narrowed a second time by prestige bias. Those individuals viewing the script originator as having high-status, celebrity, or in the case of violent behavior, notoriety[17, pp. 558–560]. Finally, a fourth subset who share distal characteristics indicating potential predisposition from TRAP-18. A Werther social contagion occurs when cultural scripts of violent radicalization are broadcast globally and then filtered to smaller and smaller populations by *similarity bias, prestige bias,* and finally, possessing TRAP-18 distal predisposition characteristics. Resulting in an at-risk population within which violent radicalization occurs. We note that the pathways of transmission of cultural scripts, and the specific embodiments of a script, consist of material and information artifacts. These are tangible or virtual objects which can be measured. However, the cultural script itself is representative of a symbolic abstracted entity[1]..

Cultural Scripts
Cultural scripts are an abstracted, symbolic, meta-language conveying "cultural norms, values and practices in terms which are clear, precise, and accessible to cultural insiders..."[18, p. 153]. Violent cultural scripts convey radicalizing content and a modus operandi, manifesting radicalization in predatory mass-violence acts[1].

Deradicalization
Deradicalization efforts target already the already radicalized and seek to cause them to abandon their radical ideology or at least shift it from violent to non-violent.

See also antiterrorism, counterterrorism, and counter radicalization.

Echo Chambers
Echo-chambers concentrate the selection preferences for radicalizing individuals for cultural scripts of their preferred conspiracy narrative. The echo-chamber strength is relative to the inter-network crossover from the moderating network effects.

Far Suffering
Grievance and moral outrage the source of which occurs in the ungoverned space.

See perception of grievance and moral outrage.

Fishermen Radicalization Template
Swarm and fishermen templates are like blueprints for this bridge of violent radicalization. Fishermen radicalization is "top-down," facilitated by non-state actor organizations that identify, recruit, and radicalize individuals [5, p. 195]. To qualify as fishermen radicalization, an individual does not have to join the group, but the interaction should be meaningful. Only consuming a limited amount of non-state actor propaganda is insufficient.

Fixation
Fixation focuses on at-risk individuals crossing the bridging of radicalization in the governed space. As narrative increases, it increases the prevalence of fixation among the at-risk population, described as "increasingly pathological preoccupation with a person or a cause, accompanied by a deterioration in social life, occupational life, or both" [5, p. 2]. Fixation occurs in both physical settings and "in virtual reality, the more intense the fixation, the greater the number of constant social media postings…increased perseveration, stridency, negative characterization of those who oppose the cause, or an angry emotional undertone"[5, p. 2].

Governed Space
The governed space has two conditions. First, it is the space within which the population the violent radical seeks to attack. Second, the governed space is a non-permissive environment for violently radicalized individuals to operate with impunity[1].

Group Cohesion

Mutual group reinforcement binds the ecosystem of radicalizing networks together as reluctant adherents succumb to "mutual encouragement egg[ing] them on to greater heights"[19, p. 88] of belief. As supporters and deniers of violent ideology become isolated from one another accelerating radicalization through "a double process of outside social isolation and internal mutual reinforcement"[19, p. 86]. This 'egging on' results in seeing who can best blend "moral outrage, personal experience…and a specific interpretation" resulting in a violent ideology interactive echo-chamber where members are "encouraging escalation of grievances and beliefs in conspiracy to the point of hatred"[19, p. 87].

Group Reinforcement

Ideological identity and social-network identity overlap to form a camaraderie that inhibits abandonment. In one example, a reluctant terrorist cornered by police chose to die rather than surrender because he was with "six of his best friends. He could not abandon them even if he disagreed with them"[19, p. 86].

Identification & Activation

Identification, and activation involves adopting a pseudo commando or warrior mentality often activated by network influences. Identification is the at-risk individual's self-actualization as a violent radical beginning to "identify with previous attackers or assassins…as an agent to advance a particular cause or belief system"[5, p. 2]. Such identification places the violent radical as the hero-in-their-own story and legitimizes their use of violence[19, p. 80]. Fixation and identification work together "fixation is what one constantly thinks about; identification is what one becomes"[5, p. 2].

Illusion of Numbers

Illusion of numbers occurs when an individual being radicalized in self-selected echo chambers is barraged by a repetition of the conspiracy narrative cultural scripts, and individuals "become more convinced that perhaps the belief is true since their whole social universe accepts it," resulting in what Sageman calls "hardening of strange beliefs" [19, p. 117].

Manifestation

Manifestations are the circumstance specific realization of contingent values of system structure propositions within violent ideologies in given regions. For example, lone-wolf school shooters in the United States are a manifestation of a given at-risk population of high-school and college aged young adults who share a set of self-similar markers, radicalization pathways, and modus operandi. Incels are a different manifestation that may overlap some of those contingent values (e.g. demographics) but vary in ideology and preferred template method [1].

Mass Shooting

We adopt the Congressional Research Service definition of mass shooting as a form of mass violence "as a multiple homicide incident in which four or more victims are murdered with firearms, within one event, and in one or more locations in close proximity.[20]" Within this overall definition of mass shooting subtypes including felony, familial, workplace, and active shooting events emerge. For purposes of our research on violent radicalization we

focus on only active shooting events, which is the form of mass shooting associated with public mass violence that qualifies under the GTD criteria of terrorism.

See also mass violence.

Mass Violence

We adopt the statutory definition of mass violence as passed into public law by Congress as "3 or more killings [20, p. 2]" and as further refined by FBI practice that the killings occur "within one event, and in one or more locations in close geographical proximity.[20]" Within this definition we recognize four sub-types of mass violence: felony, family, public, and workplace. Felony mass violence is when murder "is used to achieve some primary criminal objective, typically involving financial gain. In most instances, the murders serve to eliminate witnesses of a robbery, drug crime, or gang-related attack[21, p. 7]. Family mass violence are "principally defined by a close victim–offender relationship…typically kill[ing] everyone present in the home, including family pets[21, p. 3]." Public mass violence is when a perpetrator aims "to kill as many people as possible, leading him or her to choose densely populated public areas such as a mall, college campus, or nightclub in urban or suburban areas[21, p. 5]." This definition includes workplace violence[21, p. 6]. For purposes of this research, we focus only on public mass violence that meets the GTD criteria as terrorism, which may exclude certain incidents of workplace mass violence.

Moderate Propositions

A moderate proposition can strengthen or weaken a Contagion between the modes but not eliminate it based on contingencies. For example, a non-state actor using a safe haven in the ungoverned space to both broadcast and narrowcast cultural scripts is considered a moderate proposition because the contingent value of that activity can strengthen or dampen an existing behavior mode, but it cannot eliminate the baseline Contagion (CONT) behavior mode completely[9].

NA Template

Incidents within the N/A categorization may belong to a third kind of manifestation that is neither Fishermen nor Swarm. What this third manifestation might be is conjecture at this point. But it may represent a bandwagon or headline chasing effect, where individuals "with a mix of psychological issues and egomaniacal motivations rapidly mobilize in response" to successful terrorism and "come in reactionary waves and feature a mix of bumbled plots[22]." Examples of such effects might be the casually committed "weekend-warrior" committing an opportunistic or ill-considered attack in parallel with more serious Separatist movements. Evidence could also show a burst of activity after serious incidents representing 'wannabe' copycats. Or even simply failed efforts that neither individual nor organizations wish to be associated with. Further research is needed[2]..

Narrative

Narrative, understanding the moral outrage through a conspiratorial ideology. Delivered through cultural scripts, the Narrative contextualizes the perceived grievance and identifies a specific outgroup to blame for the injustice [23, p. 604]. The Narrative provides "a compelling rationale

for what needs to be done"[6, pp. 7777–7783] through dramatic storytelling that attributes suffering to global conspiracy [19, p. 80], or an "an evil group that is wholly responsible for all perceived injustices"[23, p. 604]. This "frame alignment" [23, pp. 605–606] aids in "indoctrination" [23, p. 607] where the target group "is blamed for the deprivation of the group" and the consideration of "radical options to counter the injustice" begins [23, pp. 606–607].

Narrowcasting

Narrowcasting targets tailored content to small populations, sometimes even individuals, who share *similarity* and *notoriety bias* [6, p. 5920]. Narrowcasting accelerates both fixation and identification and activation by tapping into these biases supporting a cultural-script contagion.

Near Suffering

Grievance and moral outrage the source of which occurs in the governed space.

See perception of grievance and moral outrage.

Non-State Actor

Non-state actors who commit predatory violence are defined broadly: including both formal organizations that possess hierarchies and internal structure as well as coalitions of groups and even 'leaderless' associations around a common cause. We have discussed these many forms of operation in our previous research [24]. For purposes of this paper, however, we envision three criteria. Radical non-state actors:

1. Operate from a permissive safe haven in an ungoverned space fueling radicalization in the governed space.
2. Serve as a destination radicalized and activated individuals from the governed space travel too in the ungoverned space.
3. Organize resistance to sovereign state actor interventions in ungoverned space[1].

Pathway to Violence

Pathway to violence involves the pursuit of tasks necessary to launch the attack. The traveler has almost reached the far side of the bridge and undertakes activities such as "research, planning, preparation for, or implementation of an attack"[5, p. 2].

Perceived Grievance & Moral Outrage

The root of violent radicalization lies with perceived grievances and moral outrage **Error! Reference source not found.** (A) amplified by personal resonance and vicarious emotional experiences. The at-risk population perceives suffering of themselves or those they share *similarity bias* in either the governed or ungoverned space. The suffering here is not random such as a car accident or a natural disaster. It arises from "human hands and seen as a major moral violation"[19, p. 72]. Cultural scripts convey this awareness of suffering in a symbolic meta-language manifesting in many mediums, helping form in-group identities based on a grievance, injustice, oppression, or socio-economic exclusion[6, pp. 7777–7783]. Even lone-wolf school shooters may "see themselves" via a *similarity bias* with other school shooters whom they have

never met or interacted with, as sharing a common identity. A perceived grievance is not objective and can involve subjective comparisons between one's group and another [23, pp. 606–607], [25, p. 513].

Personal Resonance

Personal resonance is the direct experience of suffering that creates a "cognitive opening" resulting from personal crises "such as a job loss, experiences with discrimination or victimization"[23, pp. 605–606] or shared group experience in major "historical, religious, or political events… often defined by a major loss" that provokes "feelings of anger and humiliation, and the blaming of others"[5, pp. 4–5].

See also Vicarious Exploitation

Predatory Mass-Violence

Predatory mass-violence is defined in contrast to affective violence. Affective violence is "characterized by the emotions of anger and/or fear, and is a response to a perceived imminent threat…Its evolutionary basis is self-protection." [26, p. 539] Predatory violence is "characterized by the absence of emotion or threat, and is cognitively planned….Its evolutionary basis is hunting for food" [26, p. 539]. These are distributions along a continuum – rather than explicitly distinctive and separate states and recognize that in some cases, the predatory and affective influence appear 'mixed' in a "sequencing of one mode of violence to another within one event" [26, p. 540]. The empirical basis for distinguishing forms of violence consists of neurochemical analysis[27] found in both humans and animals[28], [29]. Distinguishing between cognitively planned mass-violence and otherwise aggressive behavior comes from experimental research in neuropsychology and psychophysiology [30],[31],[32],[33] and is important as "virtually all acts of terrorism are predatory (instrumental) violence[34, p. 10]." [1].

Proposition

A proposition is one of many causal mechanism by which the system of violent radicalization in the terror contagion hypothesis operates. Propositions are the structure, while contingencies are the specific values within a given circumstance of this structure. The contingent values of propositions can create channels within the system within which specific manifestations of violent radicalization emerge. The strength of propositions are determined by the ability of a range of contingent values within that proposition to shift a given behavior mode into another behavior mode or knock out the behavior mode completely returning the model to equilibrium. If a proposition must have a contingent value in order for the system to function, it is considered a strong or root-cause proposition[9].

See also Strong, Moderate, and Weak Propositions.

Radicalization Template

A radicalization template represents a specific manifestation of radicalization pathways within a given violent ideology. At an aggregate level it consists of a Template Ideology and Template Method as well as the associated cultural scripts of those. There may be more than one radicalization template per violent ideology. In the bridging metaphor of violent radicalization, a radicalization template is the blueprint of how a specific bridge will be constructed to facilitate

crossing over psychology boundaries of violence against humans. For example a Separatist movement in a given region may have one or more of the Fishermen Radicalization Templates which represent non-state actor specific methods of facilitating radicalization and violence as well as one or more Swarm Radicalization Templates indicative of how lone-wolves may also take up separatist ideology and proceed to violence[2].

Reference Mode

Safe Haven

See ungoverned space.

Self-Selection

Self-selection occurs when radicalizing individuals "find each other on the same forum...participants…become very vocal in promoting it to a receptive audience"[19, p. 115]. Ideological deniers begin to "peel off through a process of self-selection"[19, p. 86] while remaining observers are "not sure about their beliefs" within the violent ideology and "stay silent rather than voice their doubts"[19, p. 117]. Self-selection can be conscious acts or algorithmic sorting by social media and content platforms that operate below the level of awareness yet remains a reflection of user preferences. Adherents continue self-selecting influencers and groups to their preferred violent ideology [19, p. 118].

Societal Response

Strong Proposition

A strong proposition is a proposition that has a contingency range which completely eliminates a behavior mode taking it back to or below the Equilibrium (EQ) mode. For example the average fatalities in a template method is a strong proposition because all else being equal if the contingent value of this proposition drops below 5 fatalities on average the Contagion (CONT) behavior mode is eliminated returning to an Equilibrium (EQ) mode[9].

Swarm Radicalization Template

Swarm and fishermen templates are like blueprints for this bridge of violent radicalization. Swarm radicalization is "bottom-up" occurring "in small social groups or 'bunches of guys' inspired by and socializing each other...through internal group dynamics" [35, p. 187]. This 'leaderless jihad' acts like a free-market reacting and adjusting to local domestic conditions without top-down organization[19, pp. 144–145]. The 'swarm' can appear intelligent and organized as an emergent byproduct of self-organizing and self-directing individuals.

Synthetic Experiments

Experiments conducted in a synthetic environment, via simulation, rather than empirically because of risk of harm or negative consequence. Although use in confidence buildings, the results of synthetic experiments must be understood within the context of the limitations of the simulation they were conducted within.

System Hierarchy Level 1: Incidents

A class of terror incidents as discrete events[1].

System Hierarchy Level 2: Agents
A class of human actors within the At-Risk population and the continuum of radicalization they may be located in: Moderate, Undecided, Radicalized, or Activated[1].

System Hierarchy Level 3: Networks
The class containing networks of individuals including informal and formal network structures of local communities and the influence of non-state actor cultural script broadcasting[1].

System Hierarchy level 4: Spaces
The class of spaces including the ungoverned space and its dynamics within which non-state actors operate to cast cultural scripts into the governed space[1].

System Hierarchy Level 5: Systems of Systems
The class of societal and abstracted or symbolic dynamics[1].

System Hierarchy Levels
A system hierarchy level is the vertical representation of where a causal class occupies relative to the rest of the structure.

Terror Contagion Hypothesis

Terrorism
The GTD definition of terrorism as "the threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious, or social goal through fear, coercion, or intimidation" [36, pp. 10–11]. The GTD's inclusion criteria require an intentional incident involving violence or threat of violence against people or property, and perpetrators may not be state actors. Additionally, the GTD looks for evidence in two of the three remaining categories. First, that the action occurred outside "legitimate warfare activities." Second, the act must aim to advance political, religious, social, economic, or other widespread change. Third, there is evidence of "an intention to coerce, intimidate, or convey some other message to larger audience than the victims"[36, pp. 10–11].

This definition excludes several activities that some may associate with terrorism. Cyberterrorism, for example, is not violent against "persons or property." The GTD does not include terrorism conducted by a criminal cartel motivated by profit, nor are they examined in our analysis. Violence by the state, or existing within a conflict zone, is a different form of risk than Sageman and Hoffman were examining. We limited the geographic boundary of incidents to the United States and Western Europe. These boundaries aim to replicate the focus within which the debate occurred, expanding data only in terms of time and inclusion of more ideologies. These boundaries leave hundreds of thousands of incidents outside of the scope. These incidents may have occurred earlier, in different geographic regions, in conflict zones, or conducted by state actors.

Terrorism

Are acts of predatory mass-violence by individuals or groups of violent radicals in the governed or ungoverned space. We track this event as "out-the-door" attempts, which may be thwarted or hindered once launched. Moreover, when there is a significant or catastrophic loss of life or property damage, these acts provoke a societal response.

Ungoverned Space

By contrast, the ungoverned space is where the radical non-state actor can operate with relative ease absent sovereign-state law enforcement surveillance and arrest powers. This definition acknowledges that governed and ungoverned spaces may be geographic or virtual[1].

Vicarious Exploitation

Vicarious exploitation is a second way the emotional experience of humiliation, anger, or fear is experienced when perceiving grievance or suffering [19, p. 72]. The at-risk individual vicariously exploits others' suffering even if they have not experienced it themselves[5, pp. 4–5]. Empathy centers the emotional experience on victim suffering—vicarious exploitation centers on the at-risk individual perceiving grievance and provoking moral outrage disconnected from personal experience or empathy.

See also Personal Resonance

Violent Ideology

Are "the presence of beliefs that justify the subject's intent to act," and these may be political, religious, secular, or "an idiosyncratic justification" [5, pp. 4–5]. Violent ideologies promote 'intent to act' against persons or property. Our ideologies are broad, containing many doctrines, schools of thought, and local variations while still sharing beliefs.

Violent Ideology Profile

A violent ideology profile combines 'slices' of the region, violent ideology, and suspected radicalization [37]. These profiles consist of twelve measures from within the GTD data that can help understand how different profiles manifest terrorism. The measures are not mutually exclusive to any incident. For example, a terror incident could have both casualties and property damage. However, the profiles aggregate all incidents within a violent ideology or region to identify average measures that can be tested for difference between profiles or even between the same profile in different regions. The measures are:

1. Incidents: The number of incidents in that profile over the period.
2. Success %: The percentage of those incidents marked "successful" by GTD.
3. % with Property Damage: Percentage of all incidents where any property damage occurred.
4. % with Property Damage >$1M: Percentage of incidents with property damage more than $1M.
5. Total Casualties: The number killed and wounded minus any perpetrators killed or wounded.
6. % with Casualties: The percentage of all incidents where any casualties occurred.
7. Average Casualties: The average casualties across all incidents for the profile.
8. (SD): The standard deviation of casualties across all incidents for the profile.
9. Average Casualties for Incidents with Casualties: Same as Average Casualties but excludes all incidents where no casualties occurred.

10. Incidents Suspected to be N/A: The number of incidents in the profile where we could not classify a suspected radicalization template.
11. Incidents Suspected to be Fishermen: The number of incidents in the profile we classified as suspected fishermen radicalization template.
12. Incidents Suspected to be Swarm: The number of incidents in the profile we classified as suspected swarm radicalization templates.

Within the profiles are currently five factors for statistical testing:

- Propensity to Succeed: Success % per profile/year.
- Propensity to Harm: % with Casualties per profile/year.
- Propensity to Damage Property: % with Property Damage per profile/year.
- Frequency: Measured as Incidents per 1M People per profile per year.
- Risk: Measured as Casualties per 1M People (killed wounded excluding perpetrators) per profile/year.

Violent Ideology: Anti-Government

Anti-police, anti-law-enforcement, tax policies, municipal policies, etc. not already included in Left-Wing & Right-Wing[2].

Violent Ideology: Right-Wing

White Supremacy, Anti-Immigrant, Xenophobic, Racist, Ultra-Nationalist, Anti-Abortion[2].

Violent Ideology: Separatist

Internal resistance groups seeking either a separation within the state, internal revolution (e.g., Basque, Irish, Kurdish), and counter-Separatist militant movements that spawn from these conflicts[2].

Violent Ideology: Takfiri

Espousing an extremist interpretation of Islam to justify the extrajudicial killing of civilians outside the state's authority. Distinguished from Separatists based on the religious versus secular character of their stated goals[2].

Violent Ideology: Unknown

Incidents not falling within one of the above categories but not rated "doubtful to be terrorism" by GTD (which we removed.)[2].

Violent Radicalization

Is the bridging mechanism of an ideology where, through a "personal process," an individual adopts extremist thinking and goals justifying the use of "indiscriminate violence" [38, p. 38]. Crossing the bridge changes thought patterns of in-group members towards "targeted out-group(s) in a devalued way" [39, p. 29], and this lowers the moral burden of committing violence against them. Violent terrorism is not the inevitable outcome of violent radicalization [40, p. 16], which is a process and not an event [39, p. 30]. Individuals may reverse course, choosing political engagement instead [40, pp. 6–7].

Weak Proposition

A weak proposition can adjust the behavior within a mode but not change the base mode of Contagion (CONT). For example, the prevalence of Moderating Alternatives is considered a

weak proposition because regardless of its contingent value it can adjust the point value of a Contagion (CONT) mode but not change its overall behavior out of the CONT mode[9].

A-4 System Level Overview of Terror Contagion Model

A-4.1 Top Level Model Overview

The overall model is depicted in Figure 6 below. There are eight selectable modules which can be clicked on to expose model structure. Only five of these, the "core model" are used to simulate the terror contagion hypothesis. The remaining three modules communicate key term information and/or contain model values and model testing structure. Additionally, a color-coded legend is provided to help identify the color/font combinations used throughout the modules. These are used to identify what portions of the model are structure taken from Farmers, Soldiers, Bandits[41], key structure taken from literature, testing structure, and testable leverage points.

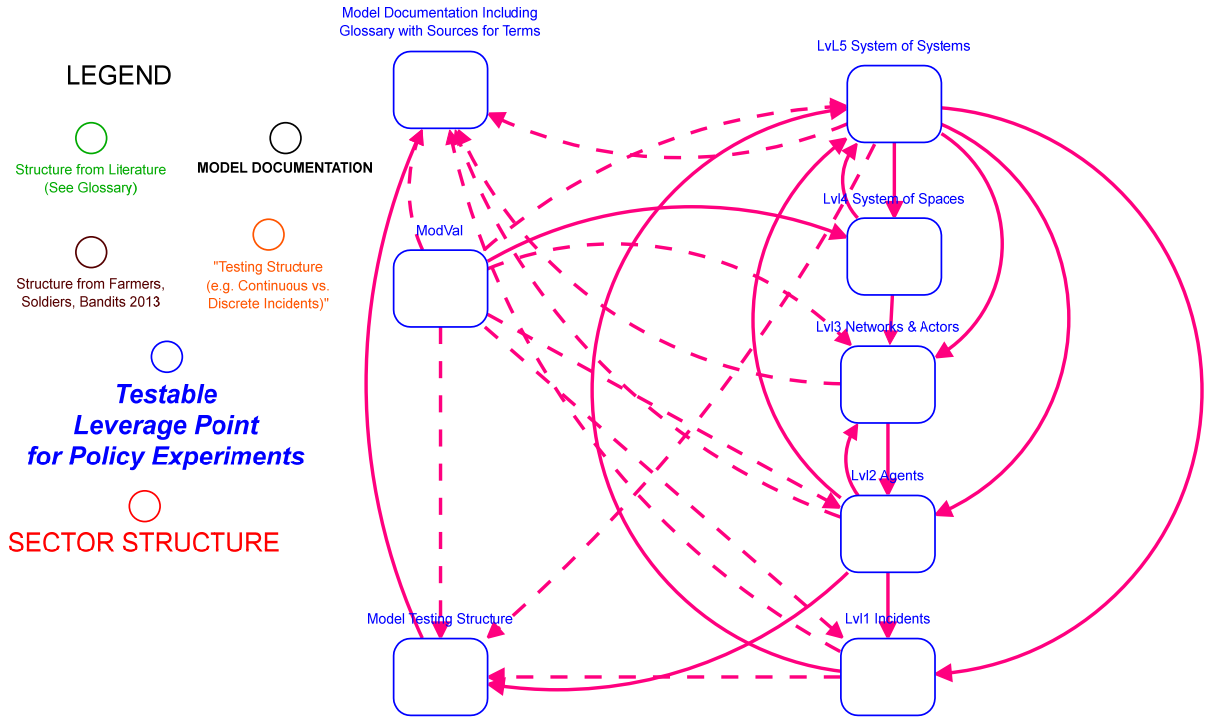


Figure 6: Top Level Model Overview

A-4.2 Core Model Overview

Figure 7 depicts an aggregate view of the Terror Contagion Model "core model" which contains five systems levels corresponding to the system hierarchy discussed above in A-2.4 System Hierarchy CLD View: Incidents (1), Agents (2), Networks & Actors (3), System of Spaces (4),

and System of Systems (5). Each level represents one layer of the system's structure in our Radicalizing Werther Contagion Theory, within which key dynamics occur. Arrows in **Error! Reference source not found.** represent the upwards and downwards causation of these causal influences crossing between system layers.

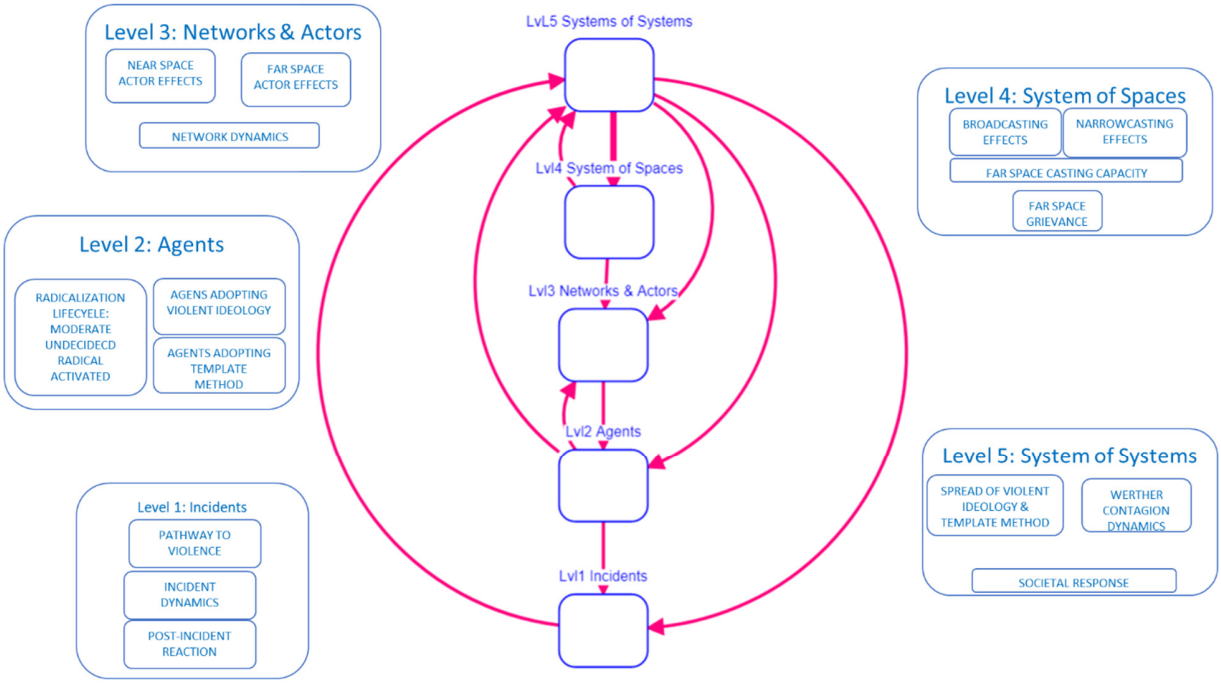


Figure 7 System Structure Levels & Sectors of Terror Contagion Hypothesis Model

A-4.3 Model Documentation & Glossary

A-4.4 System Level 1 Incidents

Level 1, depicted in **Error! Reference source not found.** contains dynamics for terror incidents and consists of five. The purpose of Level 1 of the Terror Contagion model is taken Agents who activate on a Pathway to Violence from Level 2 and endogenously generate terrorist incidents. The dynamics of these incidents are calculated using either a discrete or continuous flow formulation as selected in the profile. Explained further below, this formulation adds complexity but allows side-by-side comparison of both versions of formulation for this important portion of the Terror Contagion Model. The outcomes of these terror incidents then feed into Level 5 System of Systems via media broadcasts which influence both overall society dynamics and specific dynamics within the At-Risk Population.

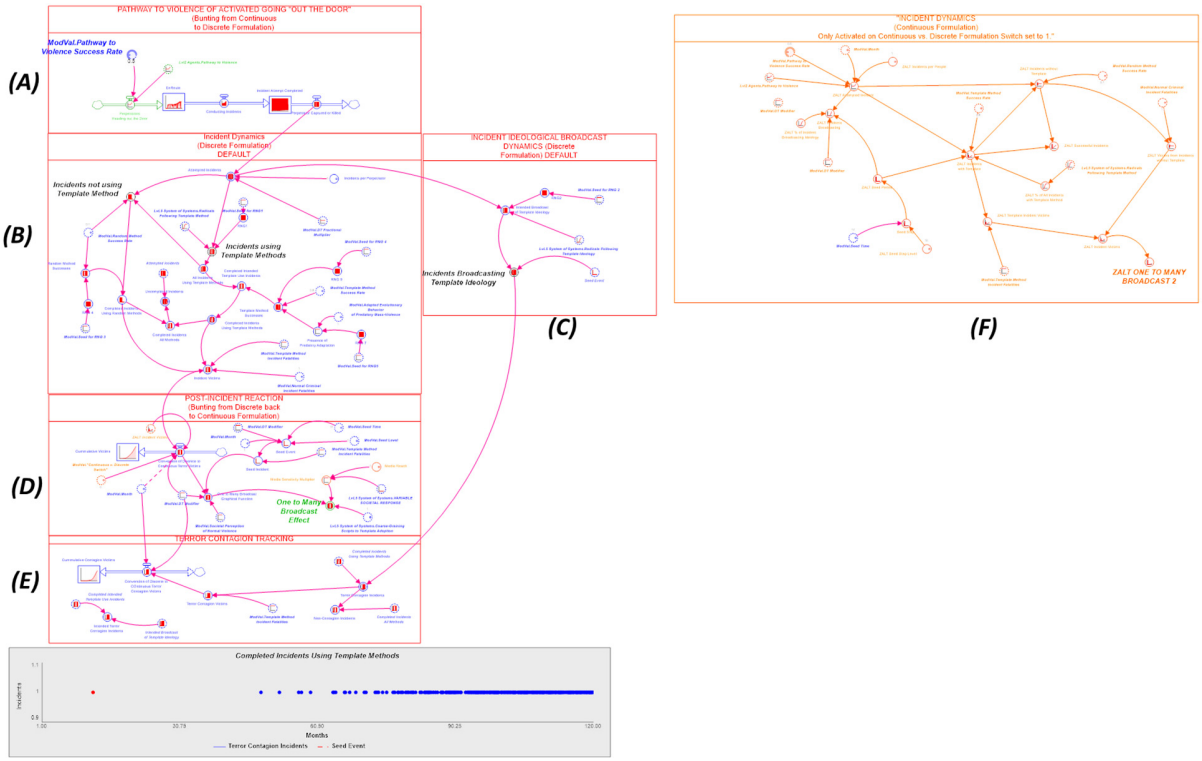


Figure 8: Level 1 Incidents. (A) Pathway to Violence going to Out The Door, (B) Incident Dynamics (Discrete), (C) Incident Ideological Broadcasts, (D) Post Incident Reaction, (E) Terror Contagion Tracking, (F) Incident Dynamics (Continuous.)

Level 1 Sector by Sector Overview

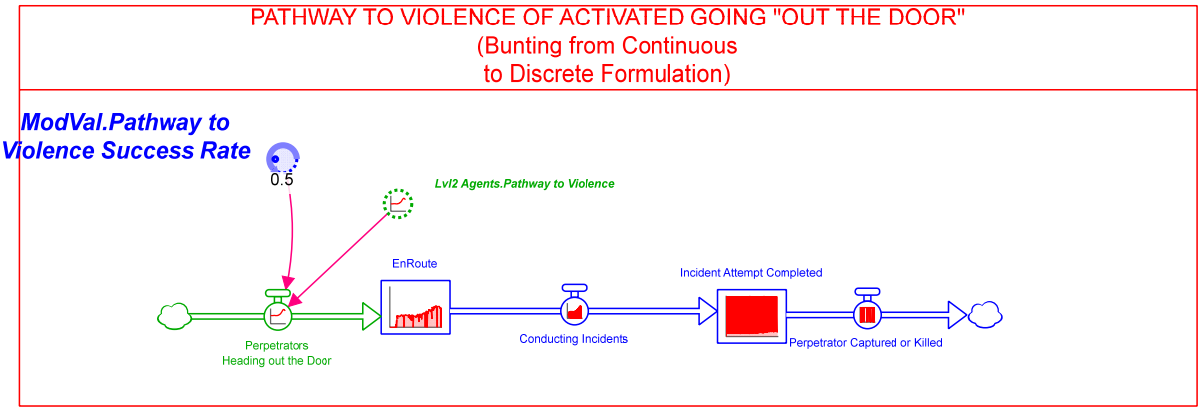


Figure 9: Detail of Pathway to Violence Sector (A) of Level 1.

The first sector, Pathway to Violence Figure 9 receives Activated agents from the Level 2 System Agents sector of Radicalization Lifecycle. These agents complete or fail to complete their Pathway to Violence based on a Pathway to Violence success rate imported from the profile. This first sector assumes all Activated people who complete their Pathway to Violence will head "out the door" to attempt an incident during which they are either captured or killed. The process of completing this is mechanistically structured as a conveyor which also serves to bunt the continuously integrated portions of the model with the discrete formulation portions represented in Incident Dynamics. When the continuous formulation approach is selected as an alternative, this sector is deactivated in favor Incident Dynamics (Continuous Formulation) Figure 8 (E).

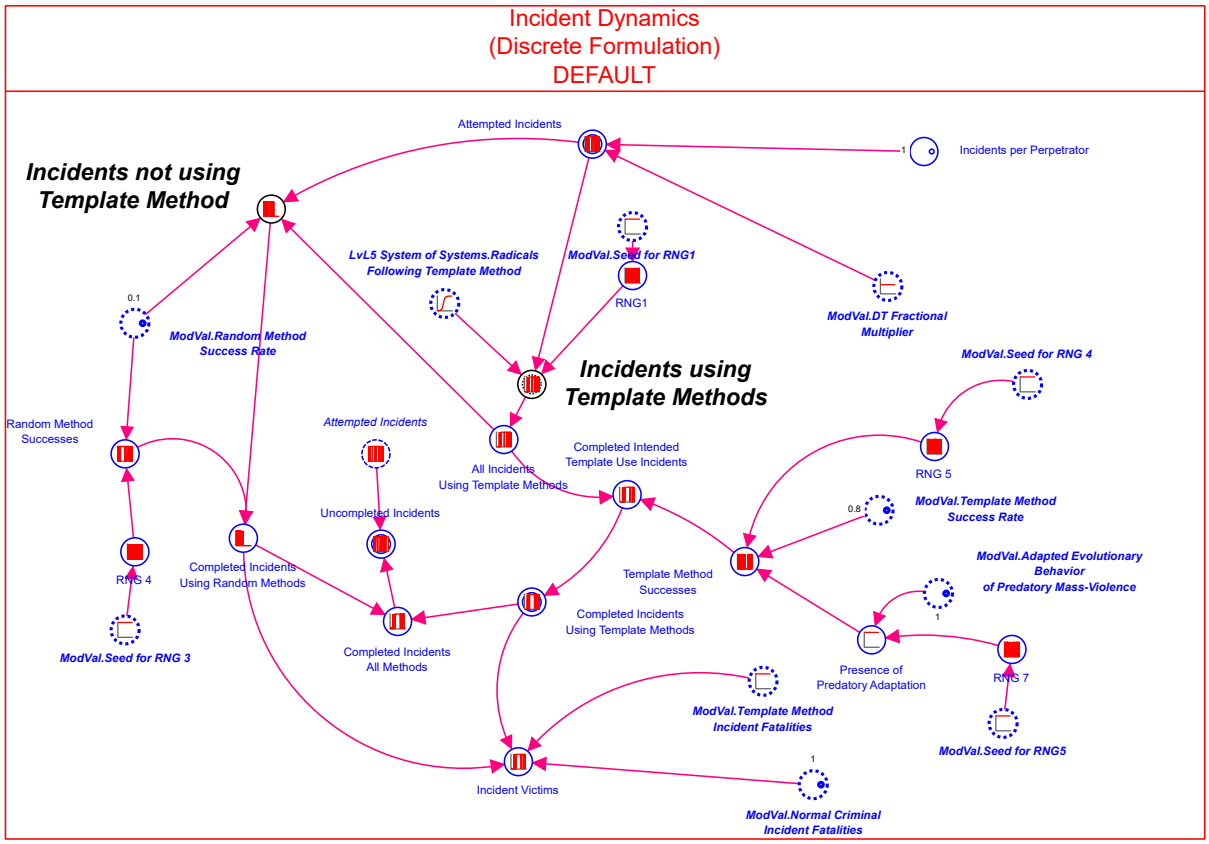


Figure 10: Detail of Incident Dynamics (Discrete Formulation) Sector (B) of Level 1.

The sector Incident Dynamics (Discrete Formulation) represented in Figure 10 is a stochastic/discrete based approach to calculating terrorist incident outcomes using Random Number Generators (RNG). These RNGs are tied to common seeds instantiated in the Model Values Module so that the same results will generate each time for replication. These seeds can be varied manually or in random distributions to generate a wide range of variable outcomes based on profile inputs. This is necessary to build statistical confidence in the use of RNG within the Discrete Formulation. .

Incidents are divided into those using Template Methods and those using other, random methods, based on the current Template Adoption Rate of Activated people in Level 5. Incidents are then checked based on success rates as to whether they complete or fail. Template Method incidents use the Out the Door (OTD) success rate. OTD corresponds with the UMD START timestamp of Out the Door in our data set and is a profile input[36]. Random methods success rate is a model constant. Random Method incident successes generate 1 Fatality while Template Method successes generate Template Method Incident Casualties, which in all base runs are 10 and is an imported profile setting. Indeed, all parameters related to Template Method can be set to correspond with UMD START profile parameters allowing the model to be calibrated to a specific violent ideology profile in future experiments. In the discrete formulation incidents can use a Template Method, a Template Ideology, neither, nor both. And the use of a Template Method alone is not considered a Contagion incident, which requires both the use of a Template Method and broadcast of specific Ideology as determined in the next sector.

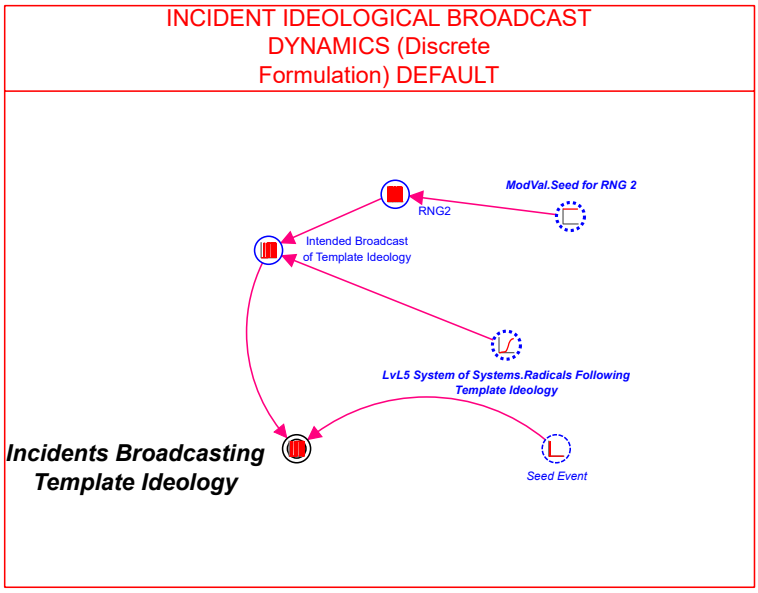


Figure 11: Detail of Incident Ideological Broadcast (Discrete Formulation) for Sector (C) of Level 1.

Sector (C) of Level 1 calculates whether an incident in discrete formulation will broadcast a Template Ideology. This is calculated using the Template Methodology Adoption Rates of Level 5. In the discrete formulation incidents can use a Template Method, a Template Ideology, neither, nor both. In this discrete formulation, a single seed event will initiate the dynamics both here and in the Post-Incident Dynamics Sector. And the broadcast of a Template Ideology alone is not considered a Contagion incident, which requires both the use of a Template Method and broadcast of specific Ideology as determined in the previous sector.

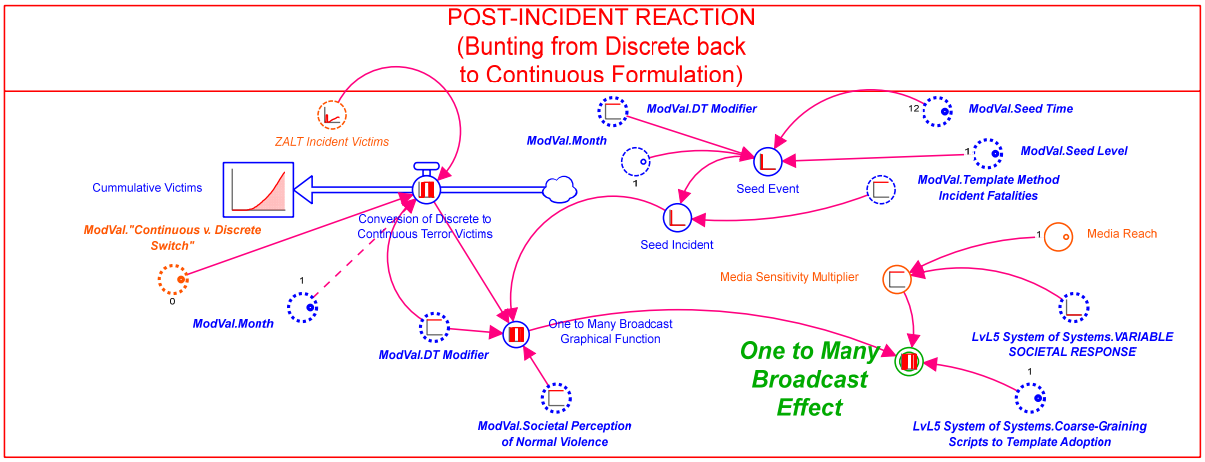


Figure 12: Detail of Post-Incident Dynamics (Discrete Formulation) for Sector (D) of Level 1.

The Post-Incident Dynamics Sector displayed in Figure 12 serves to convert a discrete/stochastic incident and convert it back into continuous integration for the rest of the model. This is done at the conclusion of an incident, where the fatalities determined in the Incident Dynamics sector determine the strength of media attention on the event. A graphical function makes a relative

comparison between normal criminal casualties (1) and the actual casualties of any incident, which in baseline and all base runs are set at 10. The larger the difference, the greater the One-to-Many Broadcast effects on a curve. Media Reach can also be adjusted here for sensitivity analysis and contingency testing. In this discrete formulation, a single seed event will initiate the dynamics both here and in the Ideological Broadcast Sector. Note that the system doesn't "recognize" contagion incidents at the One-to-Many broadcast which is determined solely on fatalities. Ideological Broadcasts from Sector (C) however are combined with One-to-Many Media broadcast based on fatalities in Level 5. This sector also bunts the discrete/stochastic results back into continuous integration which is used throughout the rest of the model.

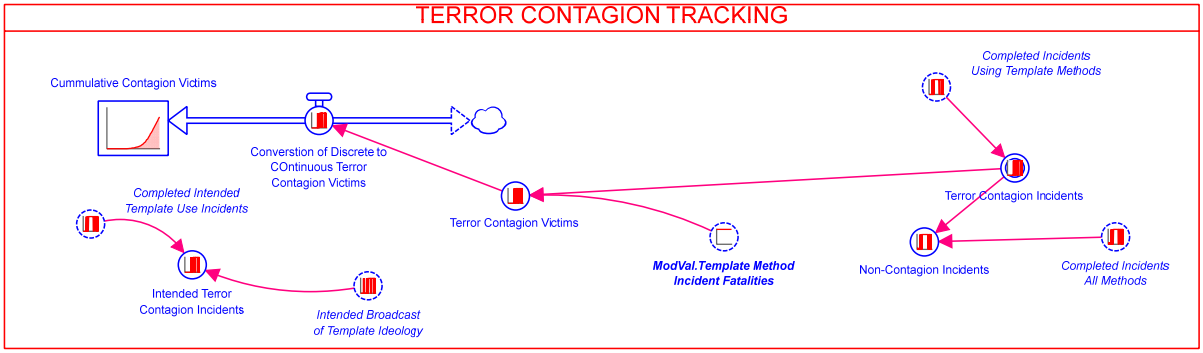


Figure 13: Detail of Terror Contagion Tracking Sector (E) of Level 1.

To ensure conservation of mass and information are appropriately followed this sector tracks Contagion incidents separate from the matching made in Level 5. Incidents which stochastically used both a Template Method and Template Ideology in Sectors B and C respectively are counted as are Contagion Victims. This is then used in the Model Testing Structure to help populate the Conservation of Mass dashboard to ensure neither incidents, nor victims, are added or lost unreasonably over the course of the model run. An error greater than one incident or one victim over the ten-year run is considered a potential sign of error. (Errors less than one are attributed to the continuous to discrete bunting and the singular seed event.)

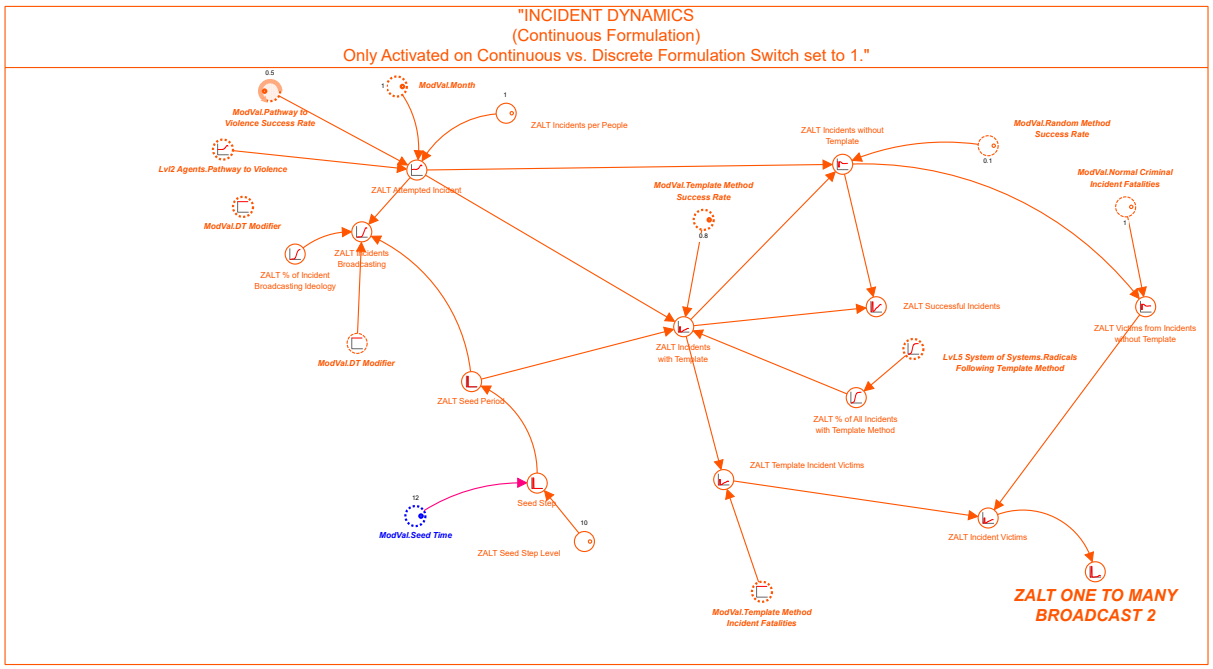


Figure 14: Detail of Incident Dynamics (Continuous) Sector (F) of Level 1.

The last sector of Level 1, as displayed in Figure 14 combines the functions of Sectors A-D in continuous, rather than discrete, formulation. This sector is activated by the Continuous vs. Discrete switch in the profile. Note that unlike the Discrete formulation, which is seeded by a single incident, the seed of the continuous formulation is a STEP function that effectively seeds 1incident/month for 12 months. Although this replicates discrete behavior and what we know of the overall dynamics of terrorism profiles, this is an unrealistic initiation process and one of the reasons discrete incident integration is selected over continuous.

This sector contains 15 equations, including 1 graphical formulation, which are strictly unnecessary for the proper functioning of the model, but are included for testing purposes to compare discrete vs. continuous incident formulations flow.

Level 1 Representative Behavior

A chart at the bottom of the model structure tracks individual contagion incidents as they occur as displayed with the CONT behavior mode in Figure 15. This tracks discrete terror contagion incidents, where both a Template Method was used and a Template Ideology broadcast as dots. The seed dot is marked in red. This chart can help show the acceleration or struggle of a contagion to take hold.

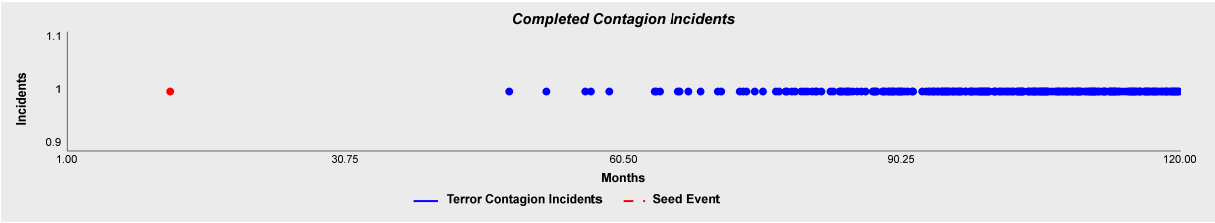


Figure 15: Representative Behavior (CONT) Completed Contagion Incidents.

Level 1 Model Equations by Sector

Lvl1_Incidents.LEVEL_1_MODULE_NOTES = 0
UNITS: Dimensionless

****
Lvl1_Incidents."INCIDENT_DYNAMICS_(Continuous_Formulation)_Only_Activated_on_Continuous_vs._Discrete_Formulation_Switch_set_to_1.":
****
Lvl1_Incidents.Seed_Step = STEP(ZALT_Seed_Step_Level, ModVal.Seed_Time)-STEP(ZALT_Seed_Step_Level,(ModVal.Seed_Time+12))
UNITS: Incidents
Lvl1_Incidents.ZALT_%_of_All_Incidents_with_Template_Method = IF((LvL5_System_of_Systems.Radicals_Following_Template_Method)>1) THEN(1) ELSE(LvL5_System_of_Systems.Radicals_Following_Template_Method)
UNITS: fraction
Lvl1_Incidents.ZALT_%_of_Incident_Broadcasting_Ideology = IF((LvL5_System_of_Systems.Radicals_Following_Template_Ideology)>1) THEN(1) ELSE(LvL5_System_of_Systems.Radicals_Following_Template_Ideology)
UNITS: fraction
Lvl1_Incidents.ZALT_Attempted_Incident = (Lvl2_Agents.Pathway_to_Violence*ModVal.Month)*(ZALT_Incidents_per_People*ModVal.Pathway_to_Violence_Success_Rate)
UNITS: Incidents
Lvl1_Incidents.ZALT_Incident_Victims = ZALT_Template_Incident_Victims+ZALT_Victims_from_Incidents_without_Template
UNITS: Victims
Lvl1_Incidents.ZALT_Incidents_Broadcasting = (ZALT_Attempted_Incident*ZALT_%_of_Incident_Broadcasting_Ideology)+(ZALT_Seed_Period/ModVal.DT_Modifier)
UNITS: Incidents
Lvl1_Incidents.ZALT_Incidents_per_People = 1
UNITS: Incidents/People
Lvl1_Incidents.ZALT_Incidents_with_Template = (ZALT_Attempted_Incident*ZALT_%_of_All_Incidents_with_Template_Method*ModVal.Template_Method_Success_Rate)+ZALT_Seed_Period
UNITS: Incidents
Lvl1_Incidents.ZALT_Incidents_without_Template = (ZALT_Attempted_Incident-ZALT_Incidents_with_Template)*ModVal.Random_Method_Success_Rate
UNITS: Incidents
Lvl1_Incidents.ZALT_ONE_TO_MANY_BROADCAST_2 = GRAPH(ZALT_Incident_Victims)
(0.0, 0.00), (10.0, 0.00), (20.0, 0.00), (30.0, 0.0599752735796), (40.0, 0.119720287004), (50.0, 0.229347510146), (60.0, 0.430504516646), (70.0, 0.799611204787), (80.0, 1.47689185039), (90.0, 2.71964655424), (100.0, 5.00)

UNITS: Scripts
Lvl1_Incidents.ZALT_Seed_Period = Seed_Step
UNITS: Incidents
Lvl1_Incidents.ZALT_Seed_Step_Level = 10
UNITS: Incidents
Lvl1_Incidents.ZALT_Successful_Incidents =
ZALT_Incidents_without_Template+ZALT_Incidents_with_Template
UNITS: Incidents
Lvl1_Incidents.ZALT_Template_Incident_Victims =
ZALT_Incidents_with_Template*ModVal.Template_Method_Incident_Fatalities
UNITS: Victims
Lvl1_Incidents.ZALT_Victims_from_Incidents_without_Template =
ZALT_Incidents_without_Template*ModVal.Normal_Criminal_Incident_Fatalities
UNITS: Victims

****
Lvl1_Incidents."Incident_Dynamics_(Discrete_Formulation)_DEFAULT":
****
Lvl1_Incidents.All_Incidents_Using_Template_Methods = Incidents_using_Template_Methods
UNITS: Incidents
Lvl1_Incidents.Attempted_Incidents =
(IF(Perpetrator_Captured_or_Killed>=1)THEN(PULSE(Incidents_per_Perpetrator*ModVal.DT
_Fractional_Multiplier, 0))ELSE(0))
UNITS: Incidents
Lvl1_Incidents.Completed_Incidents_All_Methods =
(Completed_Incidents_Using_Random_Methods+Completed_Incidents_Using_Template_Meth
ods)
UNITS: Incidents
Lvl1_Incidents.Completed_Incidents_Using_Random_Methods =
(Random_Method_Successes*Incidents_not_using_Template_Method)
UNITS: Incidents
Lvl1_Incidents.Completed_Incidents_Using_Template_Methods =
(Completed_Intended_Template_Use_Incidents)
UNITS: Incidents
Lvl1_Incidents.Completed_Intended_Template_Use_Incidents =
All_Incidents_Using_Template_Methods*Template_Method_Successes
UNITS: Incidents
Lvl1_Incidents.Incident_Victims =
(Completed_Incidents_Using_Template_Methods*ModVal.Template_Method_Incident_Fataliti
es)+(Completed_Incidents_Using_Random_Methods*ModVal.Normal_Criminal_Incident_Fatal
ities)
UNITS: Victims
Lvl1_Incidents.Incidents_not_using_Template_Method = IF(Attempted_Incidents-
All_Incidents_Using_Template_Methods=1)
THEN(Attempted_Incidents*ModVal.Random_Method_Success_Rate) ELSE(0)
UNITS: Incidents

Lvl1_Incidents.Incidents_per_Perpetrator = 1
UNITS: Incidents/Month
Lvl1_Incidents.Incidents_using_Template_Methods = IF(RNG1<LvL5_System_of_Systems.Radicals_Following_Template_Method)THEN(1*Attempted_Incidents)ELSE(0)
UNITS: Incidents
Lvl1_Incidents.Presence_of_Predatory_Adaptation = (IF(RNG_7<=ModVal."Adapted_Evolutionary_Behavior_of_Predatory_Mass-Violence")THEN(1)ELSE(0))
UNITS: fraction
Lvl1_Incidents.Random_Method_Successes = (IF(RNG_4<=ModVal.Random_Method_Success_Rate)THEN(1)ELSE(0))
UNITS: fraction
Lvl1_Incidents.RNG_4 = UNIFORM(0, 1, ModVal.Seed_for_RNG_3)
UNITS: Dimensionless
Lvl1_Incidents.RNG_5 = UNIFORM(0, 1, ModVal.Seed_for_RNG_4)
UNITS: Dimensionless
Lvl1_Incidents.RNG_7 = UNIFORM(0, 1, ModVal.Seed_for_RNG5)
UNITS: Dimensionless
Lvl1_Incidents.RNG1 = UNIFORM(0, 1,ModVal.Seed_for_RNG1)
UNITS: Dimensionless
Lvl1_Incidents.Template_Method_Successes = (IF(RNG_5<=ModVal.Template_Method_Success_Rate)THEN(1)ELSE(0))*Presence_of_Predatory_Adaptation
UNITS: fraction
Lvl1_Incidents.Uncompleted_Incidents = (Attempted_Incidents-Completed_Incidents_All_Methods)
UNITS: Incidents

****
Lvl1_Incidents."INCIDENT_IDEOLOGICAL_BROADCAST_DYNAMICS_(Discrete_Formulation)_DEFAULT":
****
Lvl1_Incidents.Incidents_Broadcasting_Template_Ideology = (Intended_Broadcast_of_Template_Ideology)+Seed_Event
UNITS: Incidents
Lvl1_Incidents.Intended_Broadcast_of_Template_Ideology = IF(RNG2<LvL5_System_of_Systems.Radicals_Following_Template_Ideology)THEN(1*Attempted_Incidents)ELSE(0)
UNITS: Incidents
Lvl1_Incidents.RNG2 = UNIFORM(0, 1, ModVal.Seed_for_RNG_2)
UNITS: Dimensionless

****
Lvl1_Incidents."PATHWAY_TO_VIOLENCE_OF_ACTIVATED_GOING_\"OUT_THE_DOOR\"_(Bunting_from_Continuous_to_Discrete_Formulation)":

```
**********
Lvl1_Incidents.EnRoute(t) = EnRoute(t - dt) + (Perpetrators_Heading_out_the_Door -
Conducting_Incidents) * dt {QUEUE}
   INIT Lvl1_Incidents.EnRoute = 0
   UNITS: People
   INFLOWS:
      Lvl1_Incidents.Perpetrators_Heading_out_the_Door =
ModVal.Pathway_to_Violence_Success_Rate*Lvl2_Agents.Pathway_to_Violence
{UNIFLOW}
         UNITS: People/Months
   OUTFLOWS:
      Lvl1_Incidents.Conducting_Incidents = QUEUE OUTFLOW
         UNITS: People/Months
Lvl1_Incidents.Incident_Attempt_Completed(t) = Incident_Attempt_Completed(t - dt) +
(Conducting_Incidents - Perpetrator_Captured_or_Killed) * dt {OVEN}
   INIT Lvl1_Incidents.Incident_Attempt_Completed = 0
      COOK TIME = 0
      CAPACITY = 1
      FILL TIME = INF
   UNITS: People
   INFLOWS:
      Lvl1_Incidents.Conducting_Incidents = QUEUE OUTFLOW
         UNITS: People/Months
   OUTFLOWS:
      Lvl1_Incidents.Perpetrator_Captured_or_Killed = OVEN OUTFLOW
         UNITS: People/Months

**********
Lvl1_Incidents."POST-
INCIDENT_REACTION_(Bunting_from_Discrete_back_to_Continuous_Formulation)":
**********
Lvl1_Incidents.Cummulative_Victims(t) = Cummulative_Victims(t - dt) +
(Conversion_of_Discrete_to_Continuous_Terror_Victims) * dt
   INIT Lvl1_Incidents.Cummulative_Victims = 0
   UNITS: Victims
   INFLOWS:
      Lvl1_Incidents.Conversion_of_Discrete_to_Continuous_Terror_Victims = ((1-
ModVal."Continuous_v._Discrete_Switch")*(Incident_Victims*ModVal.DT_Modifier)/ModVal
.Month)+
((ZALT_Incident_Victims*ModVal."Continuous_v._Discrete_Switch")/ModVal.Month)
{UNIFLOW}
         UNITS: Victims/Month
Lvl1_Incidents.Media_Reach = 1
   UNITS: Dimensionless
Lvl1_Incidents.Media_Sensitivity_Multiplier = Media_Reach*(1-
LvL5_System_of_Systems.VARIABLE_SOCIETAL_RESPONSE)
```

UNITS: Dimensionless
Lvl1_Incidents.One_to_Many_Broadcast_Effect =
IF(Media_Sensitivity_Multiplier=0)THEN(0)ELSE(Media_Sensitivity_Multiplier*One_to_Many_Broadcast_Graphical_Function+(1-
(Media_Sensitivity_Multiplier/LvL5_System_of_Systems."Coarse-Graining_Scripts_to_Template_Adoption")))
UNITS: Scripts
Lvl1_Incidents.One_to_Many_Broadcast_Graphical_Function =
GRAPH((Conversion_of_Discrete_to_Continuous_Terror_Victims/ModVal.DT_Modifier/ModVal.Societal_Perception_of_Normal_Violence)+Seed_Incident)
(0.00, 0.00), (1.00, 0.00), (2.00, 0.00), (3.00, 0.0599752735796), (4.00, 0.119720287004), (5.00, 0.229347510146), (6.00, 0.430504516646), (7.00, 0.799611204787), (8.00, 1.47689185039), (9.00, 2.71964655424), (10.00, 5.00)
UNITS: Scripts
Lvl1_Incidents.Seed_Event = PULSE(ModVal.Seed_Level/ModVal.DT_Modifier, ModVal.Seed_Time, 121)*ModVal.Month
UNITS: Incidents
Lvl1_Incidents.Seed_Incident = Seed_Event*ModVal.Template_Method_Incident_Fatalities
UNITS: Victims

****
Lvl1_Incidents.TERROR_CONTAGION_TRACKING:
****
Lvl1_Incidents.Cummulative_Contagion_Victims(t) = Cummulative_Contagion_Victims(t - dt) + (Converstion_of_Discrete_to_COntinuous_Terror_Contagion_Victims) * dt
INIT Lvl1_Incidents.Cummulative_Contagion_Victims = 0
UNITS: Victims
INFLOWS:
Lvl1_Incidents.Converstion_of_Discrete_to_COntinuous_Terror_Contagion_Victims = (Terror_Contagion_Victims*ModVal.DT_Modifier)/ModVal.Month
UNITS: Victims/Month
Lvl1_Incidents.Intended_Terror_Contagion_Incidents =
IF((Completed_Intended_Template_Use_Incidents+Intended_Broadcast_of_Template_Ideology)=2)THEN(1)ELSE(0)
UNITS: Incidents
Lvl1_Incidents."Non-Contagion_Incidents" = Completed_Incidents_All_Methods-Terror_Contagion_Incidents
UNITS: Incidents
Lvl1_Incidents.Terror_Contagion_Incidents =
IF((Incidents_Broadcasting_Template_Ideology+Completed_Incidents_Using_Template_Methods)=2)THEN(1)ELSE(0)
UNITS: Incidents
Lvl1_Incidents.Terror_Contagion_Victims =
Terror_Contagion_Incidents*ModVal.Template_Method_Incident_Fatalities
UNITS: Victims
{ The model has 89 (89) variables (array expansion in parens).

In this module and 0 additional modules with 6 sectors.
Stocks: 4 (4) Flows: 5 (5) Converters: 80 (80)
Constants: 9 (9) Equations: 76 (76) Graphicals: 2 (2)
}

A-4.5 System Level 2: Agents

The purpose of Level 2 structure is to track the Radicalization Life Cycle of individual Agents (people) and is displayed as an overview in Figure 16. It depicts the At-Risk population sorting itself between more and less radicalized positions (A), and what % of Radicalized population has adopted the Template Method (B) and Template Ideology (C).

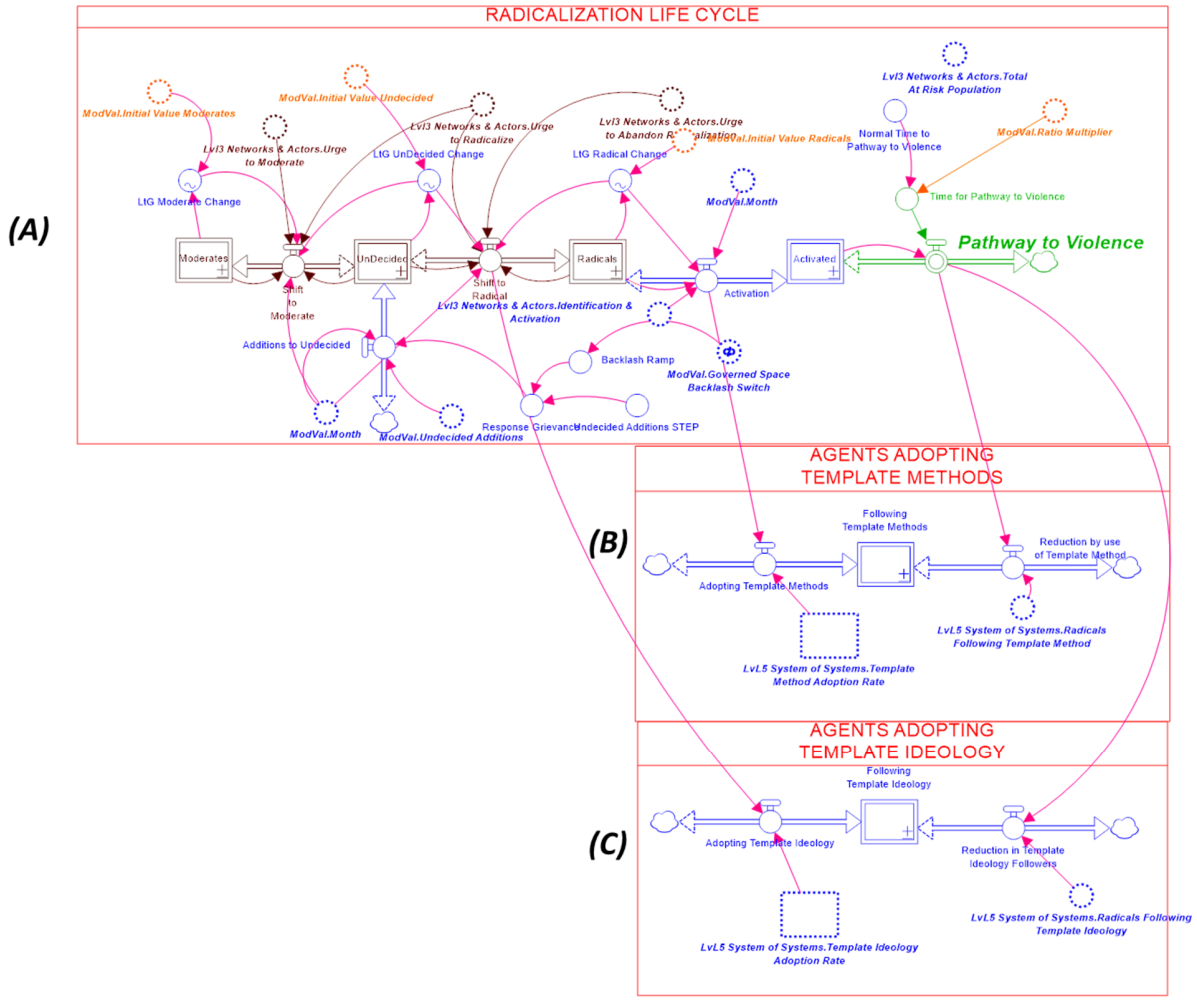


Figure 16: Level 2: Agents. Sectors (A) Radicalization Life Cycle, (B) Agents Adopting Template Methods, and (C) Agents Adopting Template Ideology.

Level 2 Sector by Sector Overview

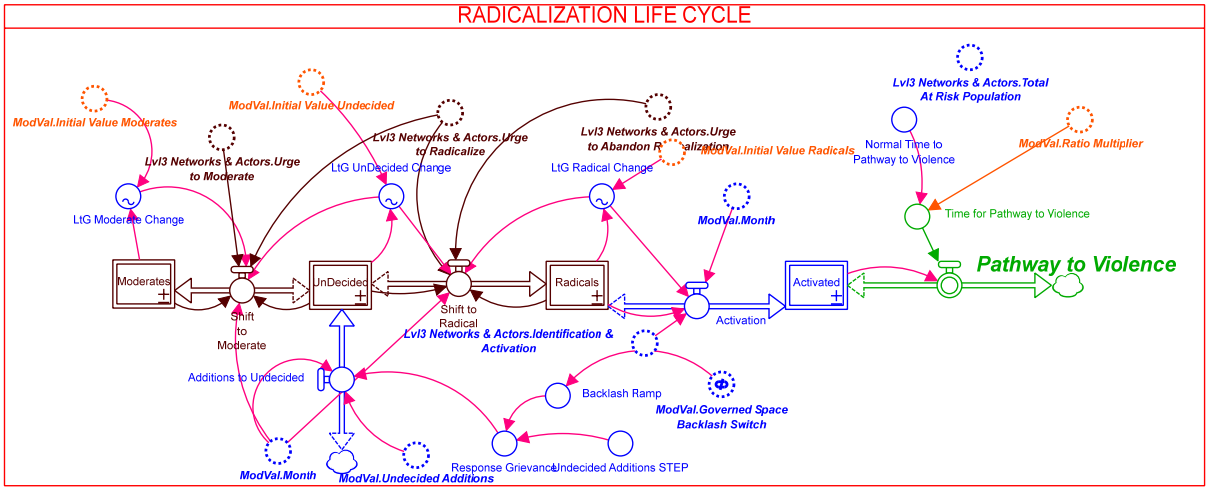


Figure 17: Detail of Radicalization Lifecycle Sector (A) of Level 2.

The first sector of Level 2, as displayed in Figure 17 represents the ebb and flow of radicalized individuals within a given at-risk population. It's structure is substantively taken from the Farmers, Soldiers, Bandits model[41]. New At-Risk agents enter the simulation as Undecided at a constant rate (10/Month). They then move between less-radical (Moderate) or more-radical (Radical) positions based on Level 3 Network Effects. Moderate, Undecided, and Radicalized in this sense match Soldiers, Farmers, and Bandits respectively in the original model.

A subset of the Radical population continuously Activates and begins their pathway to violence. Activated people are an addition to the Farmers, Soldiers, Bandit's structure.

People can move from left to right and right to left based on network effects influencing them from the Level 3 structure.

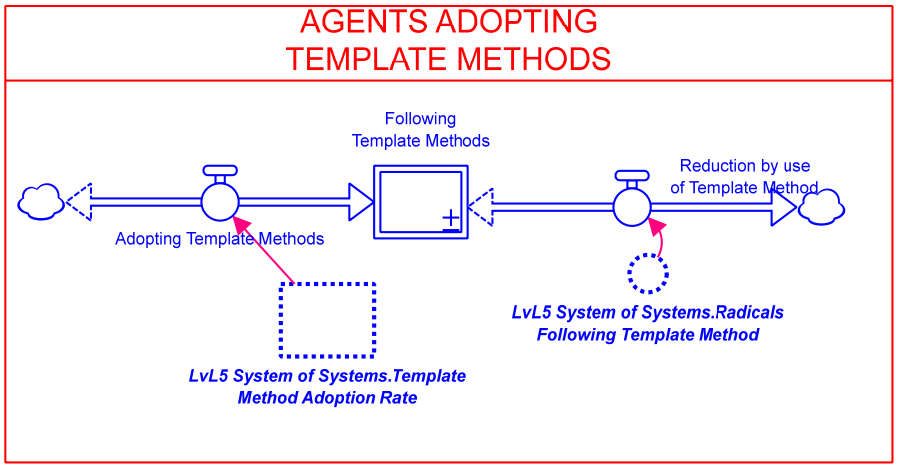


Figure 18: Detail of Agents Adopting Template Methods Sector (B) of Level 2.

The second sector is a co-flow stock attribute structure [42, pp. 497–511]tracking the subset of Activated population who have adopted Template Methods. This reflects the formulation of

modus opernadi in the Activation and Pathway to Violence period[1]. As Activated people complete their pathway to violence in Level 2 they enter Level 1 to conduct terrorist incidents.

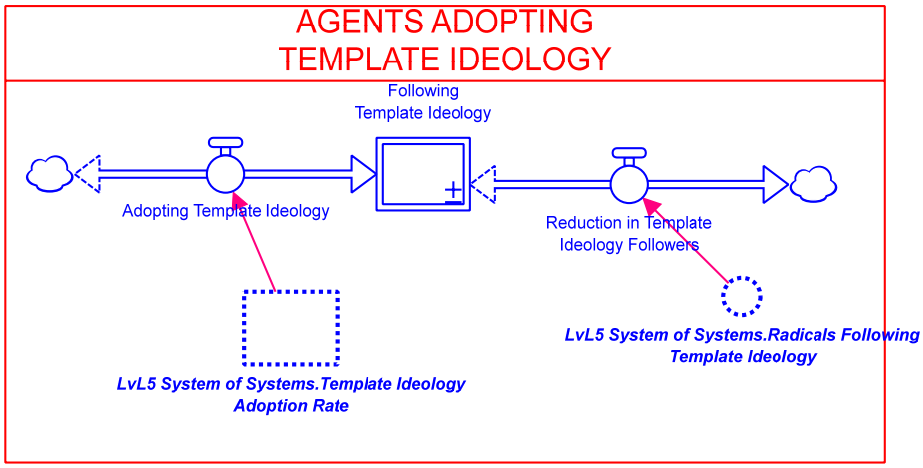


Figure 19: Detail of Agents Adopting Template Ideology Sector (C) in Level 2.

The third sector is a co-flow stock attribute structure [42, pp. 497–511]tracking the subset of Radical population who have adopted Template Ideology. This reflects the adoption of a conspiracy narrative around a core grievance [1] early in the radicalization cycle.

Level 2 Model Equations By Sector

```
Lvl2_Agents.LEVEL_2_MODULE_NOTES = 0
   UNITS: Dimensionless

**********
Lvl2_Agents.AGENTS_ADOPTING_TEMPLATE_IDEOLOGY:
**********
Lvl2_Agents.Following_Template_Ideology(t) = Following_Template_Ideology(t - dt) +
(Adopting_Template_Ideology - Reduction_in_Template_Ideology_Followers) * dt
   INIT Lvl2_Agents.Following_Template_Ideology = 0
   UNITS: People
   INFLOWS:
      Lvl2_Agents.Adopting_Template_Ideology =
Shift_to_Radical*LvL5_System_of_Systems.Template_Ideology_Adoption_Rate
         UNITS: People/Month
   OUTFLOWS:
      Lvl2_Agents.Reduction_in_Template_Ideology_Followers =
Pathway_to_Violence*LvL5_System_of_Systems.Radicals_Following_Template_Ideology
         UNITS: People/Month

**********
Lvl2_Agents.AGENTS_ADOPTING_TEMPLATE_METHODS:
**********
```

Lvl2_Agents.Following_Template_Methods(t) = Following_Template_Methods(t - dt) + (Adopting_Template_Methods - Reduction_by_use_of_Template_Method) * dt
INIT Lvl2_Agents.Following_Template_Methods = 0
UNITS: People
INFLOWS:
Lvl2_Agents.Adopting_Template_Methods = Activation*LvL5_System_of_Systems.Template_Method_Adoption_Rate
UNITS: People/Months
OUTFLOWS:
Lvl2_Agents.Reduction_by_use_of_Template_Method = Pathway_to_Violence*LvL5_System_of_Systems.Radicals_Following_Template_Method
UNITS: People/Months

****
Lvl2_Agents.RADICALIZATION_LIFE_CYCLE:
****
Lvl2_Agents.Activated(t) = Activated(t - dt) + (Activation - Pathway_to_Violence) * dt
INIT Lvl2_Agents.Activated = ModVal.Initial_Value_Activated
UNITS: People
INFLOWS:
Lvl2_Agents.Activation = ((Radicals*Lvl3_Networks_&_Actors.Identification_&_Activation)*LtG_Radical_Change)/ModVal.Month
UNITS: People/Months
OUTFLOWS:
Lvl2_Agents.Pathway_to_Violence = Activated/Time_for_Pathway_to_Violence
UNITS: People/Months
Lvl2_Agents.Backlash_Ramp = RAMP(0.02,12,60)*ModVal.Governed_Space_Backlash_Switch
UNITS: fraction
Lvl2_Agents.LtG_Moderate_Change = GRAPH(Moderates/ModVal.Initial_Value_Moderates)
(0.000, 0.000), (0.100, 0.33583091167), (0.200, 0.560945103841), (0.300, 0.7118436595), (0.400, 0.812993986277), (0.500, 0.880797077978), (0.600, 0.926246849528), (0.700, 0.956712742486), (0.800, 0.977134641257), (0.900, 0.99082384938), (1.000, 1.000)
UNITS: fraction
Lvl2_Agents.LtG_Radical_Change = GRAPH(Radicals/ModVal.Initial_Value_Radicals)
(0.000, 0.000), (0.100, 0.33583091167), (0.200, 0.560945103841), (0.300, 0.7118436595), (0.400, 0.812993986277), (0.500, 0.880797077978), (0.600, 0.926246849528), (0.700, 0.956712742486), (0.800, 0.977134641257), (0.900, 0.99082384938), (1.000, 1.000)
UNITS: Dimensionless
Lvl2_Agents.LtG_UnDecided_Change = GRAPH(UnDecided/ModVal.Initial_Value_Undecided)
(0.000, 0.000), (0.100, 0.33583091167), (0.200, 0.560945103841), (0.300, 0.7118436595), (0.400, 0.812993986277), (0.500, 0.880797077978), (0.600, 0.926246849528), (0.700, 0.956712742486), (0.800, 0.977134641257), (0.900, 0.99082384938), (1.000, 1.000)
UNITS: Dimensionless

```
Lvl2_Agents.Moderates(t) = Moderates(t - dt) + (Shift_to_Moderate) * dt
   INIT Lvl2_Agents.Moderates = ModVal.Initial_Value_Moderates
   UNITS: People
   INFLOWS:
      Lvl2_Agents.Shift_to_Moderate =
((UnDecided*Lvl3_Networks_&_Actors.Urge_to_Moderate*LtG_UnDecided_Change)-
(Moderates*Lvl3_Networks_&_Actors.Urge_to_Radicalize*LtG_Moderate_Change))
/ModVal.Month
         UNITS: People/Months
Lvl2_Agents.Normal_Time_to_Pathway_to_Violence = 10
   UNITS: Months
Lvl2_Agents.Radicals(t) = Radicals(t - dt) + (Shift_to_Radical - Activation) * dt
   INIT Lvl2_Agents.Radicals = ModVal.Initial_Value_Radicals
   UNITS: People
   INFLOWS:
      Lvl2_Agents.Shift_to_Radical =
((UnDecided*Lvl3_Networks_&_Actors.Urge_to_Radicalize*LtG_UnDecided_Change)-
(Radicals*Lvl3_Networks_&_Actors.Urge_to_Abandon_Radicalization*LtG_Radical_Change))
/ModVal.Month
         UNITS: People/Months
   OUTFLOWS:
      Lvl2_Agents.Activation =
((Radicals*Lvl3_Networks_&_Actors.Identification_&_Activation)*LtG_Radical_Change)/Mo
dVal.Month
         UNITS: People/Months
Lvl2_Agents.Response_Grievance = 1+(Undecided_Additions_STEP+Backlash_Ramp)
   UNITS: fraction
Lvl2_Agents.Time_for_Pathway_to_Violence =
Normal_Time_to_Pathway_to_Violence/ModVal.Ratio_Multiplier
   UNITS: Months
Lvl2_Agents.UnDecided(t) = UnDecided(t - dt) + (Additions_to_Undecided - Shift_to_Moderate
- Shift_to_Radical) * dt
   INIT Lvl2_Agents.UnDecided = ModVal.Initial_Value_Undecided
   UNITS: People
   INFLOWS:
      Lvl2_Agents.Additions_to_Undecided =
(ModVal.Undecided_Additions*Response_Grievance)/ModVal.Month
         UNITS: People/Months
   OUTFLOWS:
      Lvl2_Agents.Shift_to_Moderate =
((UnDecided*Lvl3_Networks_&_Actors.Urge_to_Moderate*LtG_UnDecided_Change)-
(Moderates*Lvl3_Networks_&_Actors.Urge_to_Radicalize*LtG_Moderate_Change))
/ModVal.Month
         UNITS: People/Months
      Lvl2_Agents.Shift_to_Radical =
((UnDecided*Lvl3_Networks_&_Actors.Urge_to_Radicalize*LtG_UnDecided_Change)-
```

(Radicals*Lvl3_Networks_&_Actors.Urge_to_Abandon_Radicalization*LtG_Radical_Change))
/ModVal.Month
UNITS: People/Months
Lvl2_Agents.Undecided_Additions_STEP = STEP(0,12)
UNITS: fraction
{ The model has 43 (43) variables (array expansion in parens).
In this module and 0 additional modules with 3 sectors.
Stocks: 6 (6) Flows: 9 (9) Converters: 28 (28)
Constants: 2 (2) Equations: 35 (35) Graphicals: 3 (3)
}

A-4.6 System Level 3: Networks & Actors

Level 3 system structure level represents the network effects of aggregate groups upon the individual agents of Level 2 as they interact with networks in the governed space. It also represents the influence of non-state actors within these network effects.

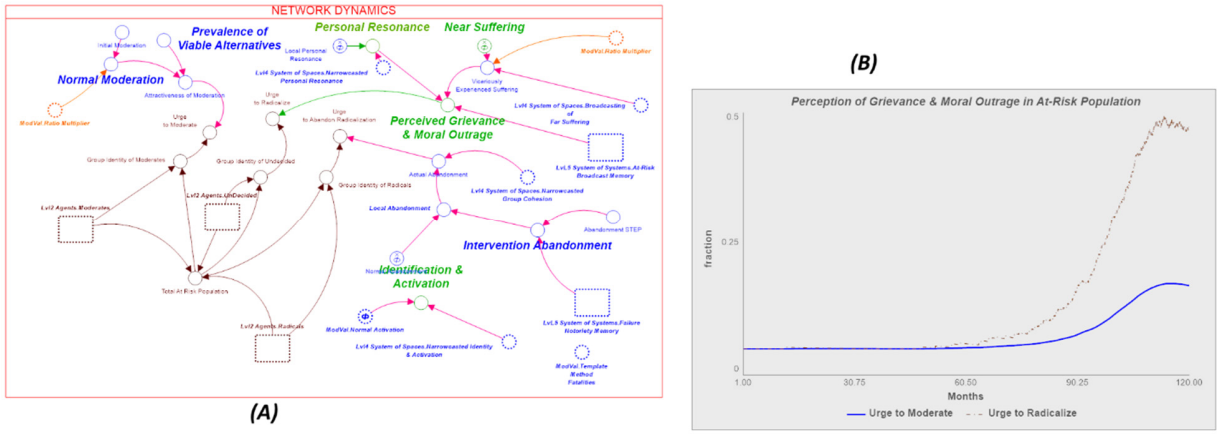


Figure 20: Level 3: Networks & Actors. (A) Network Dynamics Sector, (B) Representative Behavior mode of Moral Outrage within At Risk Population.

Level 3 Sector by Sector Overview

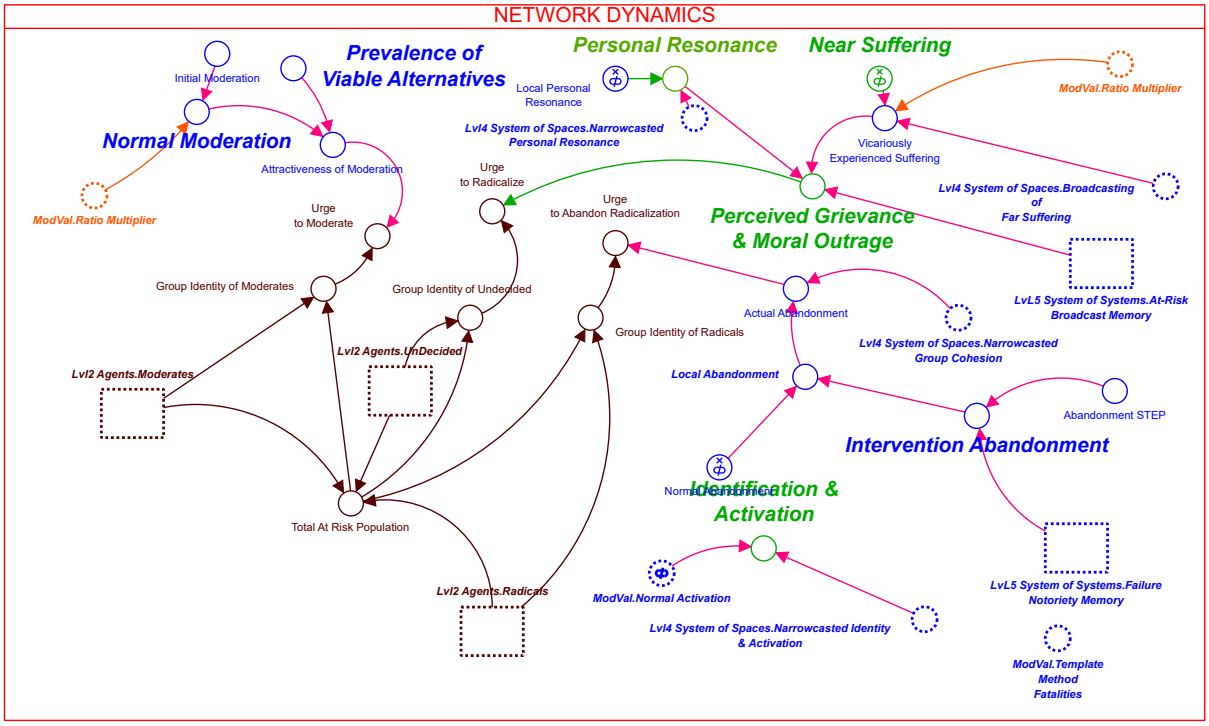


Figure 21: Detail of Network Dynamics (A) Sector of Level 3.

The only sector in this structure, Figure 21, borrows its primary network effects from the Farmers, Soldiers, and Bandits model[41]. Moderates, Undecided, and Radicals' relative population sizes are compared to create Urges to Moderate, Radicalize, or Abandon Radicalization. However, added to this structure are specific dynamics identified in our research that influence radicalization[1].

The Perceived Grievance and Moral Outrage in the Governed Space are combined between Vicariously Experienced suffering (which can occur from Governed near spaces or Ungoverned Far Spaces) with the At-Risk population's lived experience of Personal Resonance as communicated through at-risk networks through cultural scripts. These are the fuel for the conspiracy narratives which form the basis of Template Ideologies. Identification & Activation determines the rate Radicals adopt the warrior mentality and begin the Pathway to Violence. Ungoverned Space non-state actor cultural-script casting into the governed space though in Base Runs are inactivated. However, these are activated in contingency tests (see Contingency Analysis.)

Level 3 Representative Behavior

Representative behavior modes of key dynamics are shown in three figures below all using a CONT base run. The first behavior mode, Figure 22, displays the comparative strength of three group identities within the radicalization life cycle continuum. These are inverse displays so higher values result in reduced urges in the next diagram. This formulation is taken from Farmers, Soldiers, and Bandits model.

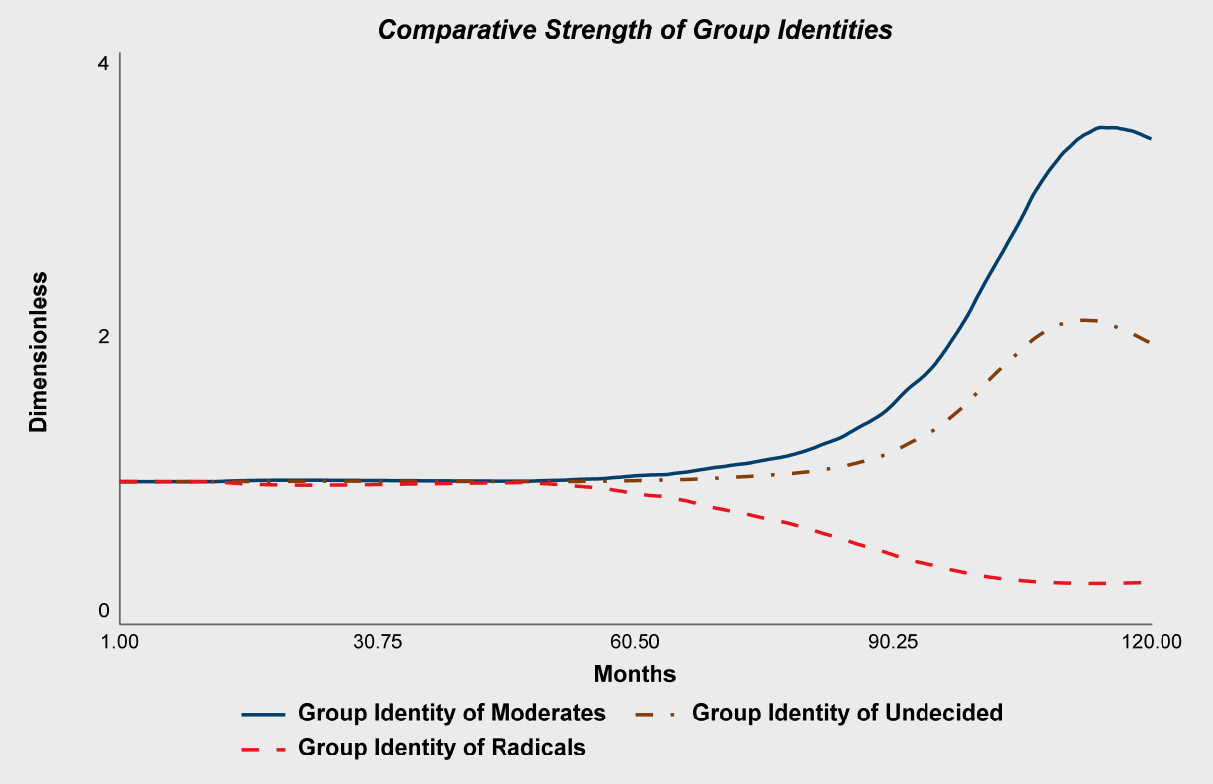


Figure 22: Comparative Strength of Group Identities Behavior in CONT run.

The second representative behavior run, Figure 23, shows the comparative Urges to Radicalize and Moderate. These build from the comparative group identity strengths and are also taken from Farmers, Soldiers and Bandits. When Urge to Radicalize is higher than Urge to Moderate, Moderates and Undecides will be pulled right into the Radical population stock in Level 2. When Urge to Moderate is higher than Urge to Radicalize, people will deradicalize and be pulled from the Radical population stock and into the Undecided and Moderate population stock. Note that once Radicals proceed to Activation, they cannot be deradicalized through network effects.

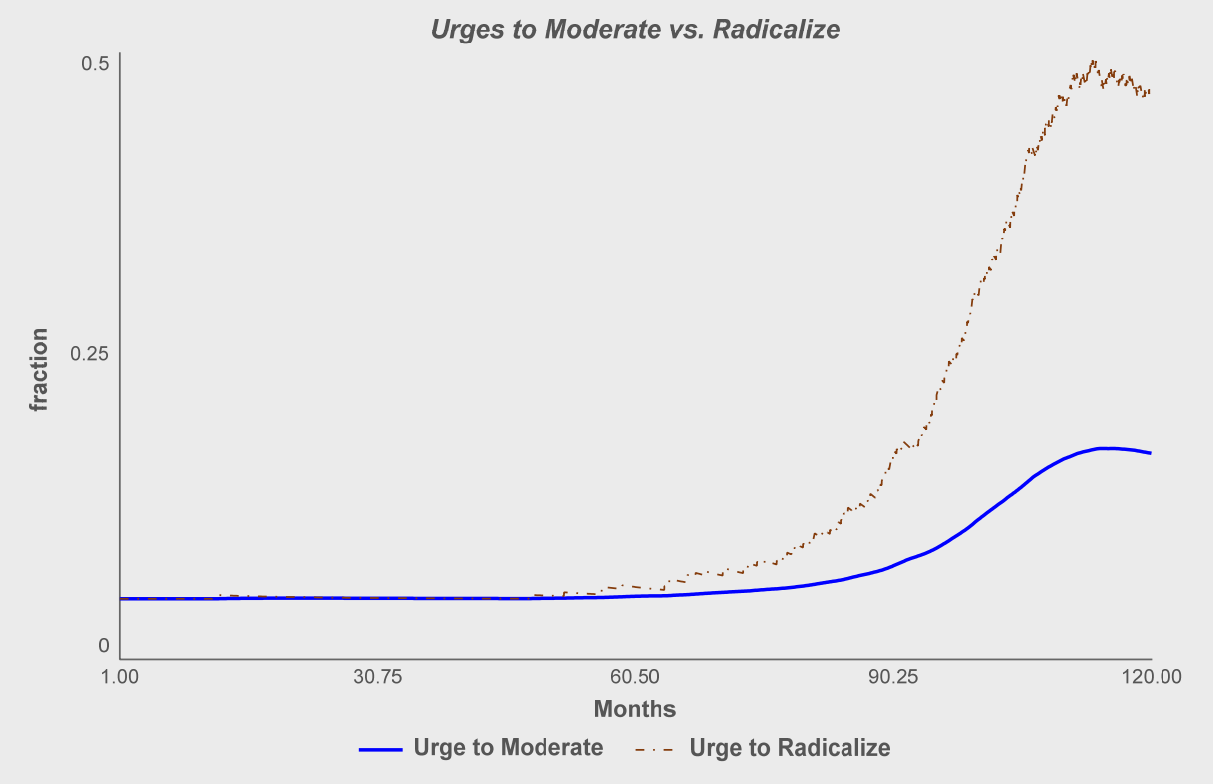


Figure 23: Urges to Moderate vs. Radicalize CONT Run.

The final behavior mode represented, Figure 24 shows the At-Risk population of perceived grievance and moral outrage. This is a key foundation tying together near and far suffering, vicariously experienced or personally lived, and also cultural script casting of non-state actors. The higher the perceived grievance, the more susceptible to radicalization they are.

Not displayed is the Actual Abandonment chart, which is located next to the charts above. Under normal circumstances this value will remain constant at zero, but under certain policy tests it will display a variable level of Abandonment. Abandonment acts to reduce the Urge to Radicalize and serves magnify efforts to pull people out of the Radical population stock in Level 2.

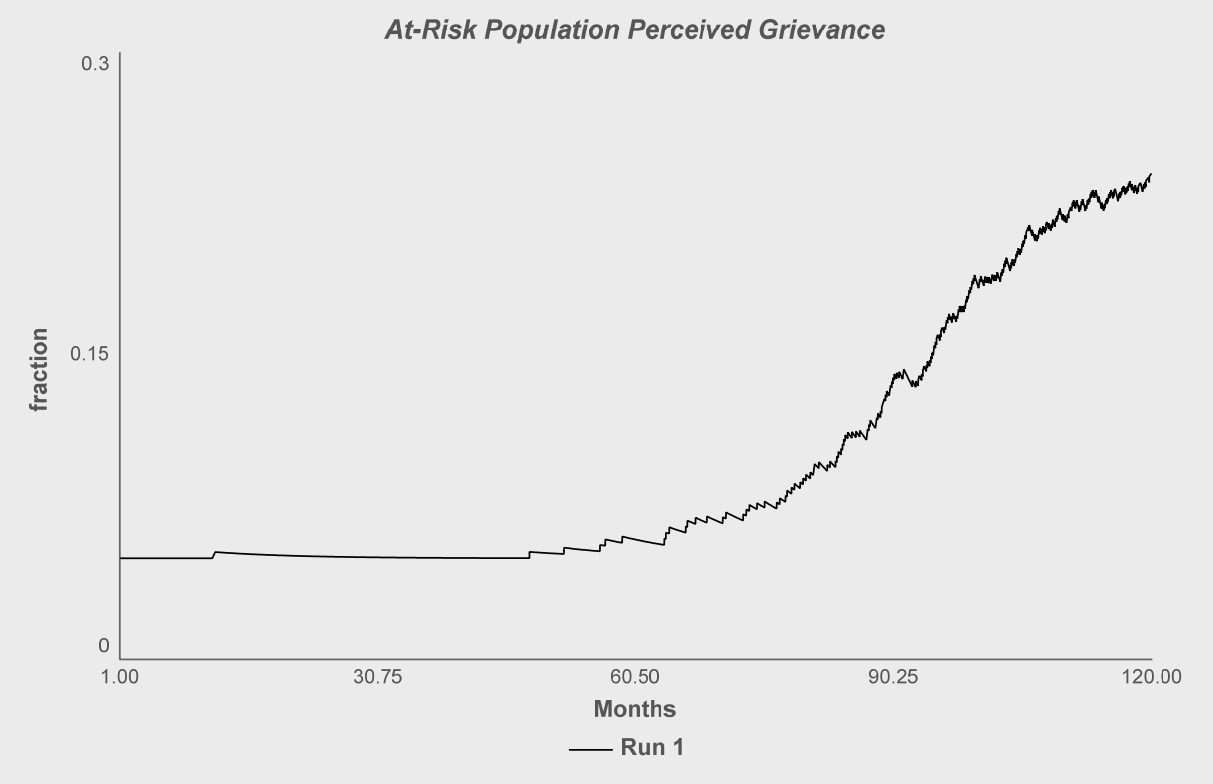


Figure 24: At Risk Population Perceived Grievance.

Level 3 Equations

Lvl3_Networks_&_Actors.Level_3_Module_Notes = 0
UNITS: Dimensionless

****
Lvl3_Networks_&_Actors.NETWORK_DYNAMICS:
****
Lvl3_Networks_&_Actors.Abandonment_STEP = STEP(0,0)
UNITS: fraction
Lvl3_Networks_&_Actors.Actual_Abandonment = MAX(0, (Local_Abandonment-Lvl4_System_of_Spaces.Narrowcasted_Group_Cohesion))
UNITS: fraction
Lvl3_Networks_&_Actors.Attractiveness_of_Moderation = Prevalence_of_Viable_Alternatives*Normal_Moderation
UNITS: fraction
Lvl3_Networks_&_Actors.Group_Identity_of_Moderates = 1/((Lvl2_Agents.Moderates/Total_At_Risk_Population)/(INIT(Lvl2_Agents.Moderates)/INIT(Total_At_Risk_Population)))
UNITS: Dimensionless

Lvl3_Networks_&_Actors.Group_Identity_of_Radicals = 1/((Lvl2_Agents.Radicals/Total_At_Risk_Population)/(INIT(Lvl2_Agents.Radicals)/INIT(Total_At_Risk_Population)))
UNITS: Dimensionless
Lvl3_Networks_&_Actors.Group_Identity_of_Undecided = 1/((Lvl2_Agents.UnDecided/Total_At_Risk_Population)/(INIT(Lvl2_Agents.UnDecided)/INIT(Total_At_Risk_Population)))
UNITS: Dimensionless
Lvl3_Networks_&_Actors.Identification_&_Activation = ModVal.Normal_Activation+Lvl4_System_of_Spaces.Narrowcasted_Identity_&_Activation
UNITS: fraction
Lvl3_Networks_&_Actors.Initial_Moderation = 0.05
UNITS: fraction
Lvl3_Networks_&_Actors.Intervention_Abandonment = Abandonment_STEP+LvL5_System_of_Systems.Failure_Notoriety_Memory
UNITS: fraction
Lvl3_Networks_&_Actors.Local_Abandonment = Normal_Abandonment+Intervention_Abandonment
UNITS: fraction
Lvl3_Networks_&_Actors.Local_Personal_Resonance = 0
UNITS: fraction
Lvl3_Networks_&_Actors.Near_Suffering = 0.05
UNITS: Dimensionless
Lvl3_Networks_&_Actors.Normal_Abandonment = 0
UNITS: fraction
Lvl3_Networks_&_Actors.Normal_Moderation = Initial_Moderation/ModVal.Ratio_Multiplier
UNITS: Dimensionless
Lvl3_Networks_&_Actors.Perceived_Grievance_&_Moral_Outrage = Vicariously_Experienced_Suffering*(Personal_Resonance*(1+LvL5_System_of_Systems."At-Risk_Broadcast_Memory"))
UNITS: fraction
Lvl3_Networks_&_Actors.Personal_Resonance = 1+(Local_Personal_Resonance+Lvl4_System_of_Spaces.Narrowcasted_Personal_Resonance)
UNITS: fraction
Lvl3_Networks_&_Actors.Prevalence_of_Viable_Alternatives = 1
UNITS: fraction
Lvl3_Networks_&_Actors.Total_At_Risk_Population = Lvl2_Agents.Moderates+Lvl2_Agents.UnDecided+Lvl2_Agents.Radicals
UNITS: People
Lvl3_Networks_&_Actors.Urge_to_Abandon_Radicalization = Group_Identity_of_Radicals*Actual_Abandonment
UNITS: fraction
Lvl3_Networks_&_Actors.Urge_to_Moderate = Group_Identity_of_Moderates*Attractiveness_of_Moderation
UNITS: fraction

Lvl3_Networks_&_Actors.Urge_to_Radicalize =
Perceived_Grievance_&_Moral_Outrage*Group_Identity_of_Undecided
UNITS: fraction
Lvl3_Networks_&_Actors.Vicariously_Experienced_Suffering =
(Near_Suffering/ModVal.Ratio_Multiplier)+(Lvl4_System_of_Spaces.Broadcasting_of_Far_Suffering/10)
UNITS: fraction

A-4.7 System Level 4: System of Spaces

Level 4 in the Terror Contagion Model represents the Ungoverned Space (e.g., Far Space) dynamics as it may influence the Governed Space (e.g., Near Space) activities as depicted in Figure 25.

The Ungoverned or Far Space is where non-state actors outside the direct control of the Governed or Near Space state-actor set up safe-havens and broadcast cultural scripts into the Near Space. The Far Space can be virtual (e.g., 4Chan/8Chan) or physical (e.g., Syria or Afghanistan.)

Changes in Grievance or Casting Capacity, through interventions, occur at this aggregate level. Chart (C) depicts two intervention methods into the far space. The first is a serial "pulse" representing periodic closure of popular website platforms or semi-annual campaigning or interventions in a physical Far Space. The first run in (C) incurs no backlash. Still, because the interventions target the Casting Capacity and not the Grievance that acts as a carrying capacity for the Casting Capacity, the Casting Capacity "grows" back. The second run in (C) depicts a serial intervention that provokes a backlash, known as the Accidental Guerilla Syndrome, where the subsequent Casting Capacities after each serial intervention grow higher than previous. Chart (D) shows why this occurs as the effects of an Accidental Guerilla intervention layer on the Far Space Grievance onto the Casting Capacity. Far Space interventions that provoke backlash spike Far Space Grievance, and as Grievance is the carrying capacity for Casting Capacity Infrastructure, over time as the Casting Capacity grows-back, it grows back to higher levels.

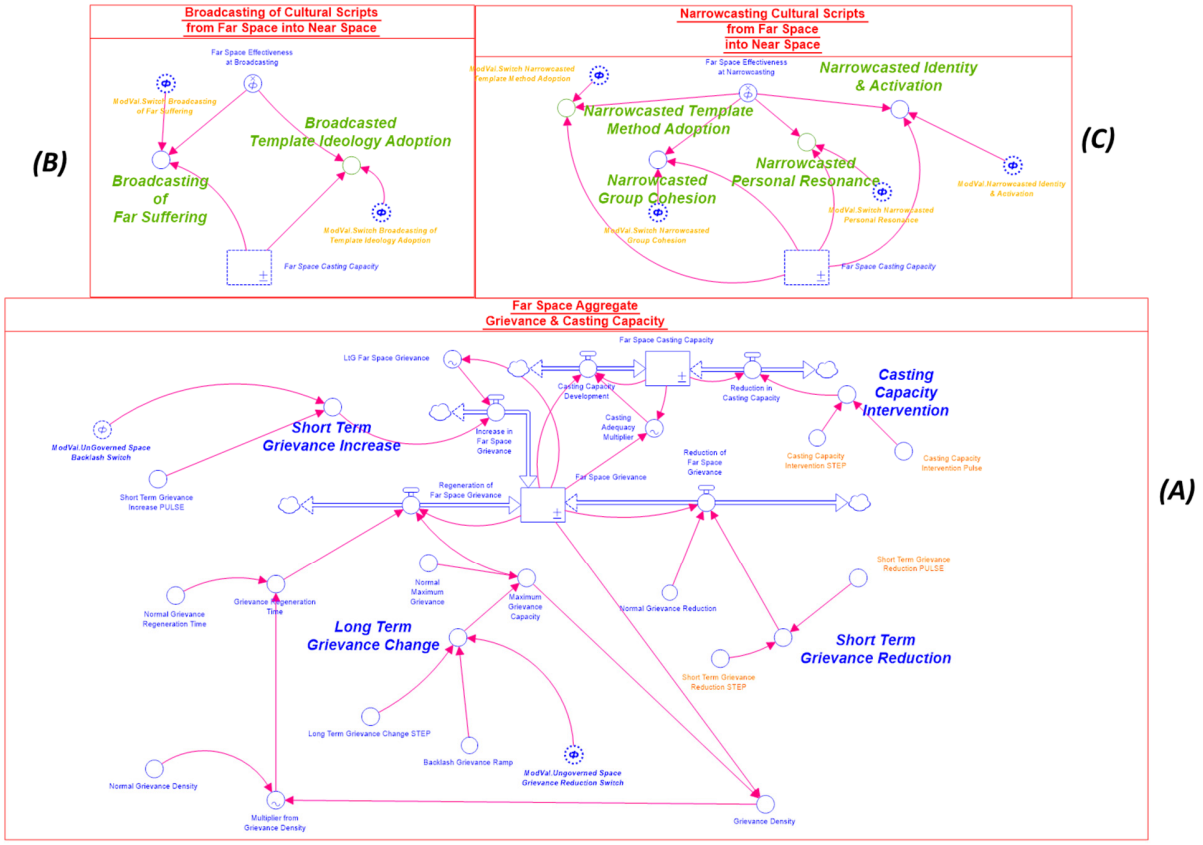


Figure 25: Level 4: System of Spaces. (A) Far Space Aggregate Grievance & Casting Capacity (B) Broadcasting of Cultural Scripts from Far Space into Near Space, and (C) Narrowcasting Cultural Scripts form Far Space into Near Space.

Level 3 Sector by Sector Overview

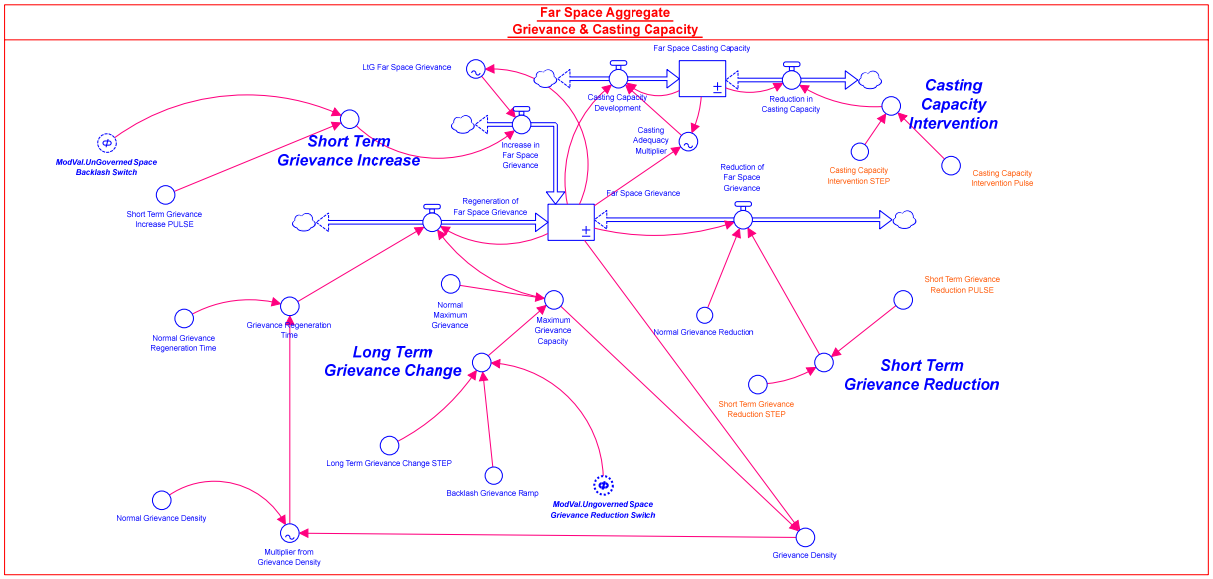


Figure 26: Detail of Aggregate Grievance & Casting Capacity Sector (A) of Level 3.

In Figure 26 Far Space grievance is structured as a Variable Regeneration Carrying Capacity[43]. Grievance in this way acts as an organic replenishment. The greater the amount of Grievance relative to a normal density, the faster it will replenish if it is reduced. Not unlike the growth of ground cover.

Far Space Grievance then influences an Implicit Stock Adjustment for Casting Capacity infrastructure[44]. The Casting Capacity infrastructure serves as the upper limit of actual ability for non-state actors to Broadcast or Narrowcast cultural scripts into the Governed space.

Both Grievance and Casting Capacity are highly aggregated. Grievance combines many potential causes of Grievance across many local actors to the Far Space. While Carrying Capacity represents a total infrastructure capacity across all non-state actors operating in the Far Space. Normally this entire Level is deactivated in the base runs. It is only activated to run Contingency Analysis and Policy Analysis for scenarios where non-state actors in an Ungoverned Space may be active.

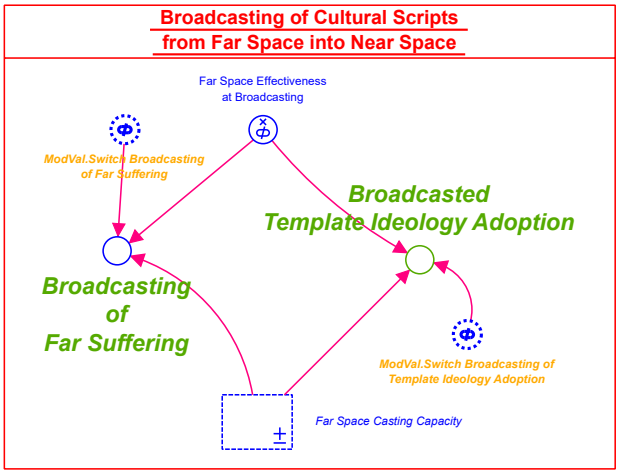


Figure 27: Detail of Broadcasting Cultural Scripts Sector (B) in Level 4.

The sector depicted in Figure 27 represents the specific ability of the non-state actor to broadcast cultural scripts in the near space. Broadcasting is used in communicating far suffering to the near space and providing a conspiracy narrative that forms the basis of a radicalized ideology [1]. The actual ability of the non-state actor to successfully broadcast is set in the imported profiles and is capped at the overall casting capability in sector (A).

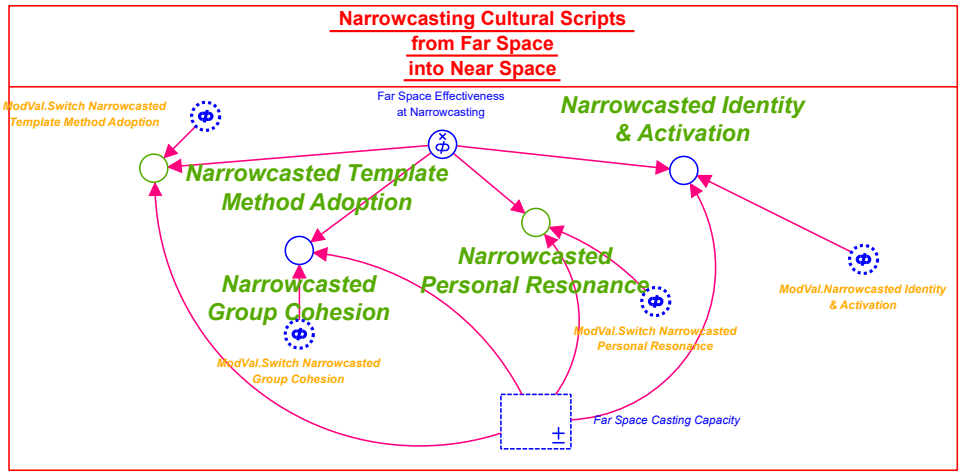


Figure 28: Detail of Narrowcasting Cultural Scripts Sector (C) in Level 4.

The sector depicted in Figure 28 represents the specific ability of the non-state actor to narrowcast cultural scripts in the near space. Narrowcasting is targeted script to already radicalized individuals that feeds fixation, adoption of the warrior or pseudo-commando identity and activation to terrorism [1]. The actual ability of the non-state actor to successfully narrowcast is set in the imported profiles and is capped at the overall casting capability in sector (A).

Level 4 Representative Behavior

There is no representative behavior for Level 4 in the base runs as the Ungoverned space is deactivated. However, when Ungoverned space is activated in both Contingency and Policy Analysis, the charts in this portion of the model provide behavior insights into two key variables: the aggregate grievance of the ungoverned far space and its total infrastructure for casting capacity.

Level 4 Equations

Lvl4_System_of_Spaces.Short_Term_Grievance_Increase_STEP = STEP(0, 24)
  UNITS: fraction/months

****
Lvl4_System_of_Spaces.Broadcasting_of_Cultural_Scripts_from_Far_Space_into_Near_Space:
****
Lvl4_System_of_Spaces.Broadcasted_Template_Ideology_Adoption =
(Far_Space_Casting_Capacity*Far_Space_Effectiveness_at_Broadcasting)*ModVal.Switch_Broadcasting_of_Template_Ideology_Adoption
  UNITS: fraction
Lvl4_System_of_Spaces.Broadcasting_of_Far_Suffering =
(Far_Space_Casting_Capacity*Far_Space_Effectiveness_at_Broadcasting)*ModVal.Switch_Broadcasting_of_Far_Suffering
  UNITS: fraction

Lvl4_System_of_Spaces.Far_Space_Effectiveness_at_Broadcasting = 0
UNITS: fraction

****
Lvl4_System_of_Spaces.Far_Space_Aggregate_Grievance_&_Casting_Capacity:
****
Lvl4_System_of_Spaces.Backlash_Grievance_Ramp = RAMP(0.02,24,60)
UNITS: fraction
Lvl4_System_of_Spaces.Casting_Adequacy_Multiplier =
GRAPH(SAFEDIV(Far_Space_Casting_Capacity, Far_Space_Grievance))
(0.000, 0.986614298151), (0.200, 0.964027580076), (0.400, 0.905148253645), (0.600, 0.761594155956), (0.800, 0.46211715726), (1.000, 0.000), (1.200, -0.46211715726), (1.400, -0.761594155956), (1.600, -0.905148253645), (1.800, -0.964027580076), (2.000, -0.986614298151)
UNITS: fraction/months
Lvl4_System_of_Spaces.Casting_Capacity_Intervention =
Casting_Capacity_Intervention_STEP+Casting_Capacity_Intervention_Pulse*ModVal.Ungoverned_Space_Casting_Capacity_Intervention_Switch
UNITS: fraction/months
Lvl4_System_of_Spaces.Casting_Capacity_Intervention_Pulse = PULSE(1,24,24)
UNITS: fraction/month
Lvl4_System_of_Spaces.Casting_Capacity_Intervention_STEP = STEP(0,24)
UNITS: fraction/month
Lvl4_System_of_Spaces.Far_Space_Casting_Capacity(t) = Far_Space_Casting_Capacity(t - dt) + (Casting_Capacity_Development - Reduction_in_Casting_Capacity) * dt
INIT Lvl4_System_of_Spaces.Far_Space_Casting_Capacity = 0.1
UNITS: fraction
INFLOWS:
Lvl4_System_of_Spaces.Casting_Capacity_Development =
((Far_Space_Casting_Capacity/10)+(Far_Space_Grievance/10))*Casting_Adequacy_Multiplier
UNITS: Per Month
OUTFLOWS:
Lvl4_System_of_Spaces.Reduction_in_Casting_Capacity =
Far_Space_Casting_Capacity*Casting_Capacity_Intervention
UNITS: Per Month
Lvl4_System_of_Spaces.Far_Space_Grievance(t) = Far_Space_Grievance(t - dt) +
(Regeneration_of_Far_Space_Grievance + Increase_in_Far_Space_Grievance -
Reduction_of_Far_Space_Grievance) * dt
INIT Lvl4_System_of_Spaces.Far_Space_Grievance = 0.1
UNITS: fraction
INFLOWS:
Lvl4_System_of_Spaces.Regeneration_of_Far_Space_Grievance =
(Maximum_Grievance_Capacity-Far_Space_Grievance)/Grievance_Regeneration_Time
UNITS: fraction/month
Lvl4_System_of_Spaces.Increase_in_Far_Space_Grievance =
Short_Term_Grievance_Increase*LtG_Far_Space_Grievance

UNITS: fraction/month
OUTFLOWS:
Lvl4_System_of_Spaces.Reduction_of_Far_Space_Grievance =
Far_Space_Grievance*(Normal_Grievance_Reduction+Short_Term_Grievance_Reduction)
UNITS: fraction/month
Lvl4_System_of_Spaces.Grievance_Density =
Far_Space_Grievance/Maximum_Grievance_Capacity
UNITS: fraction
Lvl4_System_of_Spaces.Grievance_Regeneration_Time =
Normal_Grievance_Regeneration_Time*Multiplier_from_Grievance_Density
UNITS: Months
Lvl4_System_of_Spaces.Long_Term_Grievance_Change =
((Long_Term_Grievance_Change_STEP+Backlash_Grievance_Ramp)*ModVal.UnGoverned_Space_Backlash_Switch)-
((Long_Term_Grievance_Change_STEP+Backlash_Grievance_Ramp)*ModVal.Ungoverned_Space_Grievance_Reduction_Switch)
UNITS: fraction
Lvl4_System_of_Spaces.Long_Term_Grievance_Change_STEP = RAMP(0, 24, 60)
UNITS: fraction
Lvl4_System_of_Spaces.LtG_Far_Space_Grievance = GRAPH(Far_Space_Grievance)
(0.000, 1.000), (0.100, 0.99082384938), (0.200, 0.977134641257), (0.300, 0.956712742486), (0.400, 0.926246849528), (0.500, 0.880797077978), (0.600, 0.812993986277), (0.700, 0.7118436595), (0.800, 0.560945103841), (0.900, 0.33583091167), (1.000, 0.000)
UNITS: fraction
Lvl4_System_of_Spaces.Maximum_Grievance_Capacity =
Normal_Maximum_Grievance+Long_Term_Grievance_Change
UNITS: fraction
Lvl4_System_of_Spaces.Multiplier_from_Grievance_Density =
GRAPH(Grievance_Density/Normal_Grievance_Density)
(0.000, 10.00), (0.050, 10.00), (0.100, 10.00), (0.150, 9.94), (0.200, 9.88), (0.250, 9.79), (0.300, 9.69), (0.350, 9.57), (0.400, 9.41), (0.450, 9.23), (0.500, 9.00), (0.550, 8.72), (0.600, 8.39), (0.650, 7.97), (0.700, 7.47), (0.750, 6.85), (0.800, 6.10), (0.850, 5.18), (0.900, 4.06), (0.950, 2.68), (1.000, 1.00)
UNITS: fraction
Lvl4_System_of_Spaces.Normal_Grievance_Density = 1
UNITS: fraction
Lvl4_System_of_Spaces.Normal_Grievance_Reduction = .1
UNITS: fraction/months
Lvl4_System_of_Spaces.Normal_Grievance_Regeneration_Time = 9
UNITS: Months
Lvl4_System_of_Spaces.Normal_Maximum_Grievance = 1
UNITS: fraction
Lvl4_System_of_Spaces.Short_Term_Grievance_Increase =
(Short_Term_Grievance_Increase_STEP+Short_Term_Grievance_Increase_PULSE)*ModVal.UnGoverned_Space_Backlash_Switch
UNITS: fraction/months

```
Lvl4_System_of_Spaces.Short_Term_Grievance_Increase_PULSE = PULSE(0, 24, 24)
   UNITS: fraction/months
Lvl4_System_of_Spaces.Short_Term_Grievance_Reduction =
Short_Term_Grievance_Reduction_PULSE+Short_Term_Grievance_Reduction_STEP
   UNITS: fraction/months
Lvl4_System_of_Spaces.Short_Term_Grievance_Reduction_PULSE = PULSE(0,24,24)
   UNITS: fraction/months
Lvl4_System_of_Spaces.Short_Term_Grievance_Reduction_STEP = STEP(0,24)
   UNITS: fraction/month

**********
Lvl4_System_of_Spaces.Narrowcasting_Cultural_Scripts_from_Far_Space_into_Near_Space:
**********
Lvl4_System_of_Spaces.Far_Space_Effectiveness_at_Narrowcasting = 0
   UNITS: fraction
Lvl4_System_of_Spaces.Narrowcasted_Group_Cohesion =
(Far_Space_Casting_Capacity*Far_Space_Effectiveness_at_Narrowcasting)*ModVal.Switch_N
arrowcasted_Group_Cohesion
   UNITS: fraction
Lvl4_System_of_Spaces.Narrowcasted_Identity_&_Activation =
(Far_Space_Effectiveness_at_Narrowcasting*Far_Space_Casting_Capacity)*ModVal.Narrowca
sted_Identity_&_Activation
   UNITS: fraction
Lvl4_System_of_Spaces.Narrowcasted_Personal_Resonance =
(Far_Space_Casting_Capacity*Far_Space_Effectiveness_at_Narrowcasting)*ModVal.Switch_N
arrowcasted_Personal_Resonance
   UNITS: fraction
Lvl4_System_of_Spaces.Narrowcasted_Template_Method_Adoption =
(Far_Space_Effectiveness_at_Narrowcasting*Far_Space_Casting_Capacity)*ModVal.Switch_N
arrowcasted_Template_Method_Adoption
   UNITS: fraction
{ The model has 47 (47) variables (array expansion in parens).
  In this module and 0 additional modules with 3 sectors.
  Stocks: 2 (2) Flows: 5 (5) Converters: 40 (40)
  Constants: 6 (6) Equations: 39 (39) Graphicals: 3 (3)
  }
```

A-4.8 System Level 5: System of Systems

Level 5: System of Systems, depicted in Figure 29 represents the symbolic or abstracted level of dynamics that occur at the level of society. This is where the Terror Contagion dynamics occur and individual cultural scripts are coarse-grained into coherent Template Method and Template Ideology which can then be adopted by the At-Risk population in Level 2. This level also represents Societal level responses.

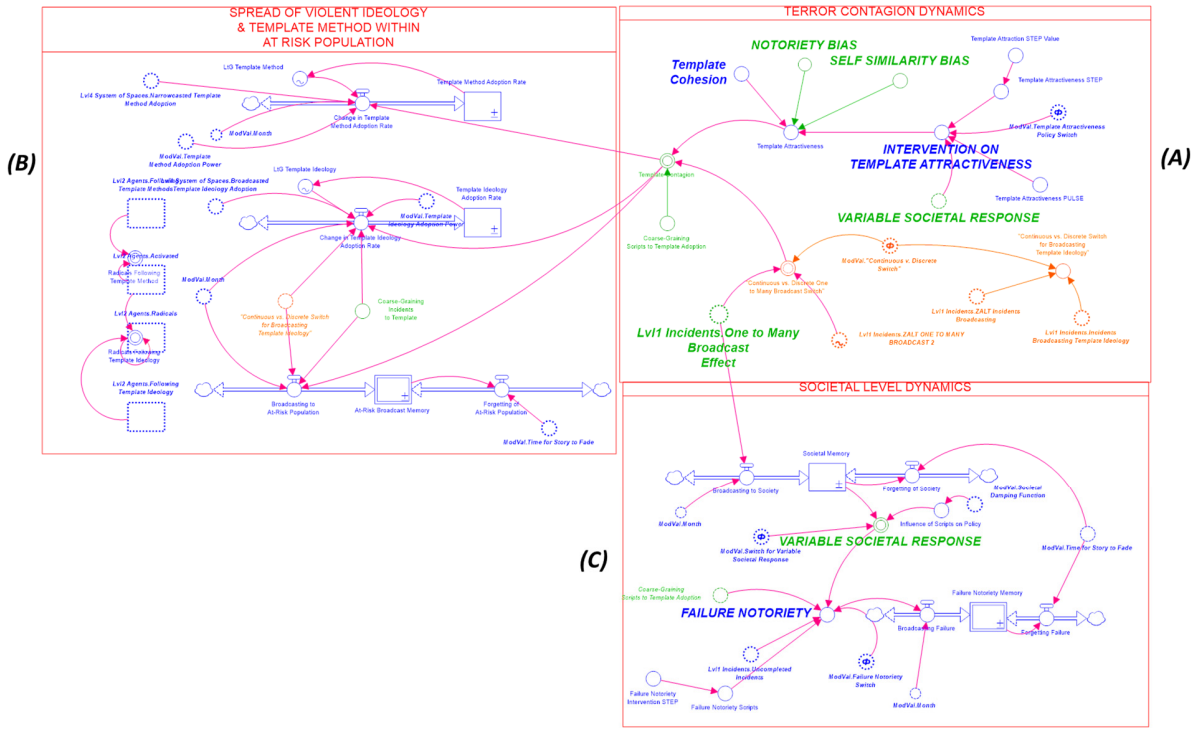


Figure 29: Level 5: System of Systems. (A) Terror Contagion Dynamics, (B) Spread of Violent Ideology & Template Method within At-Risk Population, and (C) Societal Level Dynamics.

Level 5 Sector by Sector Overview

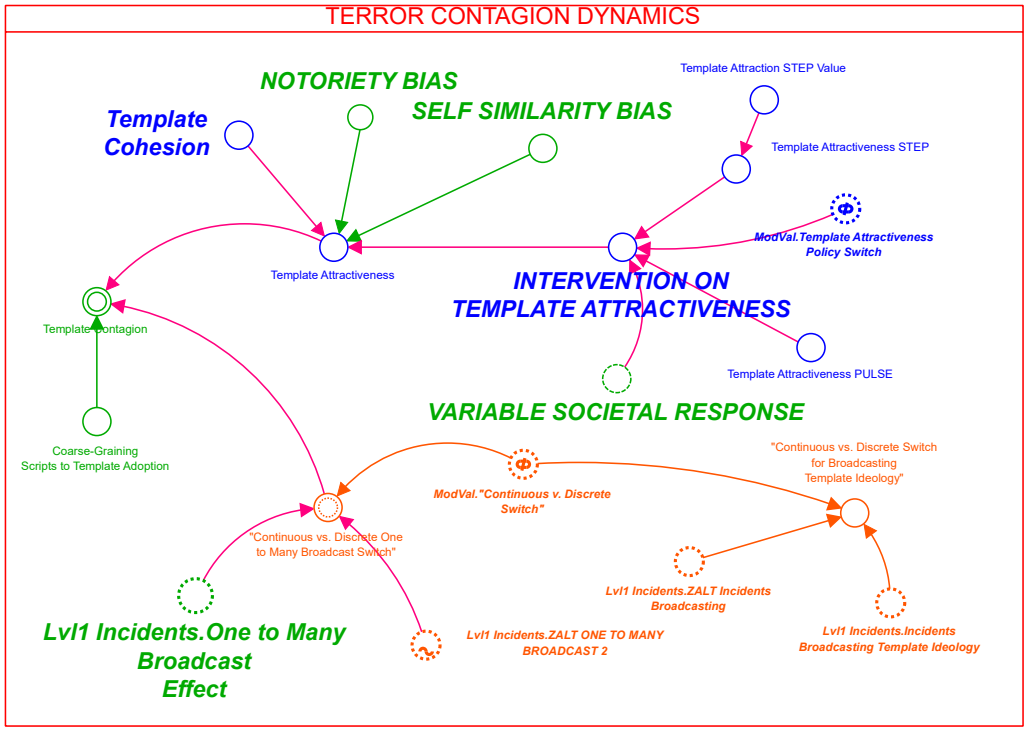


Figure 30: Detail of Terror Contagion Dynamics, Sector (A) Level 5.

In Figure 30 the Terror Contagion Sector receives the One-to-Many Broadcast effect of Level 1 and transmits the cultural scripts broadcasted to the At-Risk population. Note that the more fatalities a terrorist incident receives the greater the power of the One-to-Many Broadcast will be into this sector. However, the One-to-Many Broadcast is compared to an overall Template Attractiveness rating which combines Notoriety Bias, Self-Similarity Bias, and Template Cohesion[1]. High or Low Template Attractiveness, which ranges from 0-1, determines how much of the power of the media broadcast is transmitted to the At-Risk Populations Broadcast Memory in the next sector.

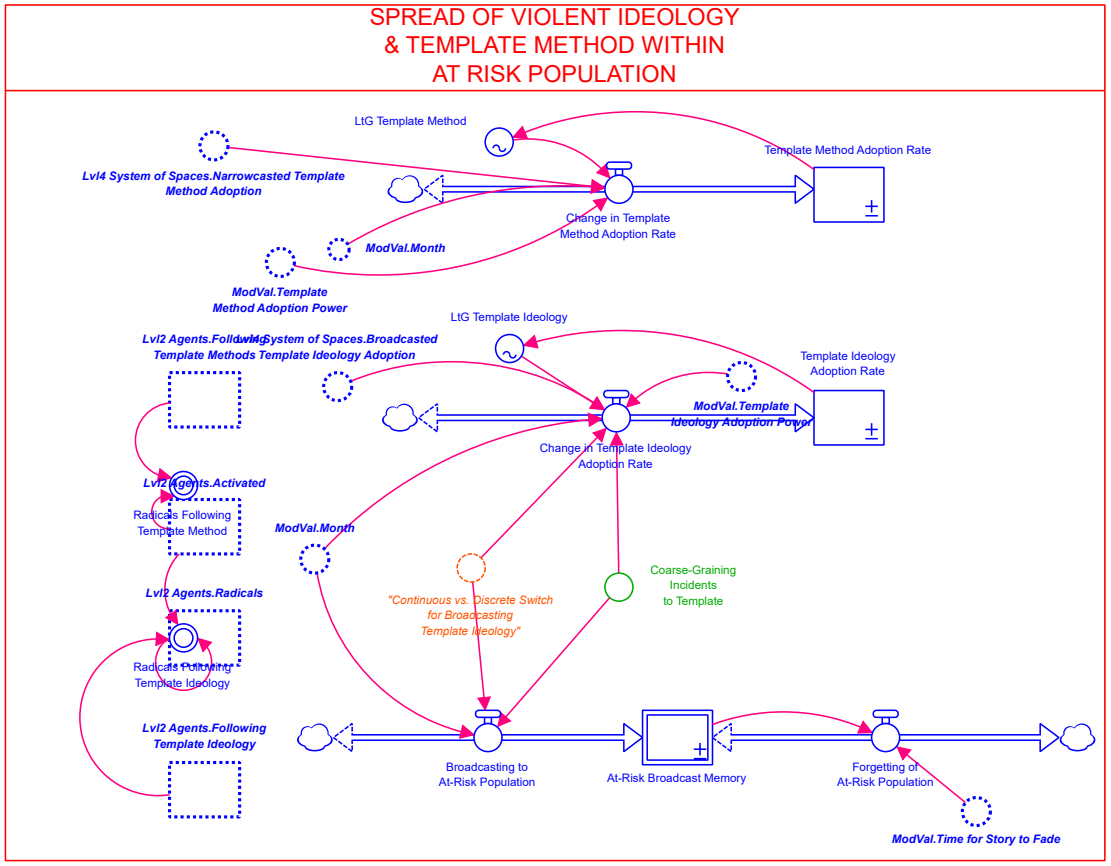


Figure 31: Detail of Spread of Violent Ideology & Template Method within At Risk Population Sector (B) Level 5.

In Sector (B), depicted in Figure 31 Broadcast Memory represents the stored media dissemination of cultural scripts from a mass-violent incident received by the At-Risk population with a natural rate of forgetting. Broadcast Memory is crucial for fueling Perceived Grievance & Moral Outrage in Level 3, by sensationalizing what may be a fringe grievance into a mass-media story. This in turn magnifies the Urge to Radicalize within the At-Risk population, drawing more Moderates and Undecided into the Radicalized population stock in Level 2 within which some will adopt the Template Method and Template Ideology. The rates of those adoptions are also determined in Level 5. Template Contagion based on its attractiveness will fuel Template Method Adoption and Template Ideology Adoption rates. This completes the cycle as people who commit terrorist acts using the Template Method will generate enough fatalities to power the mass-media dissemination of a Template Ideology over a broad enough population to reach

the At-Risk Population and perpetuate the cycle anew. This repetition is key because the Broadcast Memory has a natural rate of forgetting. A Terror Contagion needs successfully repeated incidents to sustain itself.

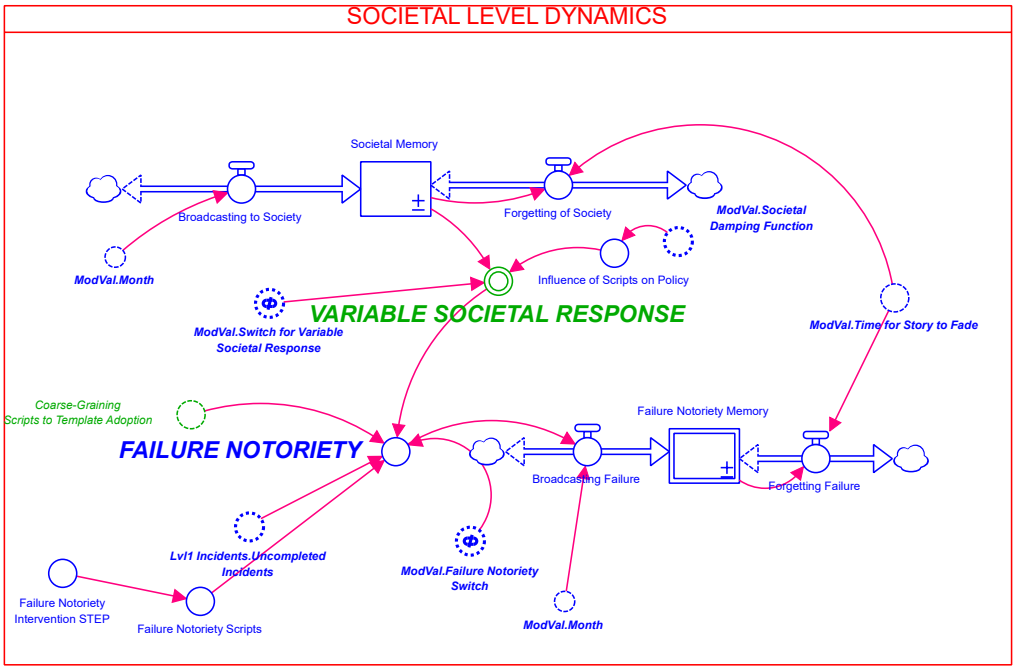


Figure 32: Detail of Societal Level Dynamics, Sector (C) in Level 5.

The Societal Level Dynamics sector, depicted in Figure 32 tracks a Societal Memory which operates similar to At-Risk Broadcast Memory. This in turn drives the Variable Societal Response which is a key policy leverage point and modeled off the Health Belief Model [45] or HBM. When turned on, the Variable Societal Response provides a dynamic change to the urgency of policy interventions that may be deployed, raising in strength when proximate to a mass-casualty event, and waning in influence as time proceeds from the last major incident. This realistically depicts the shifting attention on mass-violence incidents and ability to sustain policy interventions over time.

Level 5 Representative Behaviors

Below three of five behavior modes depicted on the Level 5 charts are displayed, using data from a CONT base run.

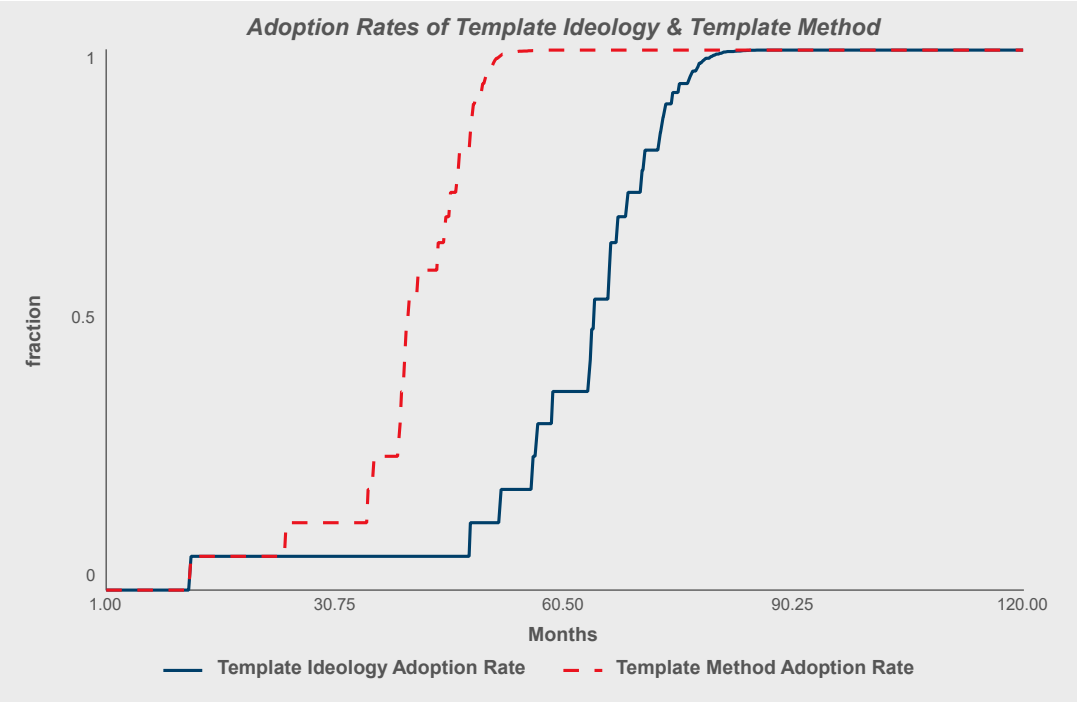


Figure 33: Adoption Rates of Template Ideology & Template Method, CONT run.

In Figure 33 the Adoption Rates of Template Ideology and Template Method from Sector (B) are displayed. These are key values to understanding Contagion behaviors, and both the rate of change (steepness) and ultimate adoption within an At-Risk Radicalized and Activated Population are key. These rates show how a Terror Contagion may end up being too weak to significantly influence an At-Risk population or may come to dominate the entirety of that At-Risk population which becomes Radicalized and Activated.

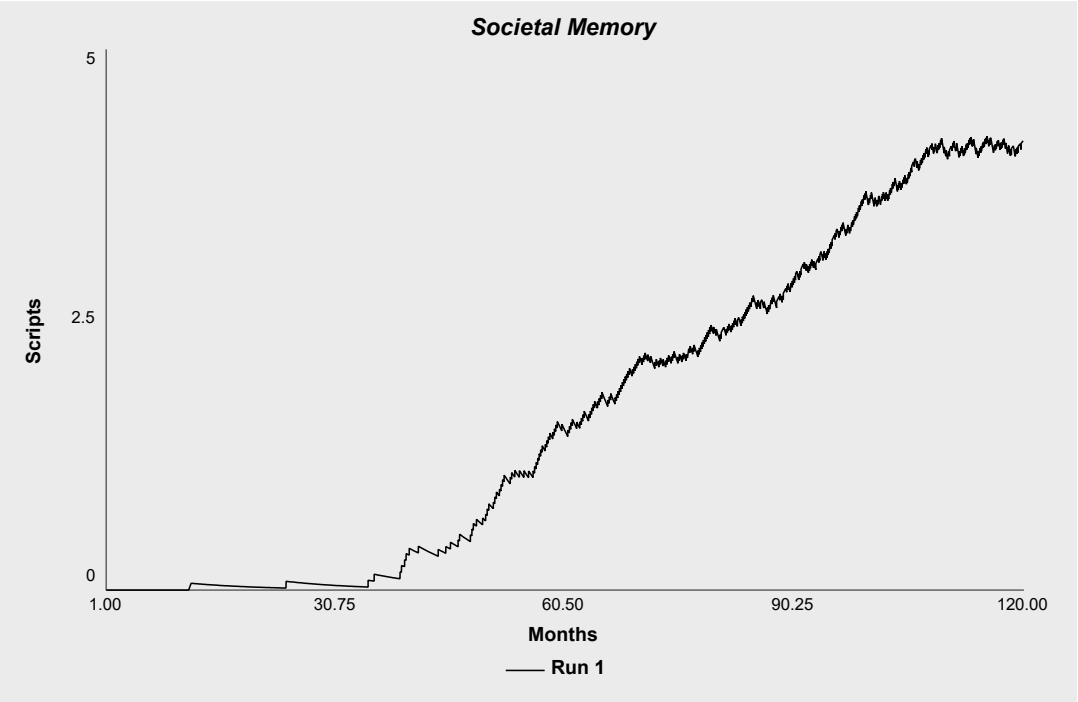


Figure 34: Societal Memory CONT Run.

The Societal Memory is the "fading memory" over time of repeated mass-casualty events. The more frequent, and more severe, the terrorist incidents are, the higher the Societal Memory will rise. However large gaps in successfully completed events will cause Societal Memory to fall. Societal Memory in turn fuels the Variable Societal Response if this switch is activated in the profile for policy analysis.

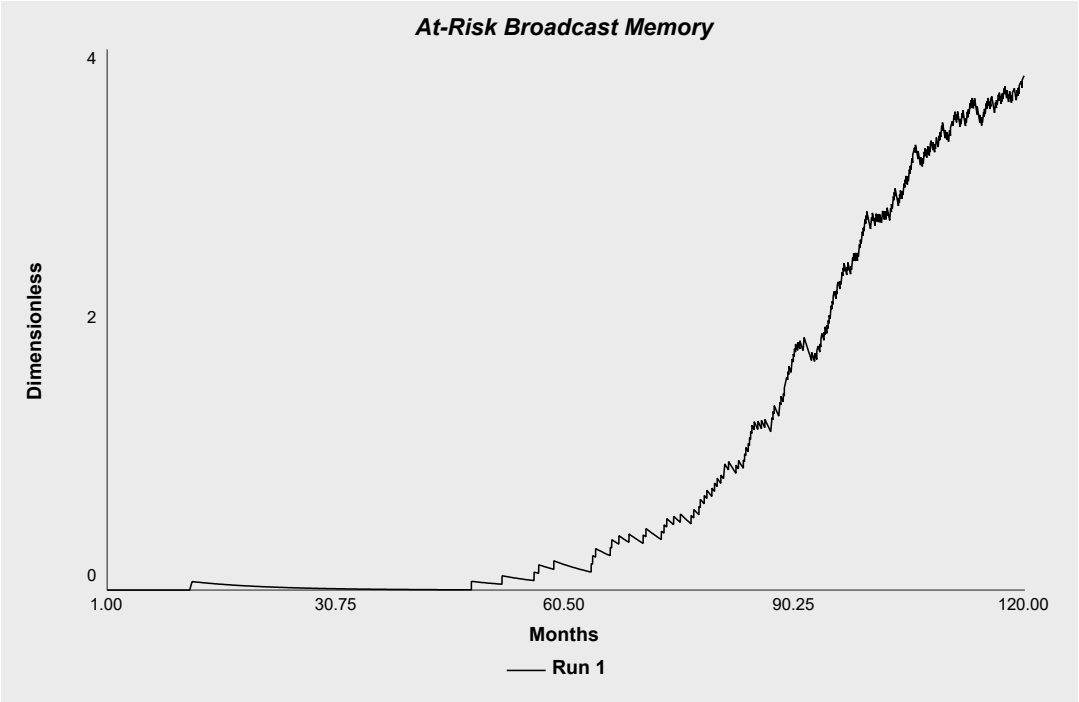


Figure 35: At-Risk Broadcast Memory, CONT run.

The At-Risk Broadcast Memory depicted in Figure 35 shows the specific broadcast memory within the At-Risk population of Terror Contagion incidents. Note that this level is not always the same as the Societal Memory, and this is important to understand how violent ideologies can permeate an At-Risk population without large awareness of the Societal Memory.

Not depicted are the charts for Template Attractiveness and Failure Notoriety Memory. Template Attractiveness in all baseline runs is set at 1, meaning the Template is attractive to 100% of the At-Risk population. This can be modified in future research for calibrated models based on specific violent ideology profiles and is also modified in policy testing. Failure Notoriety Memory is a specific policy response where the failure of attempted terrorist incidents are broadcast by the media alongside successes, and this fuels the Abandonment Rate in Level 3.

Level 5 Equations

LvL5_System_of_Systems.Lvl5_Module_Notes = 0
  UNITS: Dimensionless

****
LvL5_System_of_Systems.SOCIETAL_LEVEL_DYNAMICS:
****
LvL5_System_of_Systems.FAILURE_NOTORIETY =
(IF(VARIABLE_SOCIETAL_RESPONSE>0)THEN(
VARIABLE_SOCIETAL_RESPONSE)ELSE

(Failure_Notoriety_Scripts*Lvl1_Incidents.Uncompleted_Incidents*"Coarse-Graining_Scripts_to_Template_Adoption"))* ModVal.Failure_Notoriety_Switch
UNITS: fraction
LvL5_System_of_Systems.Failure_Notoriety_Intervention_STEP = STEP(0,0)
UNITS: scripts/incident
LvL5_System_of_Systems.Failure_Notoriety_Memory(t) = Failure_Notoriety_Memory(t - dt) + (Broadcasting_Failure - Forgetting_Failure) * dt
INIT LvL5_System_of_Systems.Failure_Notoriety_Memory = 0
UNITS: Dimensionless
INFLOWS:
LvL5_System_of_Systems.Broadcasting_Failure = FAILURE_NOTORIETY/ModVal.Month
UNITS: Per Month
OUTFLOWS:
LvL5_System_of_Systems.Forgetting_Failure = Failure_Notoriety_Memory/ModVal.Time_for_Story_to_Fade
UNITS: Per Month
LvL5_System_of_Systems.Failure_Notoriety_Scripts = Failure_Notoriety_Intervention_STEP
UNITS: scripts/Incident
LvL5_System_of_Systems.Influence_of_Scripts_on_Policy = ModVal.Societal_Damping_Function
UNITS: Scripts
LvL5_System_of_Systems.Societal_Memory(t) = Societal_Memory(t - dt) + (Broadcasting_to_Society - Forgetting_of_Society) * dt
INIT LvL5_System_of_Systems.Societal_Memory = 0
UNITS: Scripts
INFLOWS:
LvL5_System_of_Systems.Broadcasting_to_Society = Lvl1_Incidents.One_to_Many_Broadcast_Effect/ModVal.Month
UNITS: Scripts/Months
OUTFLOWS:
LvL5_System_of_Systems.Forgetting_of_Society = Societal_Memory/ModVal.Time_for_Story_to_Fade
UNITS: Scripts/Months
LvL5_System_of_Systems.VARIABLE_SOCIETAL_RESPONSE = MIN(1,MAX((Societal_Memory*ModVal.Switch_for_Variable_Societal_Response)/Influence_of_Scripts_on_Policy, 0))
UNITS: Fraction

****
LvL5_System_of_Systems.SPREAD_OF_VIOLENT_IDEOLOGY_&_TEMPLATE_METHOD_WITHIN_AT_RISK_POPULATION:
****
LvL5_System_of_Systems."At-Risk_Broadcast_Memory"(t) = "At-Risk_Broadcast_Memory"(t - dt) + ("Broadcasting_to_At-Risk_Population" - "Forgetting_of_At-Risk_Population") * dt
INIT LvL5_System_of_Systems."At-Risk_Broadcast_Memory" = 0

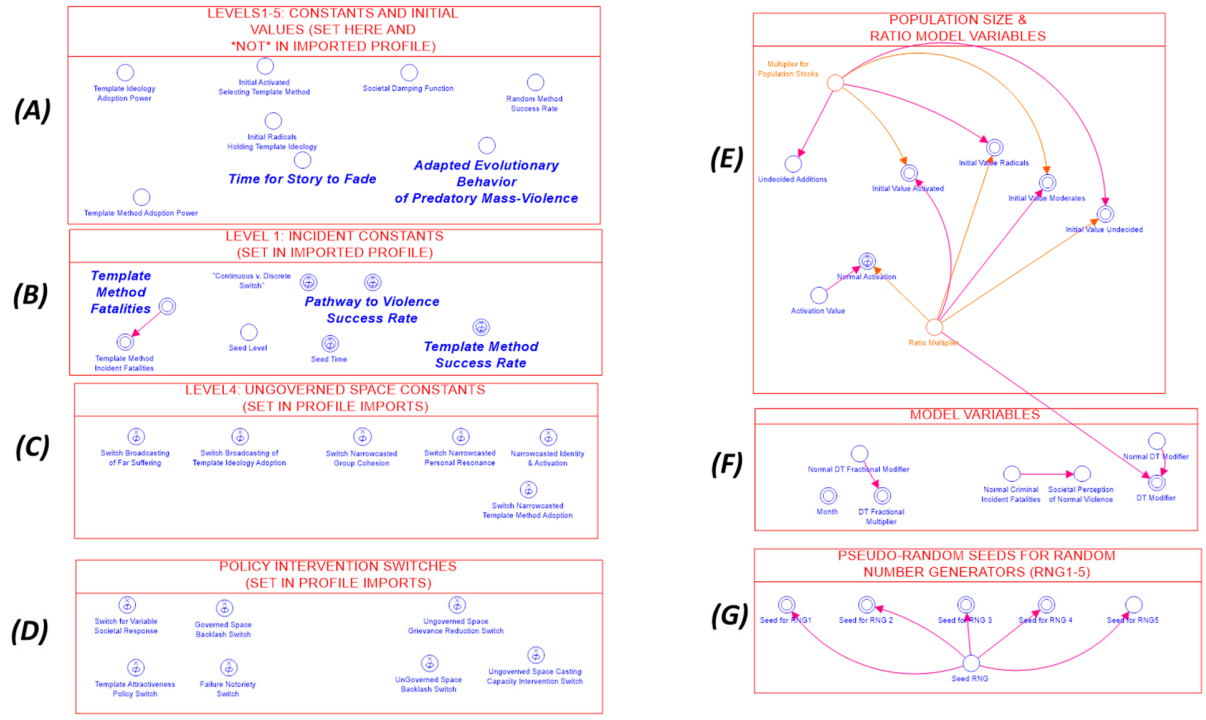
UNITS: Dimensionless
INFLOWS:
LvL5_System_of_Systems."Broadcasting_to_At-Risk_Population" = (Template_Contagion*"Continuous_vs._Discrete_Switch_for_Broadcasting_Template_Ideology"*"Coarse-Graining_Incidents_to_Template")/ModVal.Month
UNITS: Per Month
OUTFLOWS:
LvL5_System_of_Systems."Forgetting_of_At-Risk_Population" = "At-Risk_Broadcast_Memory"/ModVal.Time_for_Story_to_Fade
UNITS: Per Month
LvL5_System_of_Systems."Coarse-Graining_Incidents_to_Template" = 1
UNITS: Fraction/Incidents
LvL5_System_of_Systems.LtG_Template_Ideology = GRAPH(Template_Ideology_Adoption_Rate)
(0.000, 1.000), (0.100, 0.99082384938), (0.200, 0.977134641257), (0.300, 0.956712742486), (0.400, 0.926246849528), (0.500, 0.880797077978), (0.600, 0.812993986277), (0.700, 0.7118436595), (0.800, 0.560945103841), (0.900, 0.33583091167), (1.000, 0.000)
UNITS: 1
LvL5_System_of_Systems.LtG_Template_Method = GRAPH(Template_Method_Adoption_Rate)
(0.000, 1.000), (0.100, 0.99082384938), (0.200, 0.977134641257), (0.300, 0.956712742486), (0.400, 0.926246849528), (0.500, 0.880797077978), (0.600, 0.812993986277), (0.700, 0.7118436595), (0.800, 0.560945103841), (0.900, 0.33583091167), (1.000, 0.000)
UNITS: fraction
LvL5_System_of_Systems.Radicals_Following_Template_Ideology = SAFEDIV(Lvl2_Agents.Following_Template_Ideology,Lvl2_Agents.Radicals+Lvl2_Agents.Activated,0)
UNITS: 1
LvL5_System_of_Systems.Radicals_Following_Template_Method = SAFEDIV(Lvl2_Agents.Following_Template_Methods,Lvl2_Agents.Activated,0)
UNITS: 1
LvL5_System_of_Systems.Template_Ideology_Adoption_Rate(t) = Template_Ideology_Adoption_Rate(t - dt) + (Change_in_Template_Ideology_Adoption_Rate) * dt
INIT LvL5_System_of_Systems.Template_Ideology_Adoption_Rate = 0
UNITS: fraction
INFLOWS:
LvL5_System_of_Systems.Change_in_Template_Ideology_Adoption_Rate = (((Lvl4_System_of_Spaces.Broadcasted_Template_Ideology_Adoption*LtG_Template_Ideology)+(Template_Contagion*"Continuous_vs._Discrete_Switch_for_Broadcasting_Template_Ideology"*"Coarse-Graining_Incidents_to_Template"*LtG_Template_Ideology))*ModVal.Template_Ideology_Adoption_Power)/ModVal.Month
UNITS: Per Month
LvL5_System_of_Systems.Template_Method_Adoption_Rate(t) = Template_Method_Adoption_Rate(t - dt) + (Change_in_Template_Method_Adoption_Rate) * dt
INIT LvL5_System_of_Systems.Template_Method_Adoption_Rate = 0

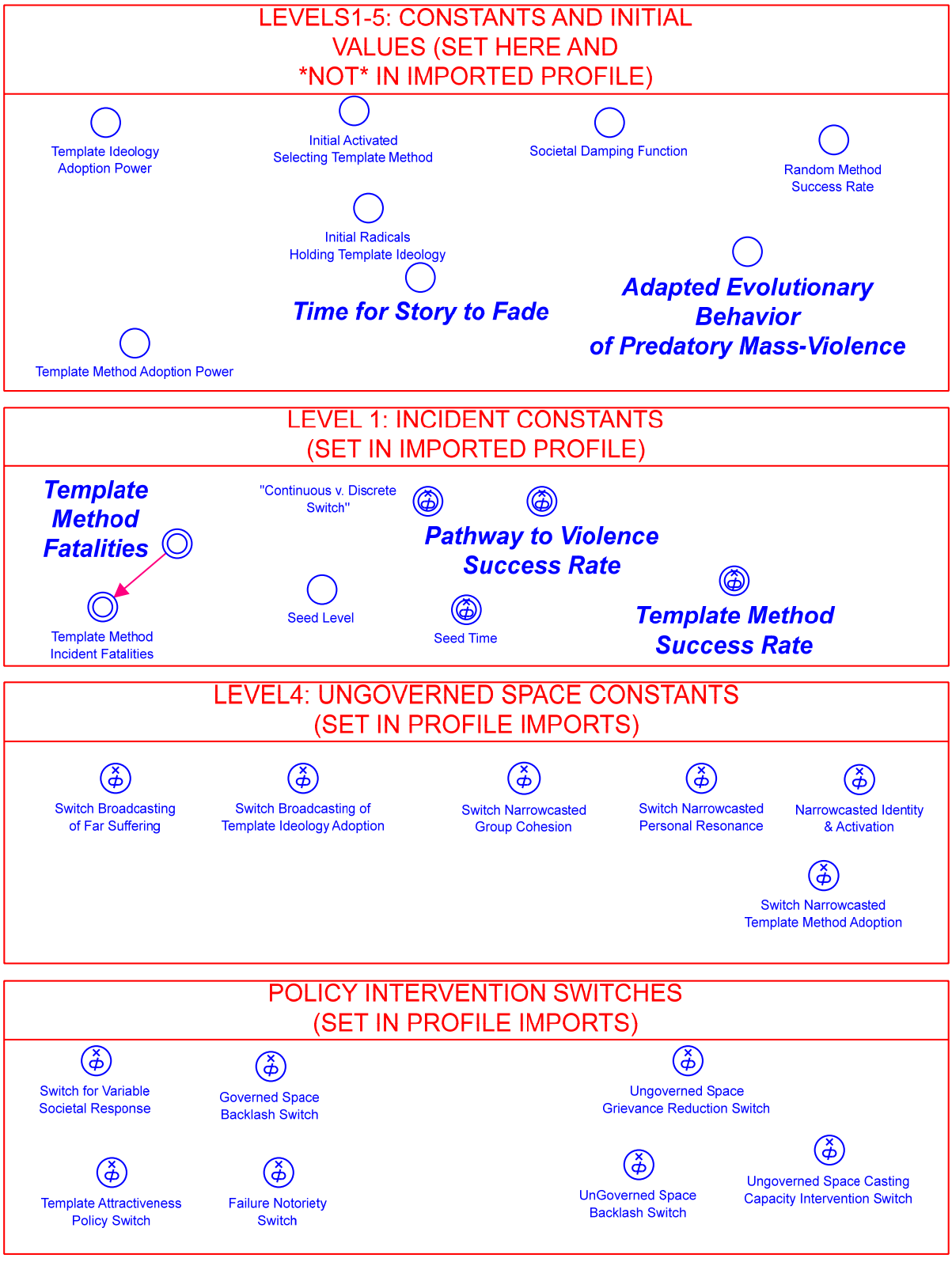
UNITS: fraction
INFLOWS:
LvL5_System_of_Systems.Change_in_Template_Method_Adoption_Rate =
(((Lvl4_System_of_Spaces.Narrowcasted_Template_Method_Adoption*LtG_Template_Method
)+ (Template_Contagion*LtG_Template_Method)
*ModVal.Template_Method_Adoption_Power))/ModVal.Month
UNITS: Per Month

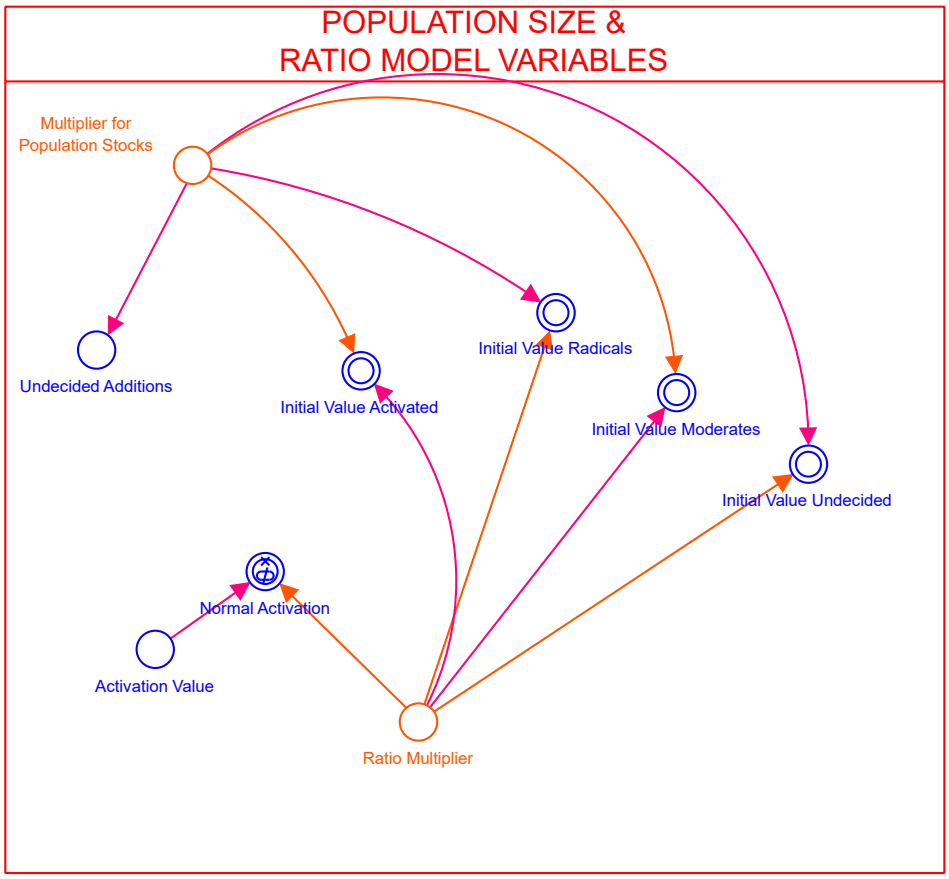
****
LvL5_System_of_Systems.TERROR_CONTAGION_DYNAMICS:
****
LvL5_System_of_Systems."Continuous_vs._Discrete_One_to_Many_Broadcast_Switch" =
(Lvl1_Incidents.One_to_Many_Broadcast_Effect*(1-
ModVal."Continuous_v._Discrete_Switch"))+
(Lvl1_Incidents.ZALT_ONE_TO_MANY_BROADCAST_2*ModVal."Continuous_v._Discrete
_Switch")
UNITS: Scripts
LvL5_System_of_Systems."Continuous_vs._Discrete_Switch_for_Broadcasting_Template_Ideo
logy" = (Lvl1_Incidents.Incidents_Broadcasting_Template_Ideology*(1-
ModVal."Continuous_v._Discrete_Switch"))+
(((Lvl1_Incidents.ZALT_Incidents_Broadcasting/10)*ModVal."Continuous_v._Discrete_Switch
"))
UNITS: Incidents
LvL5_System_of_Systems."Coarse-Graining_Scripts_to_Template_Adoption" = 1
UNITS: Fraction/Scripts
LvL5_System_of_Systems.INTERVENTION_ON_TEMPLATE_ATTRACTIVENESS =
(IF(VARIABLE_SOCIETAL_RESPONSE>0)THEN(VARIABLE_SOCIETAL_RESPONSE*
ModVal.Template_Attractiveness_Policy_Switch)ELSE(Template_Attractiveness_STEP+Templ
ate_Attractiveness_PULSE))
UNITS: fraction
LvL5_System_of_Systems.NOTORIETY_BIAS = 1
UNITS: fraction
LvL5_System_of_Systems.SELF_SIMILARITY_BIAS = 1
UNITS: fraction
LvL5_System_of_Systems.Template_Attraction_STEP_Value = 0
UNITS: fraction
LvL5_System_of_Systems.Template_Attractiveness = MAX(0,
MIN(1,((SELF_SIMILARITY_BIAS*NOTORIETY_BIAS*Template_Cohesion)-
INTERVENTION_ON_TEMPLATE_ATTRACTIVENESS)))
UNITS: fraction
LvL5_System_of_Systems.Template_Attractiveness_PULSE = PULSE(0, 10, 10)
UNITS: fraction
LvL5_System_of_Systems.Template_Attractiveness_STEP =
STEP(Template_Attraction_STEP_Value, 0)
UNITS: fraction
LvL5_System_of_Systems.Template_Cohesion = 1

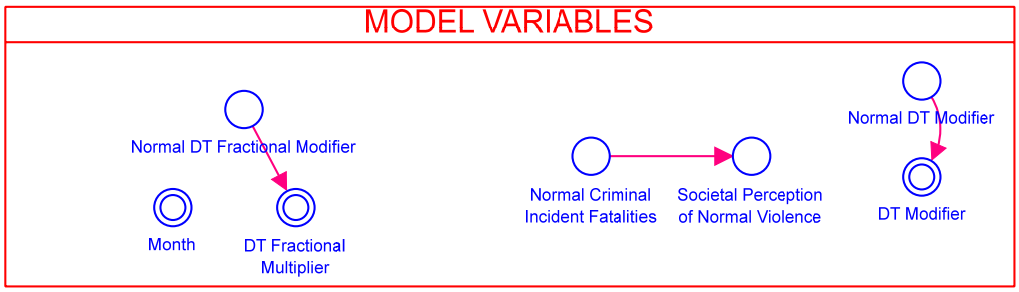
UNITS: fraction
LvL5_System_of_Systems.Template_Contagion = ("Continuous_vs._Discrete_One_to_Many_Broadcast_Switch"*Template_Attractiveness)*"Coarse-Graining_Scripts_to_Template_Adoption"
UNITS: fraction
{ The model has 57 (57) variables (array expansion in parens).
In this module and 0 additional modules with 3 sectors.
Stocks: 5 (5) Flows: 8 (8) Converters: 44 (44)
Constants: 7 (7) Equations: 45 (45) Graphicals: 3 (3)
}

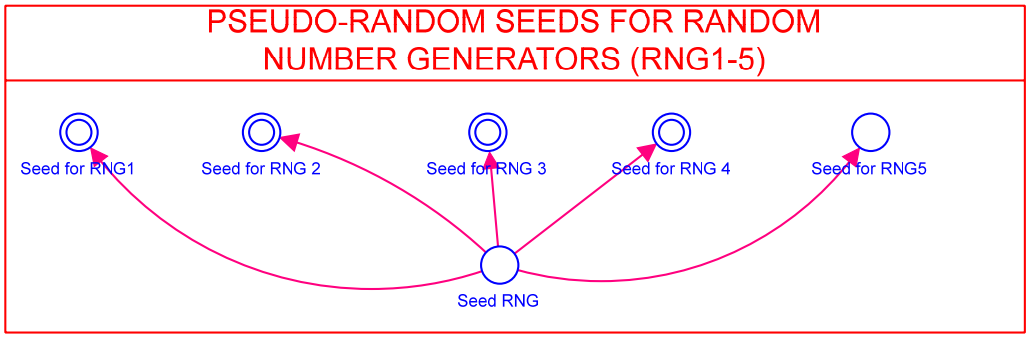
A-4.9 Model Values Structure




LEVELS1-5: CONSTANTS AND INITIAL VALUES (SET HERE AND *NOT* IN IMPORTED PROFILE)
Template Ideology Adoption Power
Initial Activated Selecting Template Method
Societal Damping Function
Random Method Success Rate
Initial Radicals Holding Template Ideology
Time for Story to Fade
Adapted Evolutionary Behavior of Predatory Mass-Violence
Template Method Adoption Power
LEVEL 1: INCIDENT CONSTANTS (SET IN IMPORTED PROFILE)
Template Method Fatalities
"Continuous v. Discrete Switch"
Pathway to Violence Success Rate
Seed Level
Seed Time
Template Method Success Rate
Template Method Incident Fatalities
LEVEL4: UNGOVERNED SPACE CONSTANTS (SET IN PROFILE IMPORTS)
Switch Broadcasting of Far Suffering
Switch Broadcasting of Template Ideology Adoption
Switch Narrowcasted Group Cohesion
Switch Narrowcasted Personal Resonance
Narrowcasted Identity & Activation
Switch Narrowcasted Template Method Adoption
POLICY INTERVENTION SWITCHES (SET IN PROFILE IMPORTS)
Switch for Variable Societal Response
Governed Space Backlash Switch
Ungoverned Space Grievance Reduction Switch
Template Attractiveness Policy Switch
Failure Notoriety Switch
UnGoverned Space Backlash Switch
Ungoverned Space Casting Capacity Intervention Switch







ModVal.ModelValues_Documentation = 0
UNITS: Dimensionless

****

ModVal."LEVEL_1:_INCIDENT_CONSTANTS_(SET_IN_IMPORTED_PROFILE)":
****
ModVal."Continuous_v._Discrete_Switch" = 0
  UNITS: Dimensionless
ModVal.Pathway_to_Violence_Success_Rate = 1
  UNITS: Fraction
ModVal.Seed_Level = 1
  UNITS: Incidents
ModVal.Seed_Time = 12
  UNITS: Months
ModVal.Template_Method_Fatalities = 10
  UNITS: Victims/Incident
ModVal.Template_Method_Incident_Fatalities = Template_Method_Fatalities
  UNITS: Victims/Incident
ModVal.Template_Method_Success_Rate = .8
  UNITS: fraction

****
ModVal."LEVEL4:_UNGOVERNED_SPACE_CONSTANTS_(SET_IN_PROFILE_IMPORTS
)":
****
ModVal.Narrowcasted_Identity_&_Activation = 0
  UNITS: Dimensionless
ModVal.Switch_Broadcasting_of_Far_Suffering = 0
  UNITS: Dimensionless
ModVal.Switch_Broadcasting_of_Template_Ideology_Adoption = 0
  UNITS: Dimensionless
ModVal.Switch_Narrowcasted_Group_Cohesion = 0
  UNITS: Dimensionless
ModVal.Switch_Narrowcasted_Personal_Resonance = 0
  UNITS: Dimensionless
ModVal.Switch_Narrowcasted_Template_Method_Adoption = 0
  UNITS: Dimensionless

****
ModVal."LEVELS1-
5:_CONSTANTS_AND_INITIAL_VALUES_(SET_HERE_AND_*NOT*_IN_IMPORTED_P
ROFILE)":
****
ModVal."Adapted_Evolutionary_Behavior_of_Predatory_Mass-Violence" = 1
  UNITS: fraction
ModVal.Initial_Activated_Selecting_Template_Method = 0
  UNITS: People
ModVal.Initial_Radicals_Holding_Template_Ideology = 0
  UNITS: People
ModVal.Random_Method_Success_Rate = 0.1

UNITS: fraction
ModVal.Societal_Damping_Function = 10
UNITS: Scripts
ModVal.Template_Ideology_Adoption_Power = 1
UNITS: Dimensionless
ModVal.Template_Method_Adoption_Power = 1
UNITS: Dimensionless
ModVal.Time_for_Story_to_Fade = 10
UNITS: Months

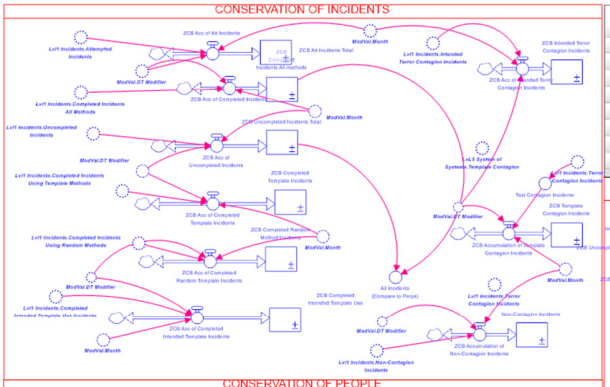
****
ModVal.MODEL_VARIABLES:
****
ModVal.DT_Fractional_Multiplier = Normal_DT_Fractional_Modifier
UNITS: Dimensionless
ModVal.DT_Modifier = Normal_DT_Modifier*Ratio_Multiplier
UNITS: Dimensionless
ModVal.Month = 1
UNITS: Months
ModVal.Normal_Criminal_Incident_Fatalities = 1
UNITS: Victims/Incident
ModVal.Normal_DT_Fractional_Modifier = 0.0125
UNITS: Dimensionless
ModVal.Normal_DT_Modifier = 80
UNITS: Dimensionless
ModVal.Societal_Perception_of_Normal_Violence = Normal_Criminal_Incident_Fatalities
UNITS: Victims/Incident

****
ModVal."POLICY_INTERVENTION_SWITCHES_(SET_IN_PROFILE_IMPORTS)":
****
ModVal.Failure_Notoriety_Switch = 0
UNITS: Dimensionless
ModVal.Governed_Space_Backlash_Switch = 0
UNITS: Dimensionless
ModVal.Switch_for_Variable_Societal_Response = 1
UNITS: Dimensionless
ModVal.Template_Attractiveness_Policy_Switch = 0
UNITS: Dimensionless
ModVal.UnGoverned_Space_Backlash_Switch = 0
UNITS: Dimensionless
ModVal.Ungoverned_Space_Casting_Capacity_Intervention_Switch = 0
UNITS: Dimensionless
ModVal.Ungoverned_Space_Grievance_Reduction_Switch = 0
UNITS: Dimensionless

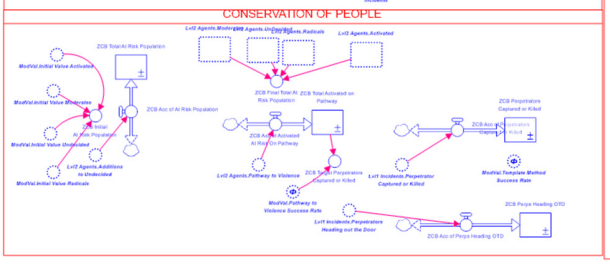
```
**********
ModVal.POPULATION_SIZE_&_RATIO_MODEL_VARIABLES:
**********
ModVal.Activation_Value = .1
   UNITS: fraction
ModVal.Initial_Value_Activated = (100*Multiplier_for_Population_Stocks)/Ratio_Multiplier
   UNITS: People
ModVal.Initial_Value_Moderates = 200*Multiplier_for_Population_Stocks*Ratio_Multiplier
   UNITS: People
ModVal.Initial_Value_Radicals = (100*Multiplier_for_Population_Stocks)/Ratio_Multiplier
   UNITS: People
ModVal.Initial_Value_Undecided = (200*Multiplier_for_Population_Stocks)*Ratio_Multiplier
   UNITS: People
ModVal.Multiplier_for_Population_Stocks = 1
   UNITS: People
ModVal.Normal_Activation = Activation_Value*Ratio_Multiplier
   UNITS: fraction
ModVal.Ratio_Multiplier = 1
   UNITS: Dimensionless
ModVal.Undecided_Additions = 10*Multiplier_for_Population_Stocks
   UNITS: People

**********
ModVal."PSEUDO-
RANDOM_SEEDS_FOR_RANDOM_NUMBER_GENERATORS_(RNG1-5)":
**********
ModVal.Seed_for_RNG_2 = 2+Seed_RNG
   UNITS: Dimensionless
ModVal.Seed_for_RNG_3 = 4+Seed_RNG
   UNITS: Dimensionless
ModVal.Seed_for_RNG_4 = 5+Seed_RNG
   UNITS: Dimensionless
ModVal.Seed_for_RNG1 = 1+Seed_RNG
   UNITS: Dimensionless
ModVal.Seed_for_RNG5 = 7+Seed_RNG
   UNITS: Dimensionless
ModVal.Seed_RNG = 0
   UNITS: Dimensionless
{ The model has 51 (51) variables (array expansion in parens).
 In this module and 0 additional modules with 7 sectors.
 Stocks: 0 (0) Flows: 0 (0) Converters: 51 (51)
 Constants: 36 (36) Equations: 15 (15) Graphicals: 0 (0)
 }
```

A-4.10 Structural Assessment: Conservation Laws

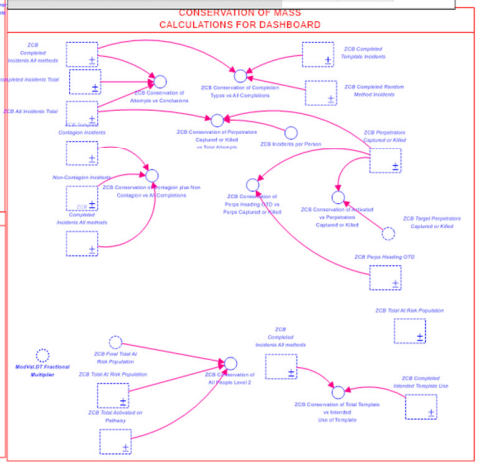
(A)



(B)



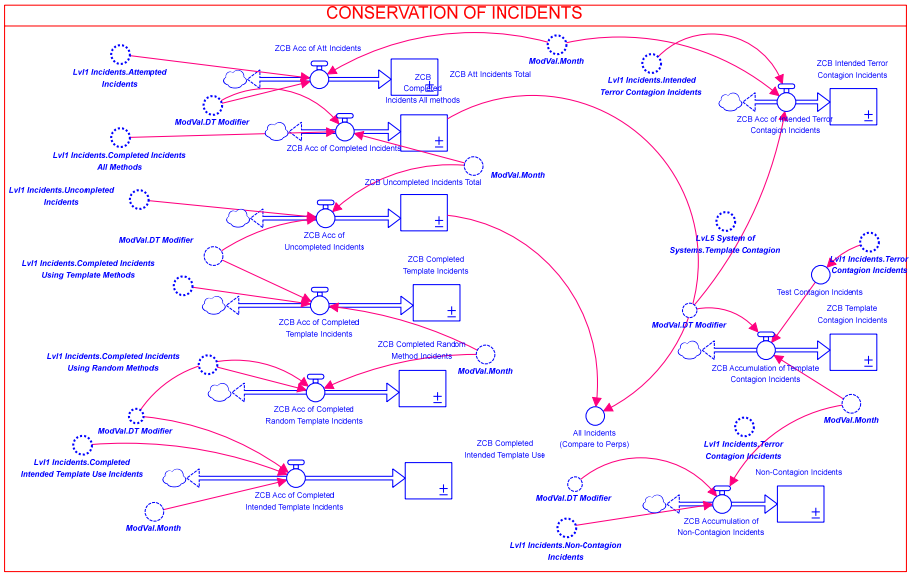
(C)

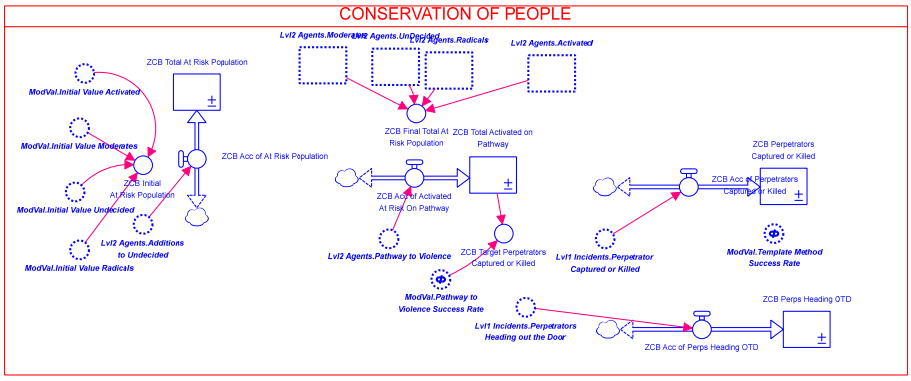


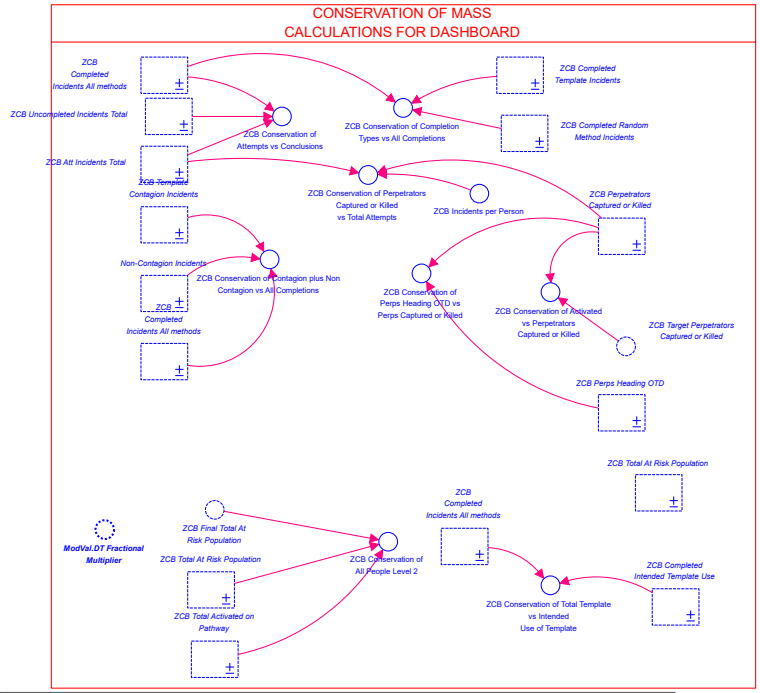
(D)

CONSERVATION TESTS: VALUES AT DT119 SUGGEST ERROR (1 = Seed Event)

	Initial	119
ZCB Conservation of All People Level 2	0	9.09e-13
ZCB Conservation of Activated vs Perpetrators Captured or Killed	0	0.164
ZCB Conservation of Perps Heading OTD vs Perps Captured or Killed	0	0.164
ZCB Conservation of Perpetrators Captured or Killed vs Total Attempts	0	0
ZCB Conservation of Attempts vs Conclusions	0	-1.14e-13
ZCB Conservation of Completion Types vs All Completions	0	0
ZCB Conservation of Contagion plus Non Contagion vs All Completions	0	0
ZCB Conservation of Total Template vs Intended Use of Template	0	1.6







CONSERVATION TESTS: VALUES >1 AT DT119 SUGGEST ERROR (1 = Seed Event)

	Initial	119
ZCB Conservation of All People Level 2	0	9.09e-13
ZCB Conservation of Activated vs Perpetrators Captured or Killed	0	0.164
ZCB Conservation of Perps Heading OTD vs Perps Captured or Killed	0	0.164
ZCB Conservation of Perpetrators Captured or Killed vs Total Attempts	0	0
ZCB Conservation of Attempts vs Conclusions	0	-1.14e-13
ZCB Conservation of Completion Types vs All Completions	0	0
ZCB Conservation of Contagion plus Non Contagion vs All Completions	0	0
ZCB Conservation of Total Template vs Intended Use of Template	0	1.6

Model_Testing_Structure.MODEL_TESTING_DOCUMENTATION = 0
UNITS: Dimensionless

****
Model_Testing_Structure.CONSERVATION_OF_INCIDENTS:
****
Model_Testing_Structure."All_Incidents_(Compare_to_Perps)" =
ZCB_Uncompleted_Incidents_Total+ZCB_Completed_Incidents_All_methods

UNITS: Incidents
Model_Testing_Structure."Non-Contagion_Incidents"(t) = "Non-Contagion_Incidents"(t - dt) + ("ZCB_Accumulation_of_Non-Contagion_Incidents") * dt
INIT Model_Testing_Structure."Non-Contagion_Incidents" = 0
UNITS: Incidents
INFLOWS:
Model_Testing_Structure."ZCB_Accumulation_of_Non-Contagion_Incidents" = (ModVal.DT_Modifier*Lvl1_Incidents."Non-Contagion_Incidents")/ModVal.Month
UNITS: Incidents/Month
Model_Testing_Structure.Test_Contagion_Incidents = IF(Lvl1_Incidents.Terror_Contagion_Incidents>0)THEN(1)ELSE(0)
UNITS: Incidents
Model_Testing_Structure.ZCB_Att_Incidents_Total(t) = ZCB_Att_Incidents_Total(t - dt) + (ZCB_Acc_of_Att_Incidents) * dt
INIT Model_Testing_Structure.ZCB_Att_Incidents_Total = 0
UNITS: Incidents
INFLOWS:
Model_Testing_Structure.ZCB_Acc_of_Att_Incidents = (Lvl1_Incidents.Attempted_Incidents*ModVal.DT_Modifier)/ModVal.Month
UNITS: Incidents/Month
Model_Testing_Structure.ZCB_Completed_Incidents_All_methods(t) = ZCB_Completed_Incidents_All_methods(t - dt) + (ZCB_Acc_of_Completed_Incidents) * dt
INIT Model_Testing_Structure.ZCB_Completed_Incidents_All_methods = 0
UNITS: Incidents
INFLOWS:
Model_Testing_Structure.ZCB_Acc_of_Completed_Incidents = (Lvl1_Incidents.Completed_Incidents_All_Methods*ModVal.DT_Modifier)/ModVal.Month
UNITS: Incidents/Month
Model_Testing_Structure.ZCB_Completed_Intended_Template_Use(t) = ZCB_Completed_Intended_Template_Use(t - dt) + (ZCB_Acc_of_Completed_Intended_Template_Incidents) * dt
INIT Model_Testing_Structure.ZCB_Completed_Intended_Template_Use = 0
UNITS: Incidents
INFLOWS:
Model_Testing_Structure.ZCB_Acc_of_Completed_Intended_Template_Incidents = (Lvl1_Incidents.Completed_Intended_Template_Use_Incidents*ModVal.DT_Modifier)/ModVal.Month
UNITS: Incidents/Month
Model_Testing_Structure.ZCB_Completed_Random_Method_Incidents(t) = ZCB_Completed_Random_Method_Incidents(t - dt) + (ZCB_Acc_of_Completed_Random_Template_Incidents) * dt
INIT Model_Testing_Structure.ZCB_Completed_Random_Method_Incidents = 0
UNITS: Incidents
INFLOWS:

Model_Testing_Structure.ZCB_Acc_of_Completed_Random_Template_Incidents = (Lvl1_Incidents.Completed_Incidents_Using_Random_Methods*ModVal.DT_Modifier)/ModVal.Month
UNITS: Incidents/Month
Model_Testing_Structure.ZCB_Completed_Template_Incidents(t) = ZCB_Completed_Template_Incidents(t - dt) + (ZCB_Acc_of_Completed_Template_Incidents) * dt
INIT Model_Testing_Structure.ZCB_Completed_Template_Incidents = 0
UNITS: Incidents
INFLOWS:
Model_Testing_Structure.ZCB_Acc_of_Completed_Template_Incidents = (Lvl1_Incidents.Completed_Incidents_Using_Template_Methods*ModVal.DT_Modifier)/ModVal.Month
UNITS: Incidents/Month
Model_Testing_Structure.ZCB_Intended_Terror_Contagion_Incidents(t) = ZCB_Intended_Terror_Contagion_Incidents(t - dt) + (ZCB_Acc_of_Intended_Terror_Contagion_Incidents) * dt
INIT Model_Testing_Structure.ZCB_Intended_Terror_Contagion_Incidents = 0
UNITS: Incidents
INFLOWS:
Model_Testing_Structure.ZCB_Acc_of_Intended_Terror_Contagion_Incidents = (Lvl1_Incidents.Intended_Terror_Contagion_Incidents*ModVal.DT_Modifier)/ModVal.Month
UNITS: Incidents/Month
Model_Testing_Structure.ZCB_Template_Contagion_Incidents(t) = ZCB_Template_Contagion_Incidents(t - dt) + (ZCB_Accumulation_of_Template_Contagion_Incidents) * dt
INIT Model_Testing_Structure.ZCB_Template_Contagion_Incidents = 0
UNITS: Incidents
INFLOWS:
Model_Testing_Structure.ZCB_Accumulation_of_Template_Contagion_Incidents = (Test_Contagion_Incidents*ModVal.DT_Modifier)/ModVal.Month
UNITS: Incidents/Month
Model_Testing_Structure.ZCB_Uncompleted_Incidents_Total(t) = ZCB_Uncompleted_Incidents_Total(t - dt) + (ZCB_Acc_of_Uncompleted_Incidents) * dt
INIT Model_Testing_Structure.ZCB_Uncompleted_Incidents_Total = 0
UNITS: Incidents
INFLOWS:
Model_Testing_Structure.ZCB_Acc_of_Uncompleted_Incidents = (Lvl1_Incidents.Uncompleted_Incidents*ModVal.DT_Modifier)/ModVal.Month
UNITS: Incidents/Month

****
Model_Testing_Structure.CONSERVATION_OF_MASS_CALCULATIONS_FOR_DASHBOARD:
****

Model_Testing_Structure.ZCB_Conservation_of_Activated_vs_Perpetrators_Captured_or_Killed = ZCB_Target_Perpetrators_Captured_or_Killed-ZCB_Perpetrators_Captured_or_Killed
   UNITS: People
Model_Testing_Structure.ZCB_Conservation_of_All_People_Level_2 = ZCB_Total_At_Risk_Population-(ZCB_Final_Total_At_Risk_Population+ZCB_Total_Activated_on_Pathway)
   UNITS: People
Model_Testing_Structure.ZCB_Conservation_of_Attempts_vs_Conclusions = ZCB_Att_Incidents_Total-(ZCB_Completed_Incidents_All_methods+ZCB_Uncompleted_Incidents_Total)
   UNITS: Incidents
Model_Testing_Structure.ZCB_Conservation_of_Completion_Types_vs_All_Completions = ZCB_Completed_Incidents_All_methods-(ZCB_Completed_Template_Incidents+ZCB_Completed_Random_Method_Incidents)
   UNITS: Incidents
Model_Testing_Structure.ZCB_Conservation_of_Contagion_plus_Non_Contagion_vs_All_Completions = ZCB_Completed_Incidents_All_methods-(ZCB_Template_Contagion_Incidents+"Non-Contagion_Incidents")
   UNITS: Incidents
Model_Testing_Structure.ZCB_Conservation_of_Perpetrators_Captured_or_Killed_vs_Total_Attempts = ZCB_Perpetrators_Captured_or_Killed-(ZCB_Att_Incidents_Total/ZCB_Incidents_per_Person)
   UNITS: People
Model_Testing_Structure.ZCB_Conservation_of_Perps_Heading_OTD_vs_Perps_Captured_or_Killed = ZCB_Perps_Heading_OTD-ZCB_Perpetrators_Captured_or_Killed
   UNITS: People
Model_Testing_Structure.ZCB_Conservation_of_Total_Template_vs_Intended_Use_of_Template = ZCB_Completed_Incidents_All_methods-ZCB_Completed_Intended_Template_Use
   UNITS: Incidents
Model_Testing_Structure.ZCB_Incidents_per_Person = 1
   UNITS: Incidents/People

****
Model_Testing_Structure.CONSERVATION_OF_PEOPLE:
****
Model_Testing_Structure.ZCB_Final_Total_At_Risk_Population = Lvl2_Agents.Moderates+Lvl2_Agents.UnDecided+Lvl2_Agents.Radicals+Lvl2_Agents.Activated
   UNITS: People
Model_Testing_Structure.ZCB_Initial_At_Risk_Population = ModVal.Initial_Value_Activated+ModVal.Initial_Value_Moderates+ModVal.Initial_Value_Undecided+ModVal.Initial_Value_Radicals
   UNITS: People
Model_Testing_Structure.ZCB_Perpetrators_Captured_or_Killed(t) = ZCB_Perpetrators_Captured_or_Killed(t - dt) + (ZCB_Acc_of_Perpetrators_Captured_or_Killed) * dt

```
  INIT Model_Testing_Structure.ZCB_Perpetrators_Captured_or_Killed = 0
  UNITS: People
  INFLOWS:
    Model_Testing_Structure.ZCB_Acc_of_Perpetrators_Captured_or_Killed =
Lvl1_Incidents.Perpetrator_Captured_or_Killed
      UNITS: People/Months
Model_Testing_Structure.ZCB_Perps_Heading_OTD(t) = ZCB_Perps_Heading_OTD(t - dt) +
(ZCB_Acc_of_Perps_Heading_OTD) * dt
  INIT Model_Testing_Structure.ZCB_Perps_Heading_OTD = 0
  UNITS: People
  INFLOWS:
    Model_Testing_Structure.ZCB_Acc_of_Perps_Heading_OTD =
Lvl1_Incidents.Perpetrators_Heading_out_the_Door
      UNITS: People/Month
Model_Testing_Structure.ZCB_Target_Perpetrators_Captured_or_Killed =
ZCB_Total_Activated_on_Pathway*ModVal.Pathway_to_Violence_Success_Rate
  UNITS: People
Model_Testing_Structure.ZCB_Total_Activated_on_Pathway(t) =
ZCB_Total_Activated_on_Pathway(t - dt) + (ZCB_Acc_of_Activated_At_Risk_On_Pathway) *
dt
  INIT Model_Testing_Structure.ZCB_Total_Activated_on_Pathway = 0
  UNITS: People
  INFLOWS:
    Model_Testing_Structure.ZCB_Acc_of_Activated_At_Risk_On_Pathway =
Lvl2_Agents.Pathway_to_Violence
      UNITS: People/Months
Model_Testing_Structure.ZCB_Total_At_Risk_Population(t) =
ZCB_Total_At_Risk_Population(t - dt) + (ZCB_Acc_of_At_Risk_Population) * dt
  INIT Model_Testing_Structure.ZCB_Total_At_Risk_Population =
ZCB_Initial_At_Risk_Population
  UNITS: People
  INFLOWS:
    Model_Testing_Structure.ZCB_Acc_of_At_Risk_Population =
Lvl2_Agents.Additions_to_Undecided
      UNITS: People/Month
{ The model has 70 (70) variables (array expansion in parens).
 In this module and 0 additional modules with 3 sectors.
 Stocks: 13 (13) Flows: 13 (13) Converters: 44 (44)
 Constants: 2 (2) Equations: 55 (55) Graphicals: 0 (0)
 }
```

SECTION B VALIDATION & CONFIDENCE BUILDING 101

B-1 INTRODUCTION

As a model for understanding the development of the Terror Contagion Model is limited. Still, we conducted standard validation & confidence building tests on the model [42, pp. 858–890].

B-2 BOUNDARY ADEQUACY

As an early-stage model for understanding, development focused initially on creating sufficient structure to recreate observed and suspected plausible behaviors. Only limited boundary testing was conducted because of this. However, during early testing we did identify that our boundary encompassing non-state actor involvement from ungoverned far space may have been too broad. When the At-Risk population was sufficiently large and the contagion dynamics significantly strong, non-state actor involvement was not necessary to recreate plausible growth modes in violent radicalization. So, we deactivated non-state actors from the baseline runs. However, we kept a highly aggregated ungoverned space structure in place as an outer boundary because testing did reveal special case scenarios where a smaller At-Risk population in the governed space or weaker contagion dynamic benefitted from non-state actor support from an ungoverned space. This boundary assessment led to the discussion of channel effects described in our research [9] and presented in D-10 CHANNEL ANALYSIS.

B-3 STRUCTURE ASSESSMENT

B-3.1 Conservation of Mass Errors

Due to the bunting of continuous integration for the majority of the model with discrete/stochastic formulation for Level 1 Incident Dynamics we paid special attention to conservation of mass errors. Earlier versions of the model would produce more incidents, than available perpetrators. A dashboard was set up in the Model Testing Structure and additional stock equations were used to evaluate conservation of mass. Depicted below in Figure 36 this dashboard compares the system totals of people, perpetrators, and incidents to ensure that the expected value based on inputs is not exceeded or missed by the in-process outputs. At DT119 a value greater than 1 in any heading indicates a risk of conservation of mass error. A value at 1 or less is considered an acceptable difference, attributable in part to the method of bunting between continuous and discrete, and to the singular seed event added arbitrarily in which Terror Contagions are manifested.

CONSERVATION TESTS: VALUES >1 AT DT119 SUGGEST ERROR (1 = Seed Event)		
	Initial	119
ZCB Conservation of All People Level 2	0	9.09e-13
ZCB Conservation of Activated vs Perpetrators Captured or Killed	0	0.164
ZCB Conservation of Perps Heading OTD vs Perps Captured or Killed	0	0.164
ZCB Conservation of Perpetrators Captured or Killed vs Total Attempts	0	0
ZCB Conservation of Attempts vs Conclusions	0	-1.14e-13
ZCB Conservation of Completion Types vs All Completions	0	0
ZCB Conservation of Contagion plus Non Contagion vs All Completions	0	0
ZCB Conservation of Total Template vs Intended Use of Template	0	1.6

Figure 36: Conservation of Mass Dashboard on CONT Behavior mode.

B-3.3 Conservation of Information Errors

To ensure conservation of information and Baker Rule guidance we added a Variable Society Response formulation to the model. Although the simulation has perfect knowledge of the extent of violent radicalization and adoption rates within the At-Risk population, society as a whole cannot. Instead, society can only recognize the violence that the At-Risk population commits, and then only if the fatalities are high enough to generate a sufficient one-to-many broadcast. Furthermore, this knowledge fades with time as other public priorities and concerns rise. This is modeled with a Societal Memory fueled by completed high fatality terror incidents that has a natural forgetting rate. This Societal Memory in turn fuels the Variable Society Response. What results is that as high-fatality incidents are more frequent and lethal, the Variable Society Response will be higher. This in turns determines the power level of policy responses. However, if there are few incidents or they are of low lethality, Variable Society Response will be lower, resulting in less power to policy implementations. This can even occur in the implementation of successful policies that reduce risk, resulting in realistic information behavior where because a policy intervention is showing success, the impetus to sustain that policy is lower for lack of violent incidents.

B-3.4 Formulation: Discrete vs. Continuous Incident Formulation

A potential area of contention in this model is the use of discrete/stochastic random number generators in the Level 1 Incident Dynamics sectors. Some system dynamics approaches eschew a hybrid approach where discrete formulations are combined with continuous formulations.

Although the overall model is a continuously integrated system dynamic model, terror incidents are stochastically resolved using random number generators (RNG). These random number generators check to see if an Activated individual successfully completes their Pathway to Violence, whether they have adopted a Template Ideology or Template Method, and whether they succeed in completing the terror incident sufficient to cause mass violence or are thwarted. All RNGs are confined to Level 1 in the system structure. Each RNG is based on a known seed to allow replication.

To build confidence in this hybrid approach we took two efforts. First we built an alternate Incident resolution structure using Continuous integration instead of Discrete. This can be activated via the profile by changing the "Continuous vs. Discrete Switch" from 0 to 1. Although this created additional structure in the model it allows easy side-by-side checking to compare results of discrete vs. continuous approaches to Level 1 incidents.

A second method we used to build confidence in the discrete formulations was to run non-equilibrium scenario across 1,000 permutations of different RNG seeds. This gave us a synthetic sample to take mean and range of results. This allowed us to use an ANOVA one-way test of means to evaluate statistical difference and power between the base run synthetic results, comparing Contagion Incidents. We used this method in both evaluating Base Runs for difference as well as policy tests and these results can be found in D-2 MODEL BASE RUNS and D-9 POLICY ANALYSIS respectively in each area they are applied.

One difficulty of using continuous formulation appear in the plausible realism of the behavior generated. Because in a continuous formulation, a little terrorism occurs each day every day, radicalization tends to accelerate rapidly after the seed event initiates the contagion. This is shown when using the baseline behavior modes under continuous formulation Figure 37.

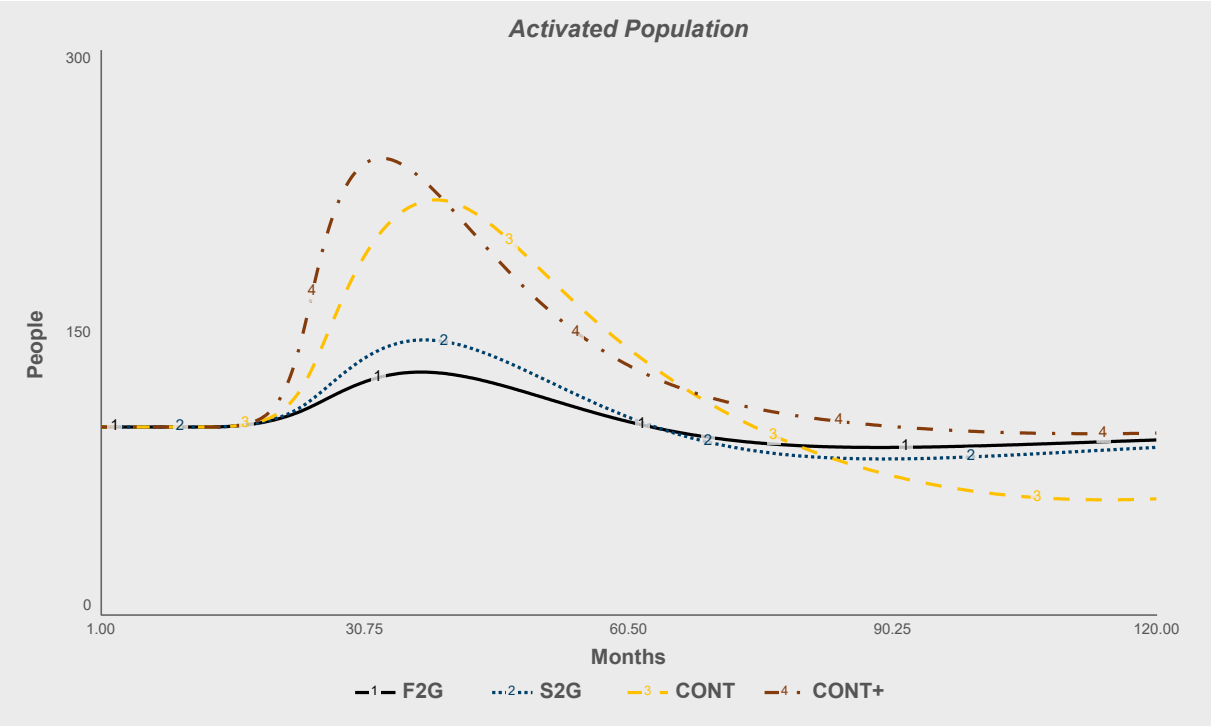


Figure 37: Baseline Behavior Modes in Continuous Formulation.

The behavior modes don't vary by location in time, just severity of contagion. Table 2 provides a numerical analysis of this effect, comparing discrete versus continuously formulated contagions. In the table we include the number of contagion incidents both at the end of the model (DT=119) and 24 months after the seed is initiated (DT=36).

Table 2: Formulation Test Numerical Results Comparison at Time=119

Formulation Method	Run Tested	Total Attempted Incidents at Time = 119	Total Failed Incidents at Time = 119	Non-Seed Completed Terror Contagion Incidents at Seed Event Time + 24 = 36	Completed Terror Contagion Incidents at Time = 119
Discrete	EQ	118	117	0	0
Continuous	EQ	118	117	0	0
Discrete	F2G	119	102	0	1
Continuous	F2G	121	40.7	58	65
Discrete	S2G	247	146	0	37
Continuous	S2G	246	80	36	135
Discrete	CONT	719	342	1	234
Continuous	CONT	705	232	160	414
Discrete	CONT+	1.54k	665	18	695
Continuous	CONT+	1.57k	487	349	940

The Table demonstrates the acceleration effect of continuous terrorism accumulation. A cluster of contagion incidents, representing a significant number of all successful terror incidents using that template method and template ideology, occur within 24 months after the seed event. This however does not match the historical record. There may be many failed attempts by copycats just after a major successful incident, but additional successful high-fatality incidents usually take time to develop and replicate.

B-3.5 IFTHENELSE Equations

The simulation contains numerous IFTHENELSE equations. These are controversial in system dynamics when used to create first order flow on a stock and can be a source of errors when used elsewhere. However, they also can be used to activate policy switches or different sectors of the model based in imported profiles. The number of IFTHENELSE by type of use for each level in the simulation is listed below in Table 3.

Table 3: Number, Location, and Type of IFTHENELSE Equations in Simulation.

Level	Number of IFTHENELSE Equations	Use of IFTHENELSE Equation
Level 1: Incidents	2	Enables user designated switching between discrete and continuous formulation.
Level 1: Incidents	5	Checks against Random Number Generators (RNG) to generate stochastic results in terror incident outcomes.

Level 1: Incidents	1	Enables user designated policy switch to be activated.
Level 1: Incidents	2	Counts Discrete Contagion Incidents
Level 5: System of Systems	2	Enables user designated switching between discrete and continuous formulation.

As shown in Table 3 there are 11 IFTHENELSE statements in the model. None are used as first order controls in the flow equations of stocks. Four enable the user to switch the model between discrete and continuous formulation via the profile. One enables the user to switch on a policy via the profile. Two count discrete contagion incidents. And five are used to generate stochastic results by checking against an RNG in determining terror incident outcomes.

B-4 DIMENSIONAL CONSISTENCY

The Units of the Model are dimensionally consistent. However, as this is a Model for Understanding, many unit measures were simplified by using fractional percentages of the population. These fractional percentages convey what percentage of the At Risk or Societal Population is impacted by the activity in questioned. This allows phenomena that may have different actual units of measure to be combined under a single unit of measure for simplicity.

For example, Template Attractiveness in Level 5 is the combination of Template Cohesion, Notoriety Bias, and Self-Similarity Bias. Realistically, each of these could be expressed in a different unit measure. However, fractional percentages are used as the unit of measure and the value of each is 0-1. For Template Cohesion, this is a percentage of cohesion itself. Where cohesion is the ability of the aggregate of cultural scripts to successfully convey templates. When this value is 0, there is no coherence, meaning no one can understand what is being communicated by the template. And a value of 1 means 100% coherence, the entirety of the template is easily and well understood by the at-risk population. For Self-Similarity Bias a 0 means 0% of the At-Risk Population finds the Template Self-Similar and a 1 means 100% do. Even though these represent different units of phenomena, by having them listed as fractional percentages they can be kept dimensionally consistent. As the model for understanding is improved into a model for policy and further research is conducted more discrete units of measure may be introduced for these items.

B-5 PARAMETER ASSESSMENT

The source of parameter estimations is covered in the sector-by-sector overview. When possible specific real world parameters were included from previous comprehensive analysis of several thousand terrorist incidents [2]. However, as this is still a Model for Understanding and the Terror Contagion Model is designed to be flexible to any violent ideology, other parameters were left at generic values. This is especially true for suspected parameters involved in the violent radicalization process proposed by the Terror Contagion Hypothesis but have not been validated by real-world experimentation or data analysis. This includes concepts like Template Coherence, Self-Similarity, Notoriety Bias, etc. [1]. In these

situations, parameters were set to represent fractional percentages with a value set between 0-1. This allows plausible causal relationships to still be estimated even if exact parameters are not known. A Self-Similarity bias of a Template at .5 for example represents that 50% of the At-Risk population will see themselves in that Template. This allows appropriate structural interactions even if exact parameter values are not known. As future versions of the Terror Contagion Model are updated newly available verified parametric data will be incorporated

B-6 EXTREME CONDITION

Extreme conditions were tested under several scenarios during proposition analysis. Specifically, in D-3.7A Proposition #7A: At-Risk Population (Multiplier x.1-1)and **Error! Reference source not found.** the At-Risk population was varied to extreme conditions. This included very small At-Risk populations (<60 people) and very large (>60,000 people). Plausible behavior resulted from both. At very small At-Risk populations there was insufficient numbers to sustain a Contagion over time as the At-Risk population would deplete itself rapidly. Conversely, even in very large At-Risk populations there was a declining effect of the Terror Contagion Hypothesis. As At-Risk population increases, the size of the corresponding Undecided and Moderate populations within that At-Risk increase as well, providing a damping effect.

Another extreme condition test was conducted in D-8.3 Proposition #17: Template Casualty Rates 0-21 Fatalities and **Error! Reference source not found.**. These two propositions examine how Terror Contagions behave when the average fatalities of each incident are either extremely high (15+) or extremely low (<3). The resulting behavior was again plausible. As the average fatality rate of a Template Method drops below 5, the Contagion suffers as it cannot distinguish itself from normal everyday criminal homicides. This results in less media attention, weaker one-to-many broadcast and the Terror Contagion effectively gets lost in the noise of everyday crime. On the other extreme, very high levels of fatalities have a decreasing marginal benefit to the Terror Contagion. This is plausible as the saturation of a media event can only occur to a point, after which any additional fatalities don't generate more media coverage. Although this diminishing effect is plausible, the model is not mean to handle truly catastrophic terrorist attacks on the levels of 9/11, Paris Bataclan Theater Attacks, Madrid Bombings, the Niece Truck Attack where hundreds or thousands of fatalities arise. These singular events may have so many fatalities that they provoke specific military, law enforcement and legislative responses unique to that specific attack. These catastrophic incidents are outside the current scope of this model.

B-7 INTEGRATION ERROR

Under the current configuration, the model passes integration validation tests comparing Euler, RK2, Cycle Time and RK4. . The model performs almost the same across every integration method as shown in D-12 INTEGRATION ANALYSIS: CONT Behavior Mode. In Table 4 we compare the ending values of Attempted Incidents, Failed Incidents, and Completed Terror Contagion Incidents at time = 119 across all four integration methods.

Table 4: Integration Test Numerical Results Comparison at Time=119

Integration Method	Run Tested	Total Attempted Incidents at Time = 119	Total Failed Incidents at Time = 119	Completed Terror Contagion

				Incidents at Time = 119
Euler	CONT	719	342	234
RK2	CONT	716	344	227
Cycle Time	CONT	719	342	234
RK4	CONT	716	344	227

Another test of integration is adjustment of the DT step in the model, which is currently set at 0.0125. Because the model uses a hybrid combination of continuous and discrete formulation, there are three parameters that convert discrete information into continuous information, and these are found in the ModVal module of the simulation in the sector labeled "Model Variables" as shown in Figure 38.

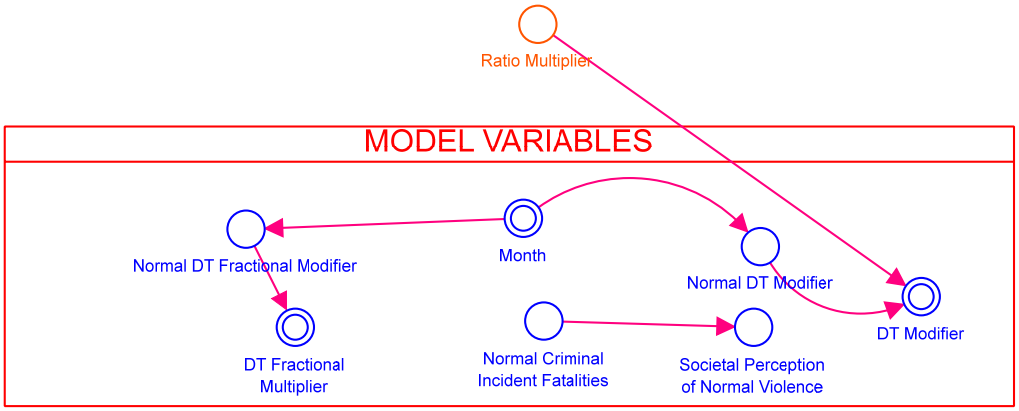


Figure 38: DT Adjusted Parameters

The first parameter is the DT Fractional Multiplier which = DT/Month. This returns a value which should be dimensionally consistent and equal to the DT step time of the model. Normal DT Modifier = 1/(DT/Month) and returns the inverse value of the DT step time, which under normal conditions is = 80. The final parameter is DT Modifier = Normal DT Modifier * Ratio Multiplier. This adjusts the DT modifier in a scale relative to the population adjustment ratio multiplier in the "Population Size & Ratio Model Variables" sector.

These values are used to convert continuous to discrete values and back again related to Level 1 Incidents. They should adjust automatically as the time step changes.

However, when DT is adjusted from the current value, discrepancies occur in the final values of the baseline modes. For example, comparing over 1,000 permutations of RNG the mean and range of values of a CONT behavior at normal, twice, and half DT under Euler integration is shown in Table 5: DT Adjustment Results under Euler at 1,000 Runs.

Table 5: DT Adjustment Results under Euler at 1,000 Runs

CONT Run	***Mean Total Contagion Incidents***	***Range Total Contagion Incidents***
Euler DT = 0.0125 (Baseline)	259.8	57-372
Euler DT = 0.00625	40.3	0-275
Euler DT = 0.25	382	282-450

As is displayed in the table, the final mean contagion incidents and range does vary based on the halving or doubling of the current DT. As DT is reduced, the overall number of terror contagion incidents reduces both on average and across the range. As the DT is increased, contagion incidents increase. This could raise questions of confidence in the model. The cause of this discrepancy is known however and described below.

We selected the DT value specifically to represent a window of time within which terrorism incidents occur and media begins the mass broadcast effect both on the template method and template ideology. At DT = 0.0125 this represents ~9hours of time. This is because the time period of the model is 1 month and 1 * 30 days * 24 hours = 720 hours * 0.0125 = 9hours.

The perpetrator of every terror incident has a random chance of having adopted the template method to conduct the attack or the template ideology to broadcast grievance and conspiracy narrative. The chance of this happening on any incident is based on an RNG check against the then current level of adoption of the Radicalized and Activated populations in the Level 2: Agent's portion of the model.

The spread of a template method or template ideology among the at-risk population is based on these incident probabilities. Any high-fatality event caused by use of a template method attracts robust media attention. The number of fatalities creates the media story and an archive of cultural scripts are generated which can be found later by an Activated researching methods to conduct mass-violence terrorism as part of their pathway to violence. So, the template adoption rate in level 5 is based simply on the number of incidents that generate sufficient media coverage. But template ideology is only broadcast when it accompanies a high-fatality event. Normal criminal activities may be fueled by ideological drives, but they don't gain sufficient media attention to generate the archive of cultural scripts and fade from memory quickly. So, although template method adoption can occur among the Activated without a corresponding broadcast of a template ideology, the reverse is not true. Template ideologies can only be broadcast successfully if the incident which they motivate corresponds with the use of a high-fatality template method.

This formulation is the current cause of the integration discrepancy and deals with the windows of time in which the ideological pulse and media broadcast from high fatalities are able to overlap for a given incident. As the DT reduces, the window within which this overlap occurs reduces. At DT = 0.00625 the overlap window shrinks from representing ~9hours to only ~4.5 hours. As DT increases, the overlap window broadens until at DT = 0.025 the window

is 18hours. This increasing and shrinking of the overlap window explains the discrepancy in results.

The way this impacts in integration is that the initial contagion incidents created by the seed event are identical. But with a reduced DT and smaller window of potential overlap the timing of incidents where template ideology may have been broadcast don't overlap frequently enough with template method broadcasts to create contagion events which sustains the contagion. Conversely, as the window broadens, multiple overlapping incidents can be captured in the same window, magnifying the contagion effect dramatically. The result of this discrepancy in template ideology adoption can be seen in which plots the adoption rate of radicalization across three runs, in Figure 39. These runs show the baseline of DT = 0.0125, Half DT = 0.00625, and 2x DT = 0.025.

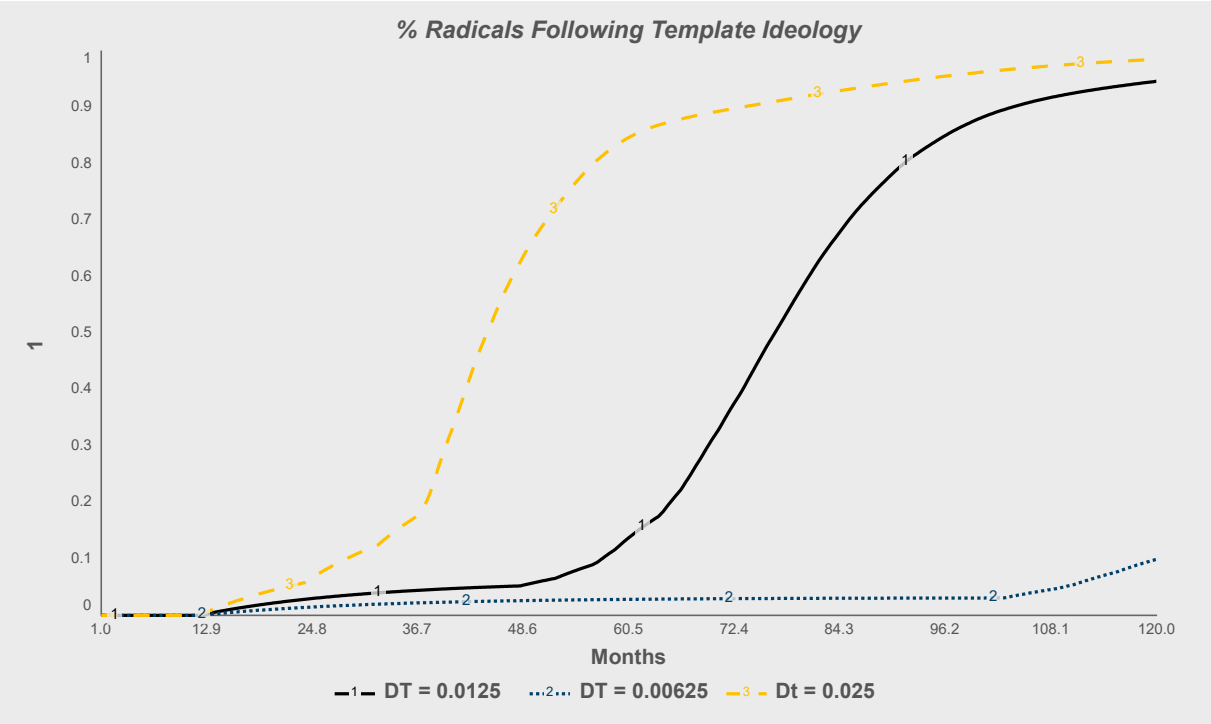


Figure 39: Different Template Ideology Adoption Levels by DT.

In Figure 39, not only the level of adoption rates vary, but the rate of adoption significantly alters. Because template ideology is the signaling mechanism to the at-risk population providing conspiracy narrative to explain their grievance, a lower radicalization rate results in lower radicalizations, and lower contagion incidents. By contrast the rate of template method adoption across the same three runs is shown in Figure 40.

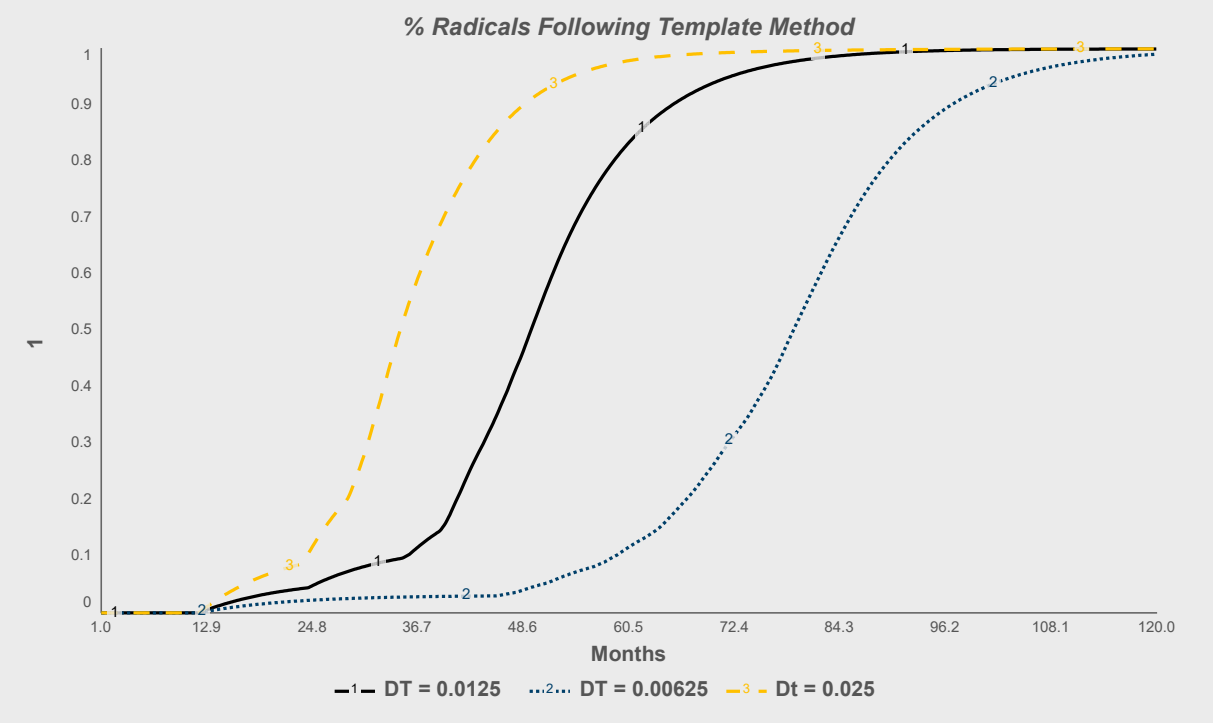


Figure 40: Different Template Method Adoption Levels by DT.

In Figure 40 the rate of template method adoption does not vary in shape of growth or final level, only the time in the model where it occurs (which itself is a byproduct of the differing template ideology rates as discussed above.)

Ultimately, at this early stage in development, as a model for understanding, it is not clear which timing window is correct within which the template method and template ideology should overlap. All three behaviors are roughly plausible within the historical record, and all three behaviors over a sufficiently long period result in roughly similar behavior as shown in Figure 41.

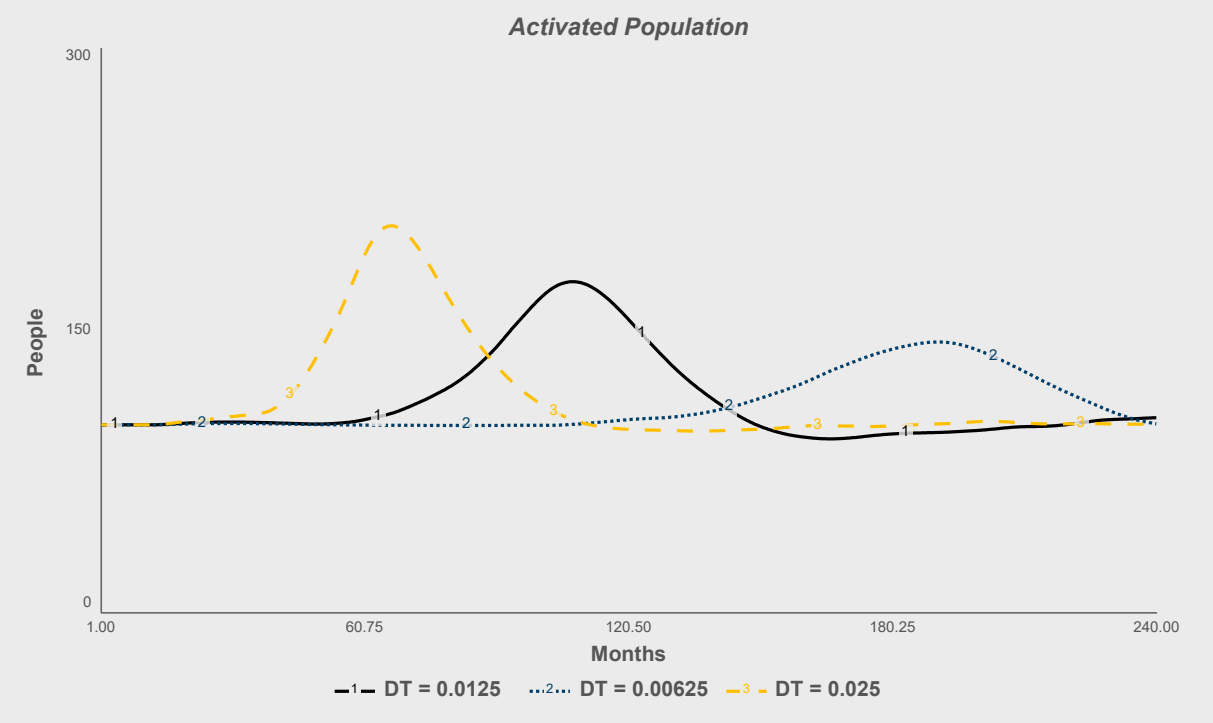


Figure 41: Activated Population over Double Duration Model at varying DT Levels.

Figure 41 shows the behavior modes over a model run for 240 months, rather than the baseline of 120 months. It shows that the ultimate effect of changing DT step is not fundamental change in behavior mode, but variation in time delay as to when the contagion occurs and the peak point value. In Table 6 we evaluate the numerical values of attempted, failed, and completed contagion incidents at the conclusion of this doubled length run.

Table 6: Numerical Values over Double Duration Model at varying DT Levels.

DT Value across 240 Month Duration Model	Run Tested	Total Attempted Incidents at Time = 239	Total Failed Incidents at Time = 239	Completed Terror Contagion Incidents at Time = 239
DT = 0.0125 (Baseline)	CONT	1.34k	470	718
DT = 0.00625	CONT	1.33k	566	438
DT = 0.025	CONT	1.37k	418	868

Table 6 shows that although the final point-value of contagion incidents varies, in none of the different DT's was there an absolute failure to produce a contagion.

The source of this discrepancy could be related to the structural formulations we use in Level 5 to capture and match template ideology and template method broadcasting incidents due to the timing window, the bunting structure of Level 1 which converts continuous formulation to

discrete, or the switching structure which allows the model to adjust between continuous and discrete formulation (since all results flow through these switches.) As we continue to develop the model this specific integration issue, as well as the overall concept of a hybrid model with a stochastic discrete terror engine within a larger continuously formulated model will be one we examine closely. Revisions may seek to improve the structural formulations resulting in the discrepancy, improving the structural formulations of the continuously integrated function so that it plausibly replicates seed event and replication behavior, or replacing the sector entirely with an agent based model or other simulation method.

B-8 BEHAVIOR REPRODUCTION

The model was able to recreate historical time series behaviors[2] as well as our reference growth mode [9] behaviors described in A-2 REVIEW OF REFERENCE MODES AND CAUSAL LOOP STRUCTURES and demonstrated in D-2 MODEL BASE RUNS.

B-9 BEHAVIOR ANOMALY

In the contingency tests feedback loop knockout tests were conducted by setting over a dozen key variables to varying values. A value of 0 acted as a knockout of the feedback loop that variable lay upon. We identified six strong propositions, that when they were set to zero, the contagion completely failed to materialize and stayed in equilibrium. The results of all contingency testing can be found by level and then proposition in Sections D-3 through D-8.

B-10 FAMILY MEMBER TEST

As an early-stage Model for Understanding, Family Member Tests were limited. The ability to configure by Profile Import any violent ideology allows future experimentation within the Family Member Test. However, in Channel Analysis, a Family Member test was conducted to demonstrate how a low At-Risk population could be bolstered by a non-state actor in an ungoverned space to convert what might normally be a F2G or S2G into a CONT behavior mode. This replicates the fishermen hypothesis as traditionally understood within the Salafi-Takfiri violent ideologies operating in small at-risk populations of Muslims in western Europe and the united states. This can be seen in Section D-10 CHANNEL ANALYSIS.

B-11 SURPRISE BEHAVIOR

Surprise behavior was detected in several areas. For example, it was initially believed that Template Ideology and Template Method could result in contagion spread independently. But testing showed that these two had to combine to create the effect. The reasons are plausible, if surprising. The Template Method is required to generate enough fatalities to gain widespread media attention in the one-to-many broadcast. However, what gets disseminated has to have an ideological basis that conveys notoriety bias and self-similarity to the At-Risk Population as well as providing a well cohered narrative addressing a grievance that At-Risk population has. These elements are all conveyed through the Template Ideology. In retrospect this matches the behavior of the most well-known anchor cases where mass-shootings such as Columbine, Isla Vista, and Norway combined large fatalities with a manifesto provided by the shooters outlining their ideologies. Mass-shootings that did not include ideological markers, even with higher fatality counts such as the Las Vegas Casino shootings and Virginia Tech, are not as well known for sparking replication.

B-12 SENSITIVITY ANALYSIS

Over sixteen proposition tests were conducted in Section D-3 PROPOSITION ANALYSIS LEVEL 5: SYSTEM OF SYSTEMS through Section D-8 PROPOSITION ANALYSIS LEVEL 1: INCIDENTS and many of these are effectively sensitivity tests as they test time delays, population sizes, media sensitive, and power effects under wide conditions.

B-13 SYSTEM IMPROVEMENT

System improvement is demonstrated when evidence can be collected and shown that an intervention proposed by a model resulted in the expected change. As the Terror Contagion Model is an early-stage exploratory model it has not yet been used in this manner. No such data can be collected and this remains an area for continued application and research. Such efforts should not just focus on whether the model behavior was realistic to the result of a policy – but also whether users increased their understanding of violent radicalization and the Terror Contagion Hypothesis before and after the use of the Terror Contagion Model.

C-1 ONLINE RESEARCHER INTERFACE AND USER INSTRUCTIONS

This section left blank until a Stella Architect interface for researchers to access online is developed after peer review in versions 0.8 and 0.9.

D-1 MODEL SETTINGS

This section contains technical information on setting up and running the simulation, as well as experiment results.

D-1.1 Model Control Settings

A profile is an external document, typically in excel, that includes initial values and key parameter values representing a violent ideology. It also contains switches for activating ungoverned space non-state actors at different levels and implementing policies.

Profile Field	Definition
ModVal.Seed Time	The time at which a Seed event will occur, typically set at 12 months. Seed events are the first Contagion incident combining a given Template Method and Template Ideology. If this is set to >120 no seed events will occur and Equlibrium base run will result.
ModVal.Template Method Success Rate	The rate at which a perpetrator going out-the-door completes an incident, inflicting fatalities.
ModVal.Pathway to Violence Success Rate	The rate at which Activated successfully complete their preparations to the point they are able to go out-the-door.
Lvl3 Networks & Actors.Local Personal Resonance	The percentage of the At-Risk population who personal experiences the Grievance vs. experience through vicarious suffering.
Lvl3 Networks & Actors.Normal Abandonment	The rate at which Abandonment depresses the urge to radicalize.
Lvl3 Networks & Actors.Near Suffering	The grievance At Risk Population perceives in the Governed space through vicarious experience, magnified by Personal Resonance.
ModVal.Normal Activation	The rate at which Radicalized individuals will Activate to begin Pathway to Violence preparations to conduct a Terrorist incident.
ModVal."Continuous v. Discrete Switch"	Switches the model between discrete formulation and continuous formulation in Level 1: Incidents. The default behavior is 0 which = discrete formulation.
Lvl4 System of Spaces. Far Space Effectiveness at Narrowcasting	A value of 0-1 that equals the non-state actor's ability to leverage casting capacity to narrowcast cultural scripts.
Lvl4 System of Spaces. Far Space Effectiveness at Broadcasting	A value of 0-1 that equals the non-state actor's ability to leverage casting capacity to broadcast cultural scripts.
ModVal. Switch Broadcasting of Far Suffering	A value of 0-1 indicating the effectiveness non-state actors, within broadcasting overall, have in communicating far space or ungoverned space suffering into the near or governed space.

ModVal.Switch Broadcasting of Template Ideology Adoption	A value of 0-1 indicating the effectiveness non-state actors, within broadcasting overall, have in communicating the conspiracy narrative to be adopted during radicalization that explains the grievance of the At-Risk population and provides the target/enemy to blame for it.
ModVal. Switch Narrowcasted Personal Resonance	A value of 0-1 indicating the effectiveness non-state actors, within narrowcasting overall, to communicate personal resonance or lived experience to At-Risk populations who themselves do not share that lived experience in order to increase radicalization.
ModVal. Switch Narrowcasted Template Method Adoption	A value of 0-1 indicating the effectiveness non-state actors, within narrowcasting overall, to communicate the modus operandi of preparing, planning, and executing terrorist incidents, collectively known as the Template Method to At-Risk populations. When Radicals become Activated there is a chance they will adopt the Template Method for conducting a terrorist incident.
ModVal. Switch Narrowcasted Group Cohesion	A value of 0-1 indicating the effectiveness non-state actors, within narrowcasting overall, to counteract abandonment urges within the At-Risk population who have become radicalized.
ModVal. Narrowcasted Identity & Activation	A value of 0-1 indicating the effectiveness non-state actors, within narrowcasting overall, to spur Radicalized individuals in the At-Risk population to adopt the warrior or pseudo-commando identity, Activate and begin their Pathway to Violence activities.
ModVal.Switch for Variable Societal Response	A value of 1 turns on the Variable Societal Response for policy analysis.
ModVal.Governed Space Backlash Switch	A value of 1 turns on the Governed Space Backlash for policy analysis.
ModVal.UnGoverned Space Backlash Switch	A value of 1 turns on the Ungoverned Space Backlash for policy analysis.
ModVal.Failure Notoriety Switch	A value of 1 turns on Failure Notoriety Broadcasting for policy analysis.
ModVal.Template Attractiveness Policy Switch	A value of 1 turns on Template Attractiveness measures for policy analysis.
ModVal.Ungoverned Space Casting Capacity Intervention Switch	A value of 1 turns on ungoverned space interventions targeting casting capacity for policy analysis.
ModVal.Ungoverned Space Grievance Reduction Switch	A value of 1 turns on ungoverned space grievance reduction interventions for policy analysis.

The five profiles most frequently used in current research correspond to the base runs identified in A-2.2 Violent Radicalization Growth Modes Subsuming Historical Time Series Behavior and the behaviors of which are displayed in D-2 MODEL BASE RUNS. The profile settings for these five runs are listed below in Table 7. Only values for the first seven settings of each profile are displayed because in the base runs all other settings in the profile are set to 0.

Table 7: Base Run Profile Settings

Policy	Seed Event	ModelValues. Template Method OTD Success Rate	ModelValues. Pathway to Violence Success Rate	Lvl3 Networks & Actors.Local Personal Resonance	Lvl3 Networks & Actors.Normal Abandonment	Lvl3 Networks & Actors.Near Suffering	ModelValues. Normal Activation
EQ	12	0.8	0.1	0	0	0.05	0.1
F2G	12	0.8	0.1	0	0	0.05	0.1
S2G	12	0.8	0.2	0	0	0.05	0.1
CONT	12	0.8	0.5	0	0	0.05	0.1
CONT+	12	0.8	1	0	0	0.05	0.1

In the associated model files these five profiles are excel files which must be associated via import into the Stella Architect software and are listed as:
EQ Parameters.xlsx
F2G Parameters.xlsx
S2G Parameters.xlsx
CONT Parameters.xlsx
CONT+ Parameters.xlsx

D-1.2 Running the Simulation

The simulation is run by loading a profile into the Model Imports section of Stella Architect and activated, as shown in the screenshot below in Figure 42. Note that files may need to first be identified in the file directory and associated before they can be activated.

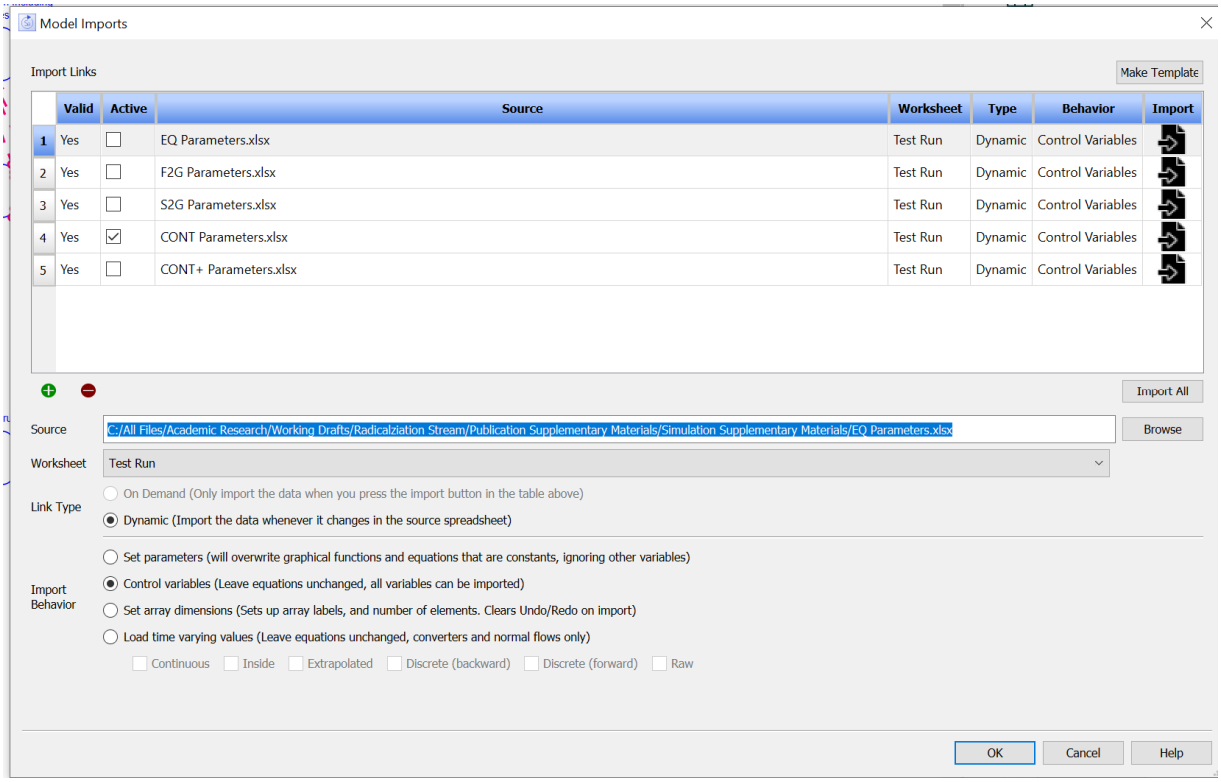


Figure 42: Screenshot of Stella Architect Model Imports where profiles are associated and activated.

D-1.3 Notes on Model Software & Settings

The Terror Contagion Model was created using Stella Architect software and final testing prior to publication was completed on version 1.9.4.

The mode settings are:
Initial Time: 1
Stop Time: 120 (~= 10 years)
Unites of Time: Months
Time Step: 0.0125 (~=9hours)
Integration Type: Euler

Statistical analysis was performed using MiniTab software version 20.1.3 (64-bit).

D-1.4 Discussion of Time Period Selection & Integration Method

The model is designed to enable review of policies by policy makers. This led to very specific decisions being made on how to set the overall time period, as well as the dt at which each time slice the continuous integration would occur.

The time period is equal to 1 month with an overall simulation run covering 10 years. Seed events are instantiated at the 12th month. This allows each run to have a year of equilibrium, followed by a contagion Seed event, and then nine years of subsequent behavior. This is

important as it captures the length of time in some cases necessary to display behavior modes of weaker contagions.

A dt of .0125 corresponds to roughly 9hours. This is useful because this is slightly more than 1/3rd the smallest time measure of processes contained in the mode, which are the incident dynamics contained in Level 1. From a perpetrator heading "out the door" to conduct a terrorist event, the incident itself, and the immediate post-incident media reaction based on the reported fatalities, one day is usually sufficient. Very few terrorist incidents play out over more than a day, and even if they are shorter the single day unit is a useful demarcation as the lowest level time process in the model.

D-2 MODEL BASE RUNS

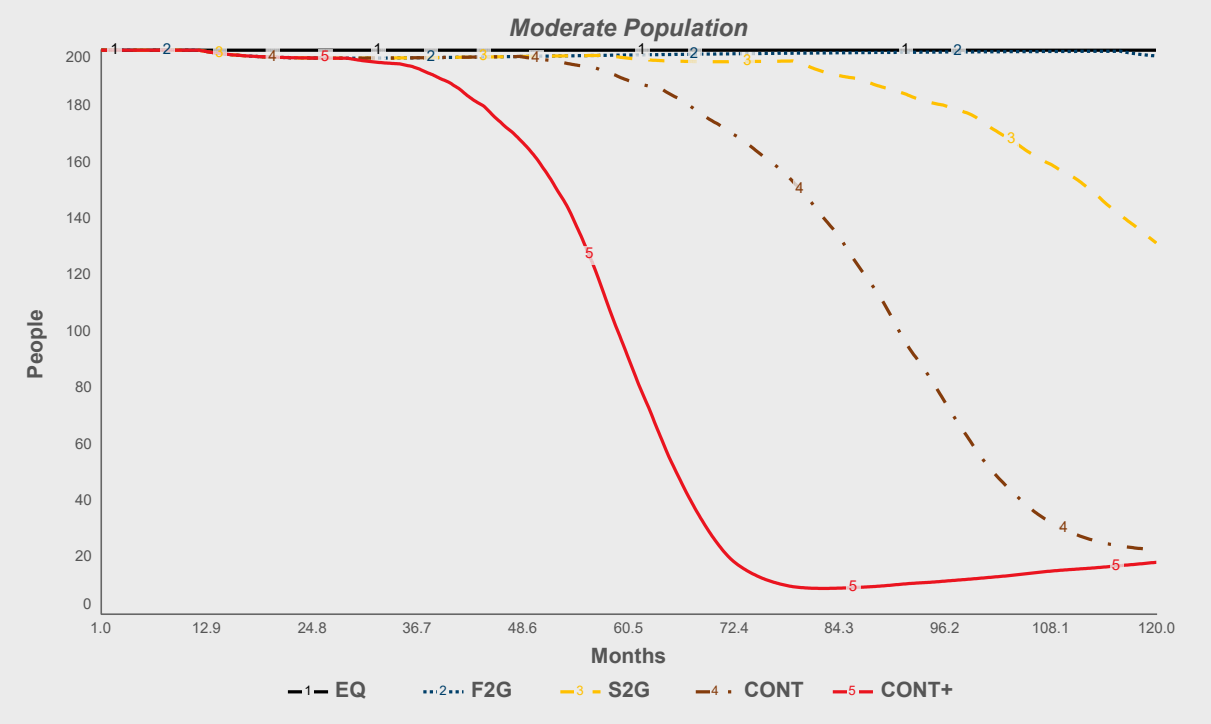
Base runs are set at the following values for each profile. In the base runs, no policy switches are active, and the only varied parameter is Pathway to Violence Success Rate.

Table 8: Base Run Parameter Values

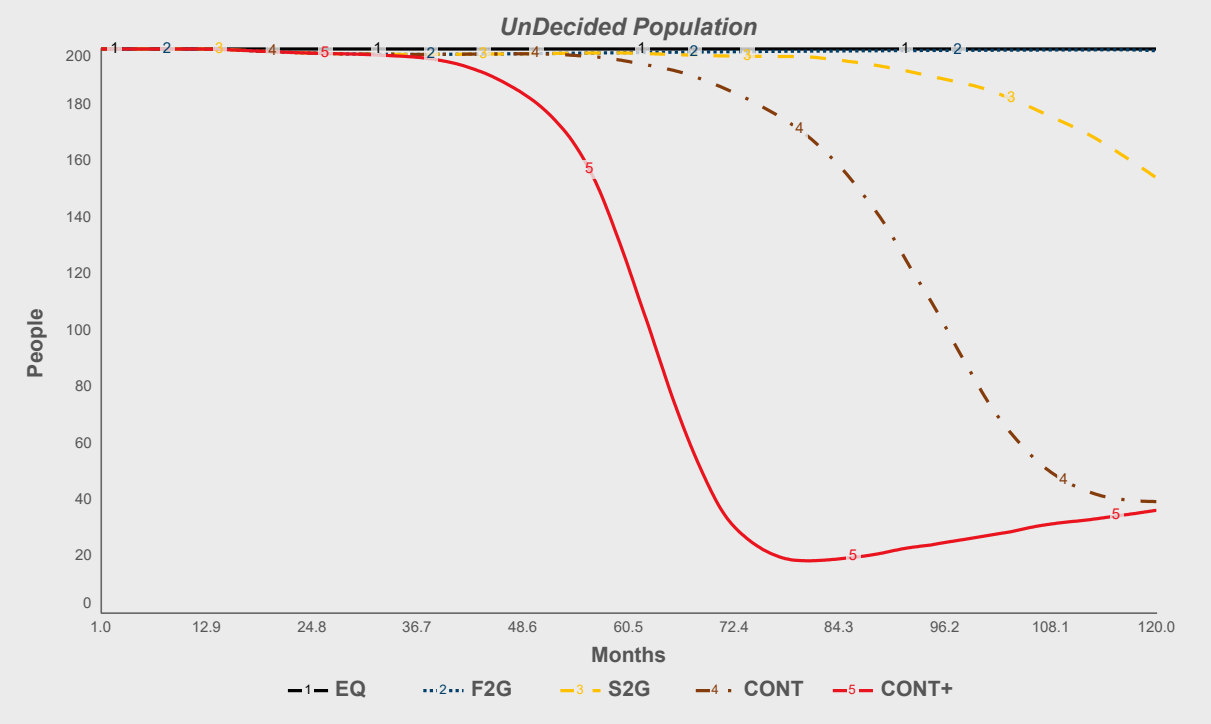
Policy	Seed Event	Template Method OTD Success Rate	Pathway to Violence Success Rate	Local Personal Resonance	Normal Abandonment	Near Suffering	Normal Activation
EQ	121	0.8	0.1	0	0	0.05	0.1
F2G	12	0.8	0.1	0	0	0.05	0.1
S2G	12	0.8	0.2	0	0	0.05	0.1
CONT	12	0.8	0.5	0	0	0.05	0.1
CONT+	12	0.8	1	0	0	0.05	0.1

D-2.1 BASE RUNS

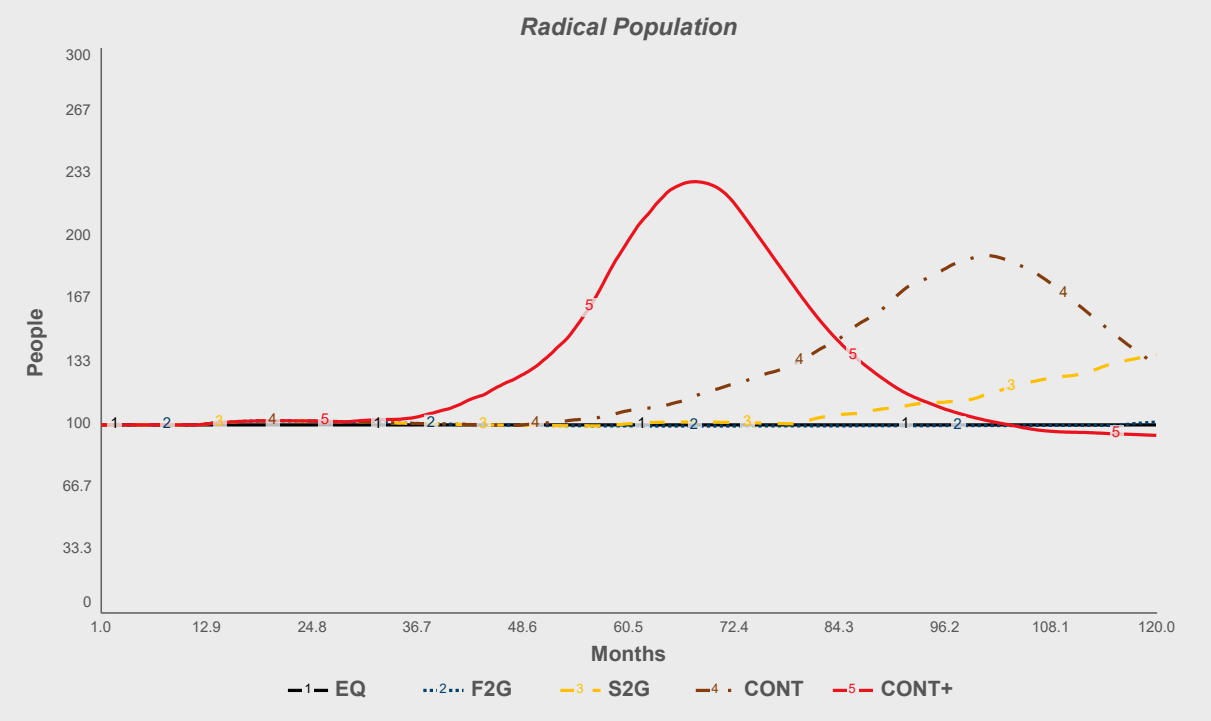
Moderate Population



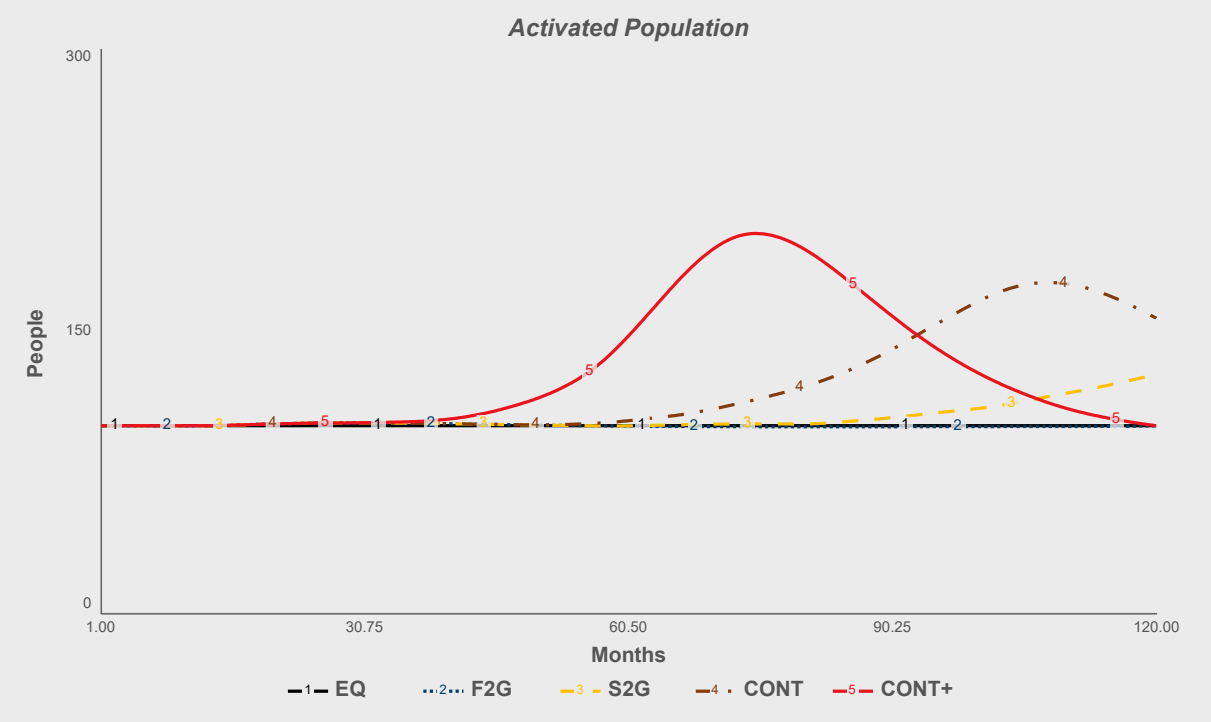
Undecided Population



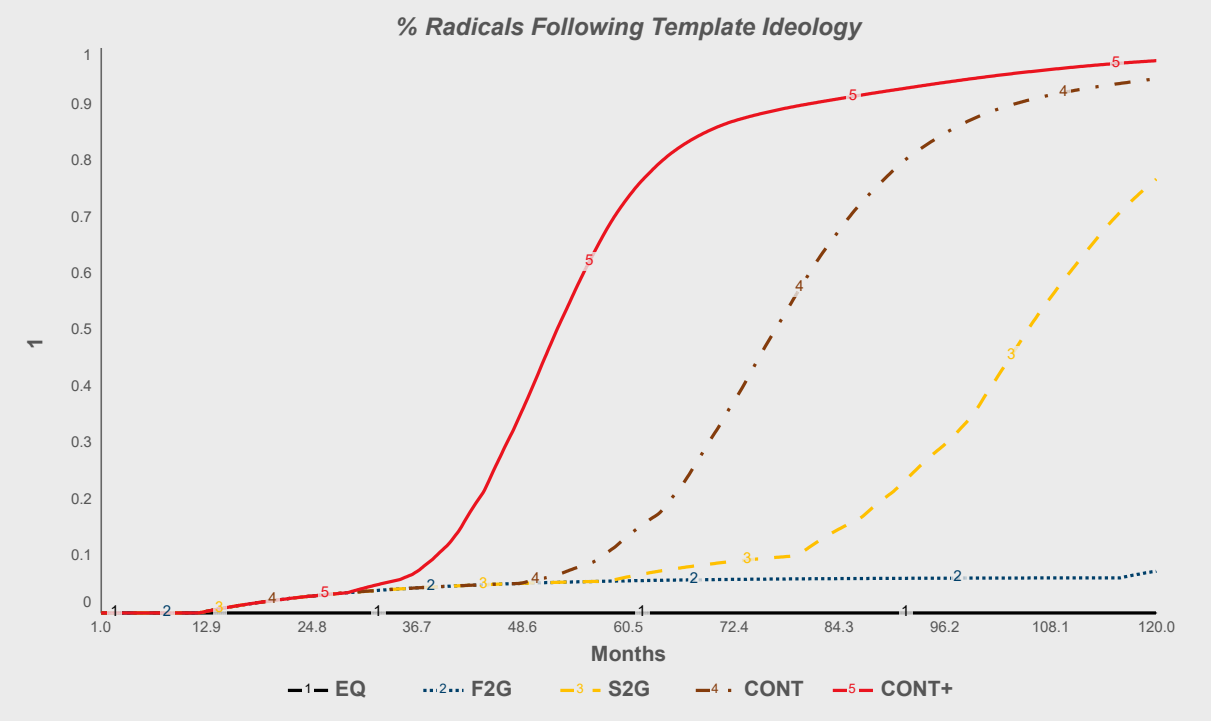
Radical Population



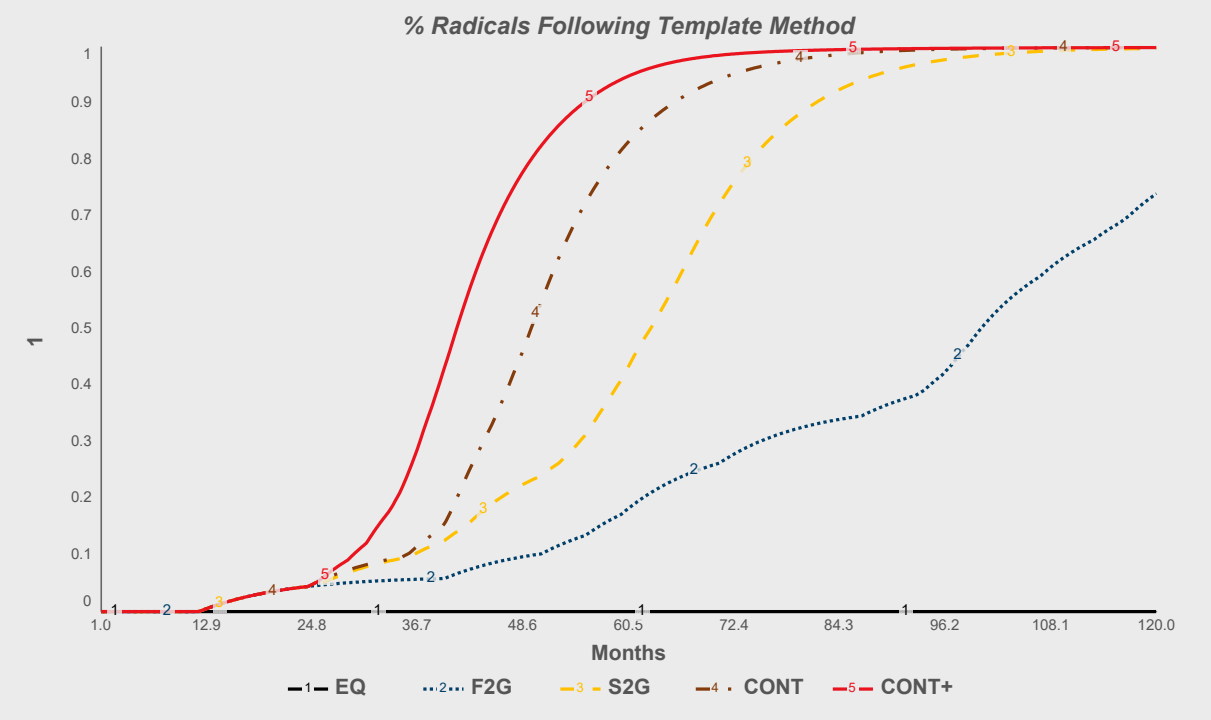
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Statistics

Descriptive Statistics across Base Runs. ATT = Attempts, Fails = Failures & TCont = Terror Contagion Incidents.

Table 9: Descriptive Statistics across Base Runs

Variable	Mean	Minimum	Maximum
(F2G)Att	119.29	119.00	125.00
(F2G)Fails	90.508	54.000	118.100
(F2G)TCont	3.249	0.000	32.000
(F2G)ICont	3.249	0.000	32.000
(F2G)Vic	32.49	0.00	320.00
(S2G)Att	245.43	238.00	271.00
(S2G)Fails	146.29	100.80	235.60
(S2G)Tcont	27.731	0.000	105.000
(S2G)Icont	27.731	0.000	105.000
(S2G)Vic	277.31	0.00	1050.00
(CONT)Att	726.44	620.00	756.00
(CONT)Fails	318.25	264.60	405.90
(CONT)TCont	259.82	57.00	372.00
(CONT)ICont	259.82	57.00	372.00
(CONT)Vic	2598.2	570.0	3720.0
(CONT+)Att	1540.2	1491.0	1544.0
(CONT+)Fails	591.62	511.00	770.70
(CONT+)TCont	704.81	469.00	806.00
(CONT+)ICont	704.81	469.00	806.00
(CONT+)Vic	7048.1	4690.0	8060.0

One-Way ANOVA for Base Runs on Terror Contagion Incidents

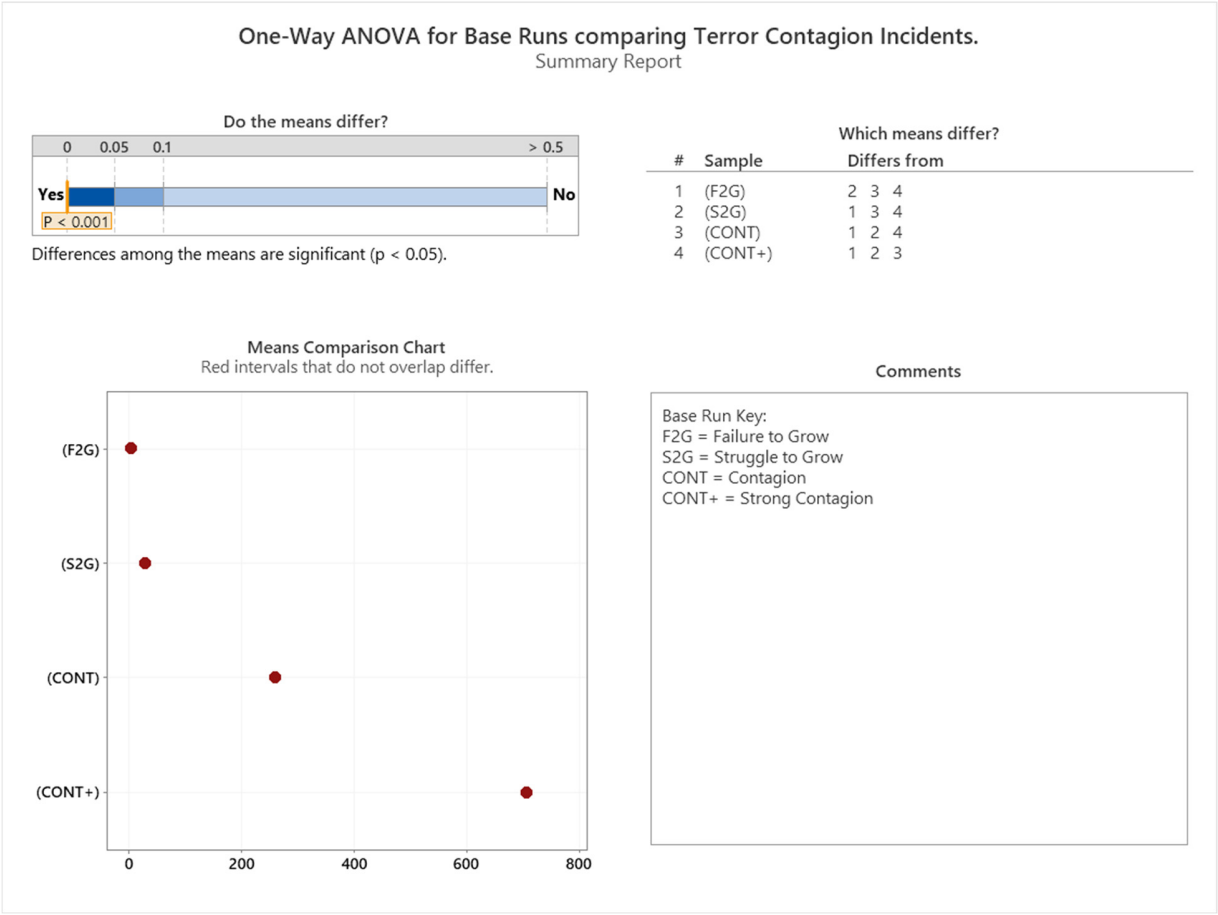


Figure 43: One Way ANOVA for Base Runs comparing Terror Contagion Incidents Summary Report.

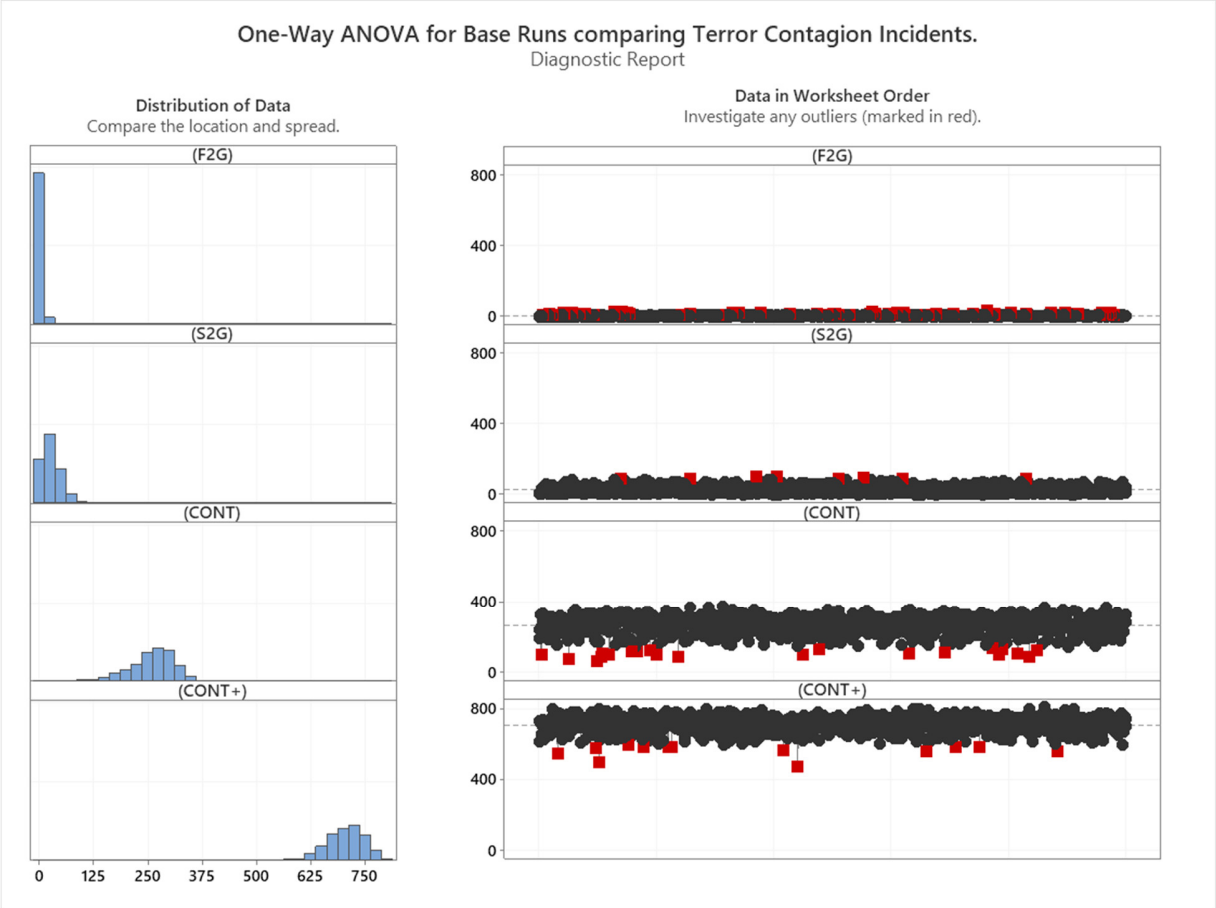
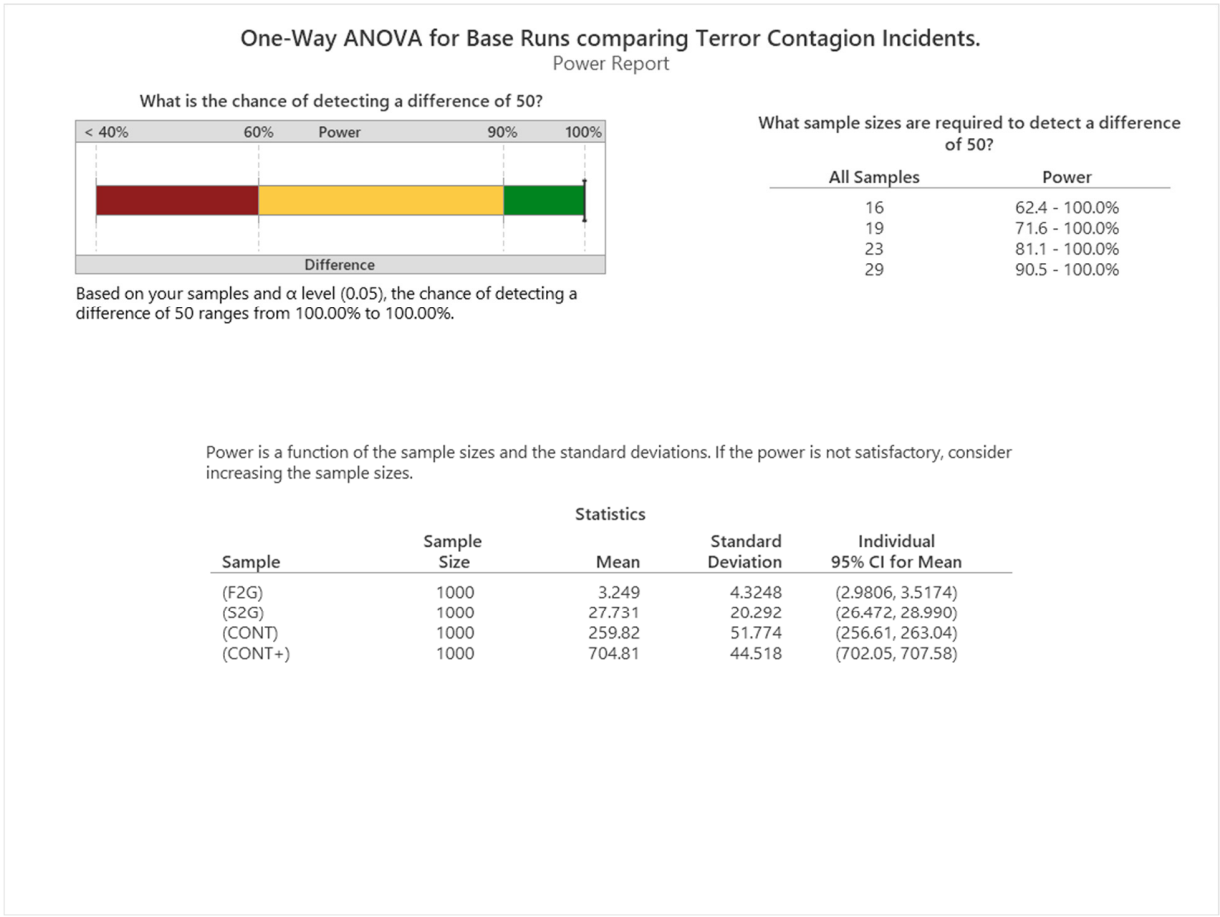


Figure 44: One Way ANOVA for Base Runs comparing Terror Contagion Incidents Diagnostic Report.



One-Way ANOVA for Base Runs comparing Terror Contagion Incidents.
Power Report

What is the chance of detecting a difference of 50?

Based on your samples and α level (0.05), the chance of detecting a difference of 50 ranges from 100.00% to 100.00%.

What sample sizes are required to detect a difference of 50?

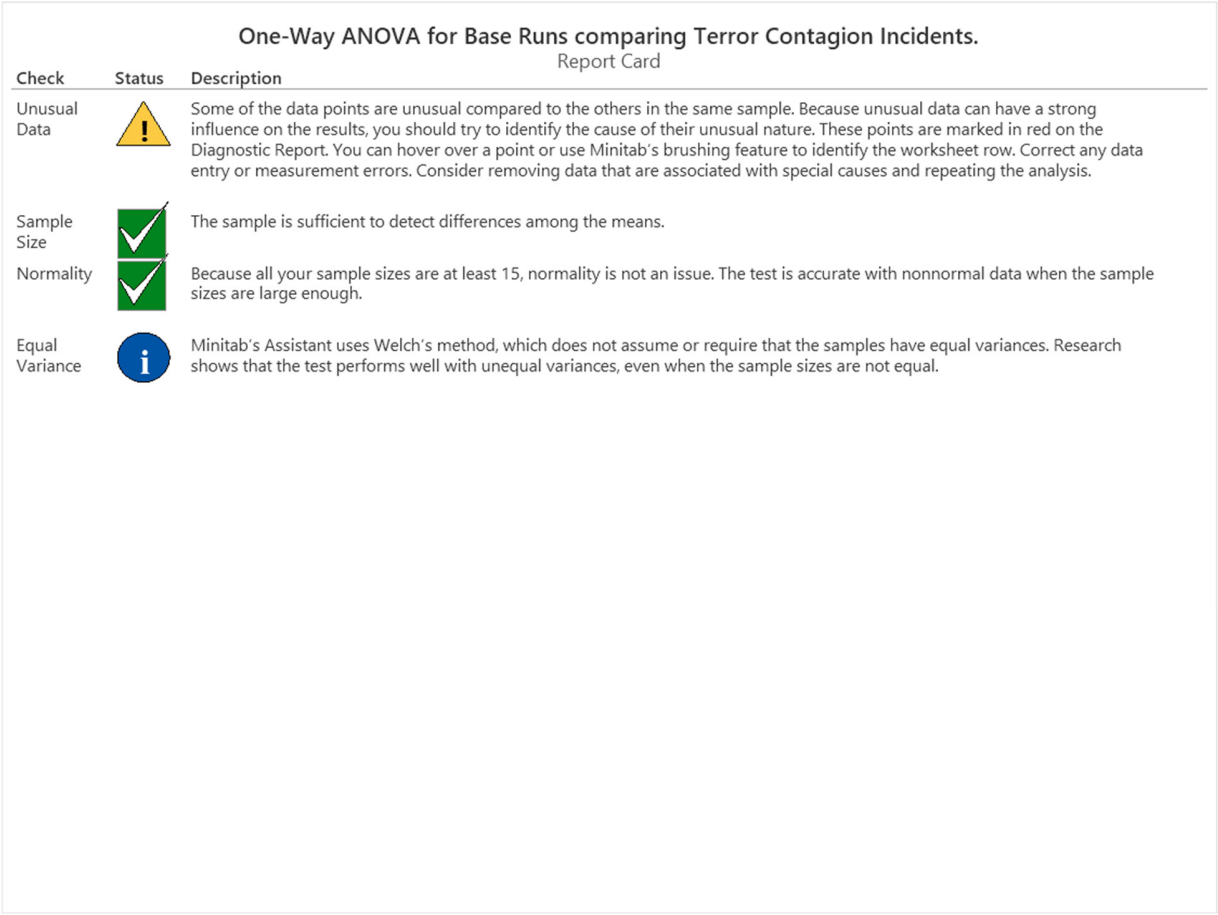
All Samples	Power
16	62.4 - 100.0%
19	71.6 - 100.0%
23	81.1 - 100.0%
29	90.5 - 100.0%

Power is a function of the sample sizes and the standard deviations. If the power is not satisfactory, consider increasing the sample sizes.

Statistics

Sample	Sample Size	Mean	Standard Deviation	Individual 95% CI for Mean
(F2G)	1000	3.249	4.3248	(2.9806, 3.5174)
(S2G)	1000	27.731	20.292	(26.472, 28.990)
(CONT)	1000	259.82	51.774	(256.61, 263.04)
(CONT+)	1000	704.81	44.518	(702.05, 707.58)

Figure 45: One Way ANOVA for Base Runs comparing Terror Contagion Incidents Power Report.



One-Way ANOVA for Base Runs comparing Terror Contagion Incidents.

Report Card

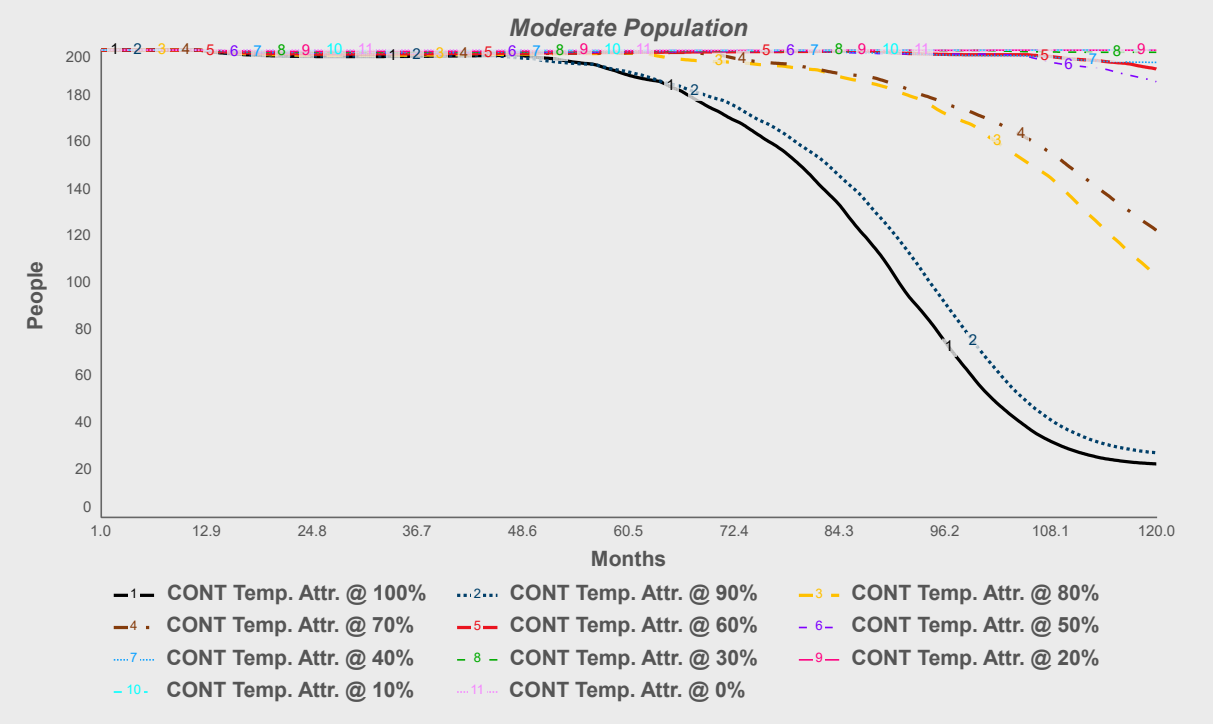
Check	Status	Description
Unusual Data	⚠	Some of the data points are unusual compared to the others in the same sample. Because unusual data can have a strong influence on the results, you should try to identify the cause of their unusual nature. These points are marked in red on the Diagnostic Report. You can hover over a point or use Minitab's brushing feature to identify the worksheet row. Correct any data entry or measurement errors. Consider removing data that are associated with special causes and repeating the analysis.
Sample Size	✓	The sample is sufficient to detect differences among the means.
Normality	✓	Because all your sample sizes are at least 15, normality is not an issue. The test is accurate with nonnormal data when the sample sizes are large enough.
Equal Variance	ℹ	Minitab's Assistant uses Welch's method, which does not assume or require that the samples have equal variances. Research shows that the test performs well with unequal variances, even when the sample sizes are not equal.

Figure 46: One Way ANOVA for Base Runs comparing Terror Contagion Incidents MiniTab Report Card.

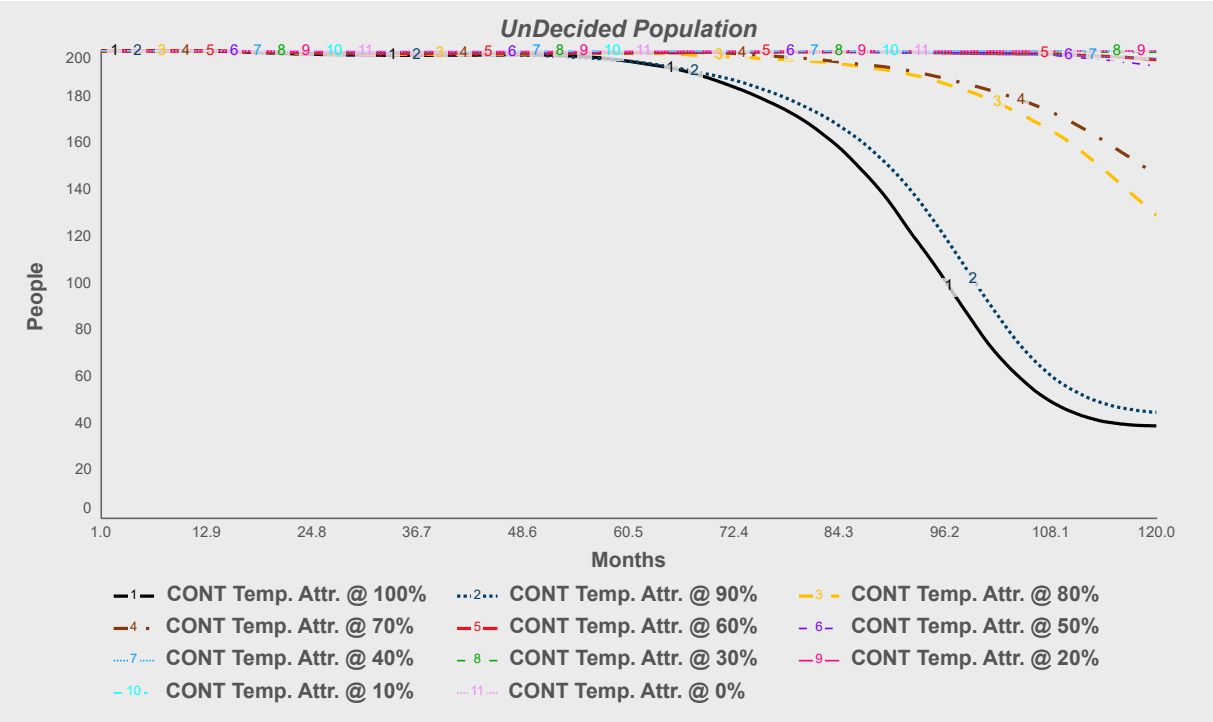
D-3 PROPOSITION ANALYSIS LEVEL 5: SYSTEM OF SYSTEMS

D-3.1 Proposition #1: Template Attractiveness for Social Contagion

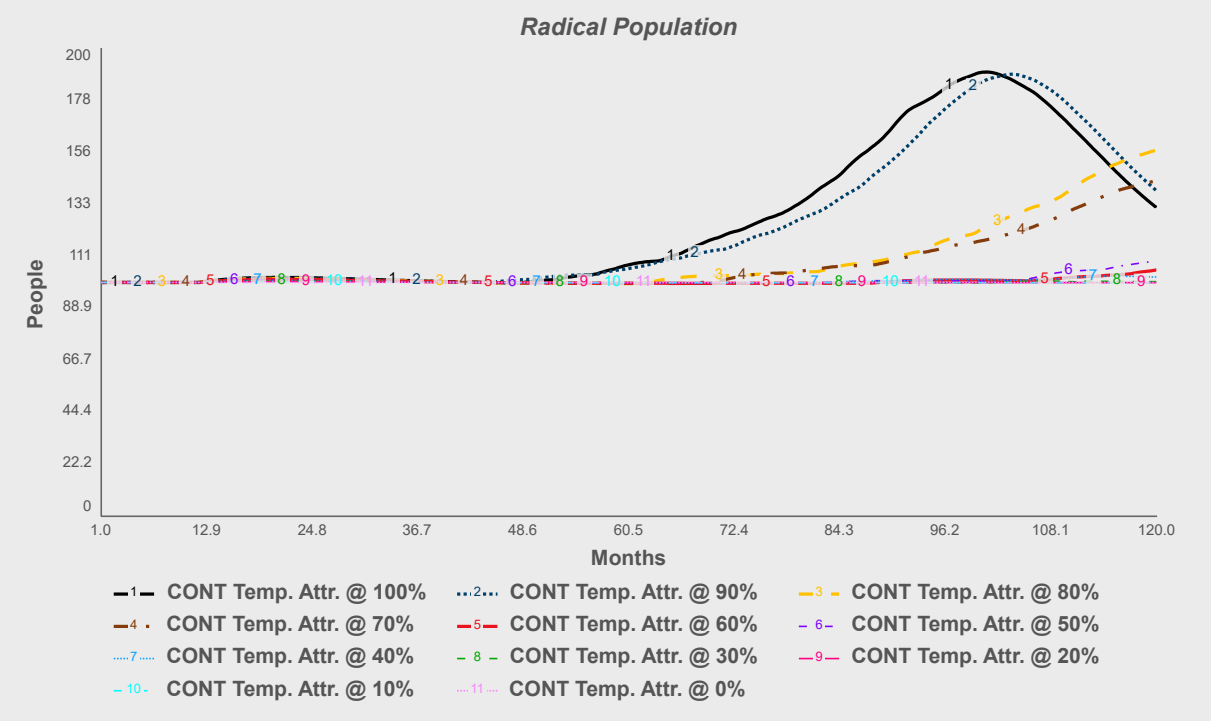
Moderate Population



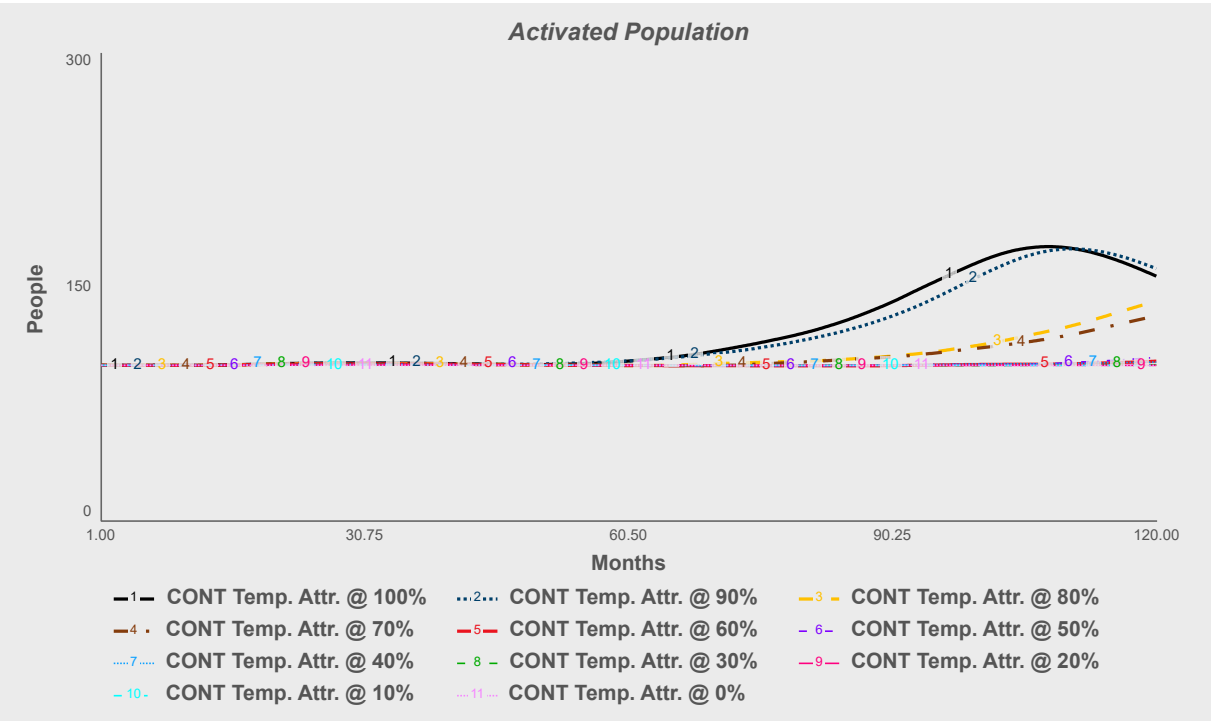
Undecided Population



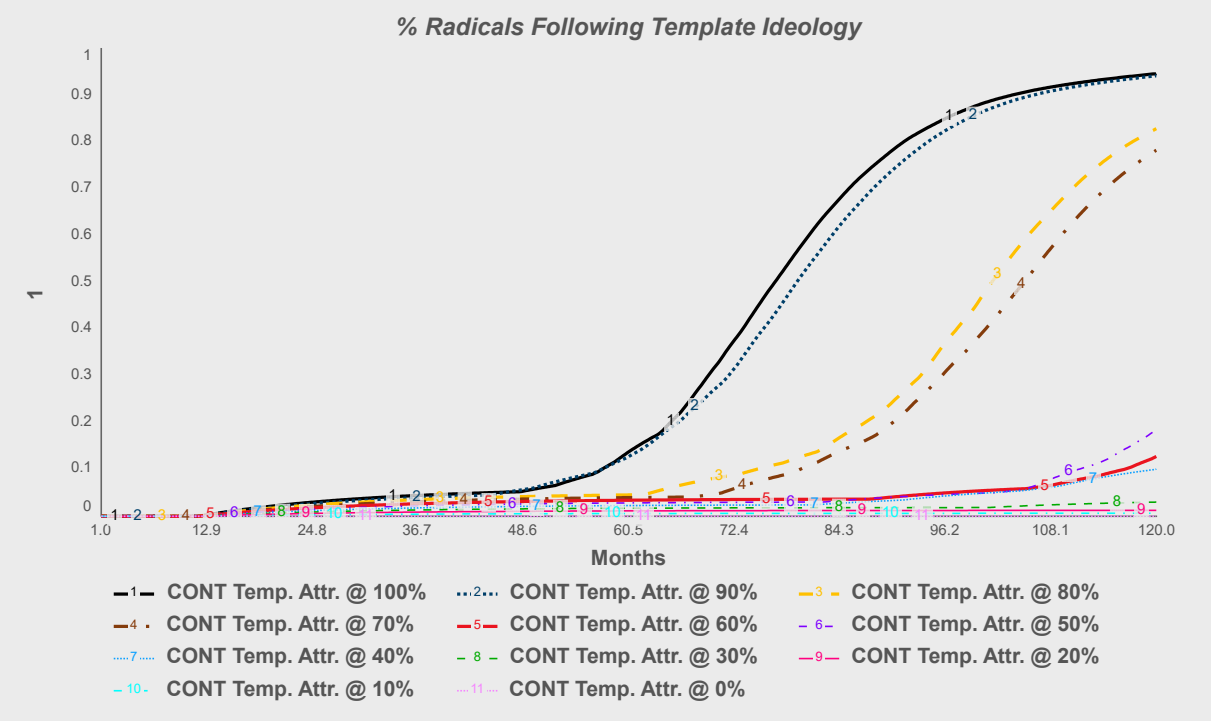
Radical Population



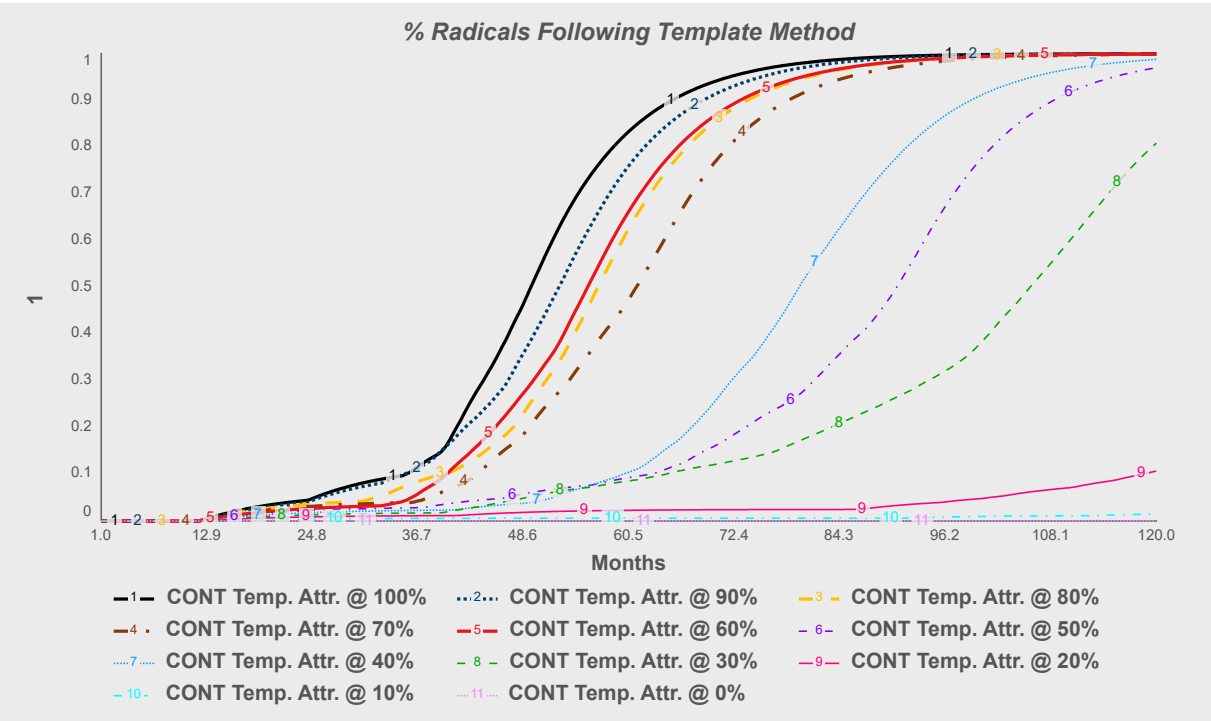
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

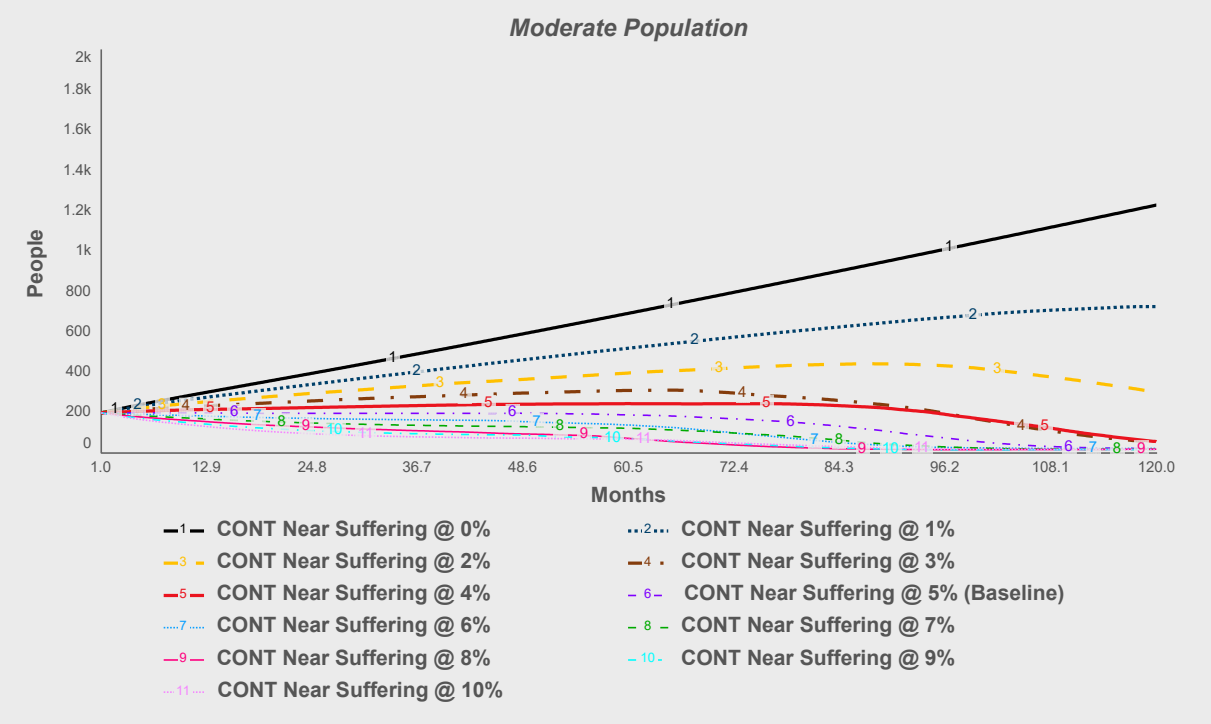
PROPOSITION #1: TEMPLATE ATTRACTIVENESS			

RUN VALUE	***Total Attempted Incidents***	***Failed Incidents***	***Total Contagion Incidents***
CONT Temp. Attr. @ 100% : Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT Temp. Attr. @ 90%: Model Testing Structure.ZCB Att Incidents Total	707	359.6	216
CONT Temp. Attr. @ 80%: Model Testing Structure.ZCB Att Incidents Total	629	362.8	72
CONT Temp. Attr. @ 70%: Model Testing Structure.ZCB Att Incidents Total	622	385.7	62
CONT Temp. Attr. @ 60%: Model Testing Structure.ZCB Att Incidents Total	596	327.3	7
CONT Temp. Attr. @ 50%: Model Testing Structure.ZCB Att Incidents Total	597	460.8	13
CONT Temp. Attr. @ 40%: Model Testing Structure.ZCB Att Incidents Total	597	420.6	6
CONT Temp. Attr. @ 30%: Model Testing Structure.ZCB Att Incidents Total	595	509	1
CONT Temp. Attr. @ 20%: Model Testing Structure.ZCB Att Incidents Total	595	578.8	0
CONT Temp. Attr. @ 10%: Model Testing Structure.ZCB Att Incidents Total	594	584.5	0
CONT Temp. Attr. @ 0%: Model Testing Structure.ZCB Att Incidents Total	594	589.2	0

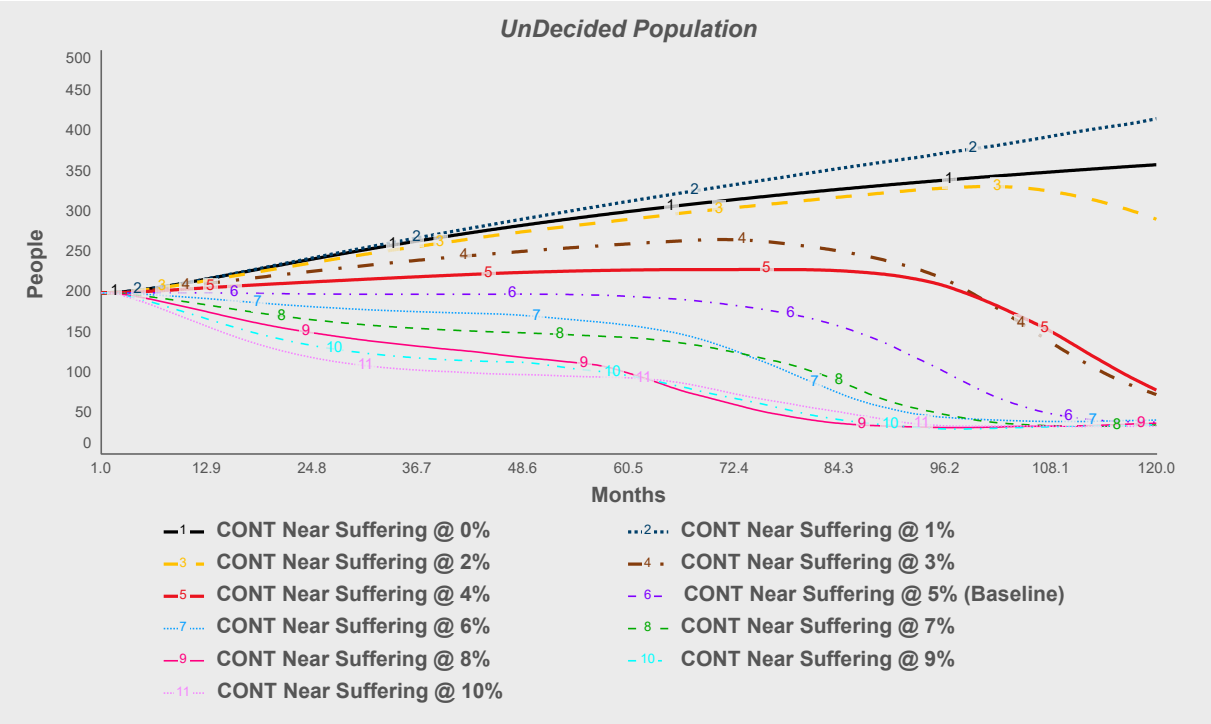
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-3.2 Proposition #2: Perceived Grievance & moral Outrage

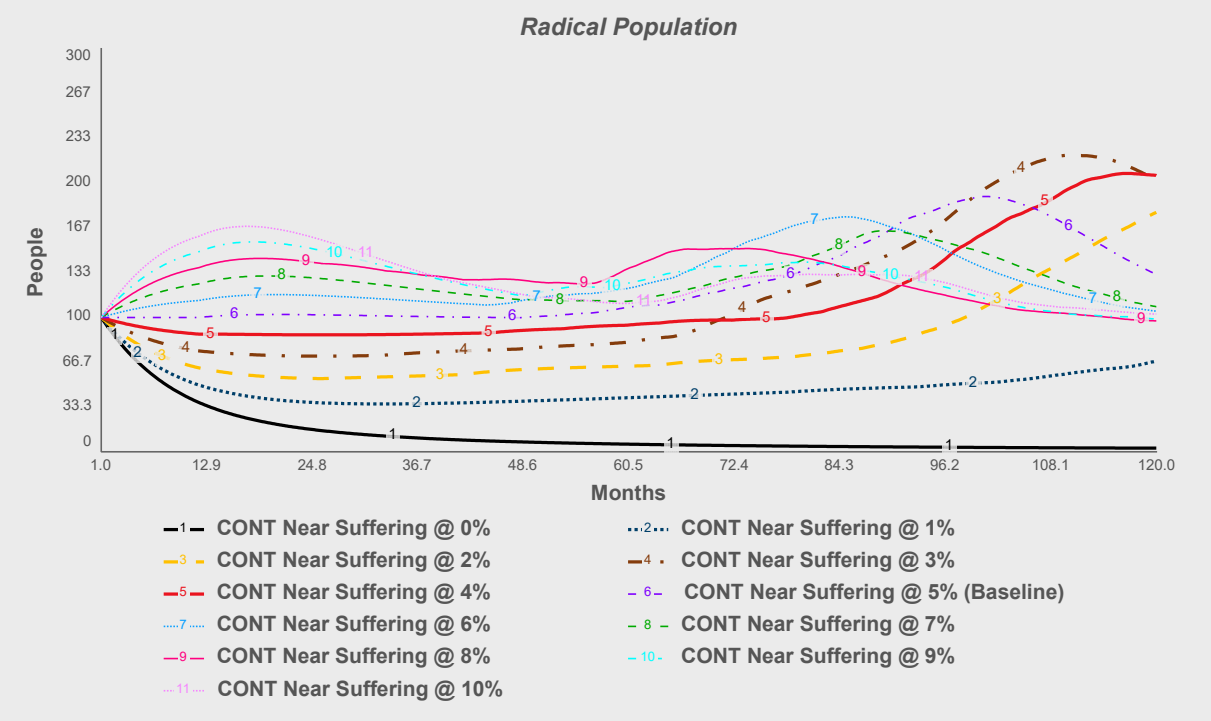
Moderate Population



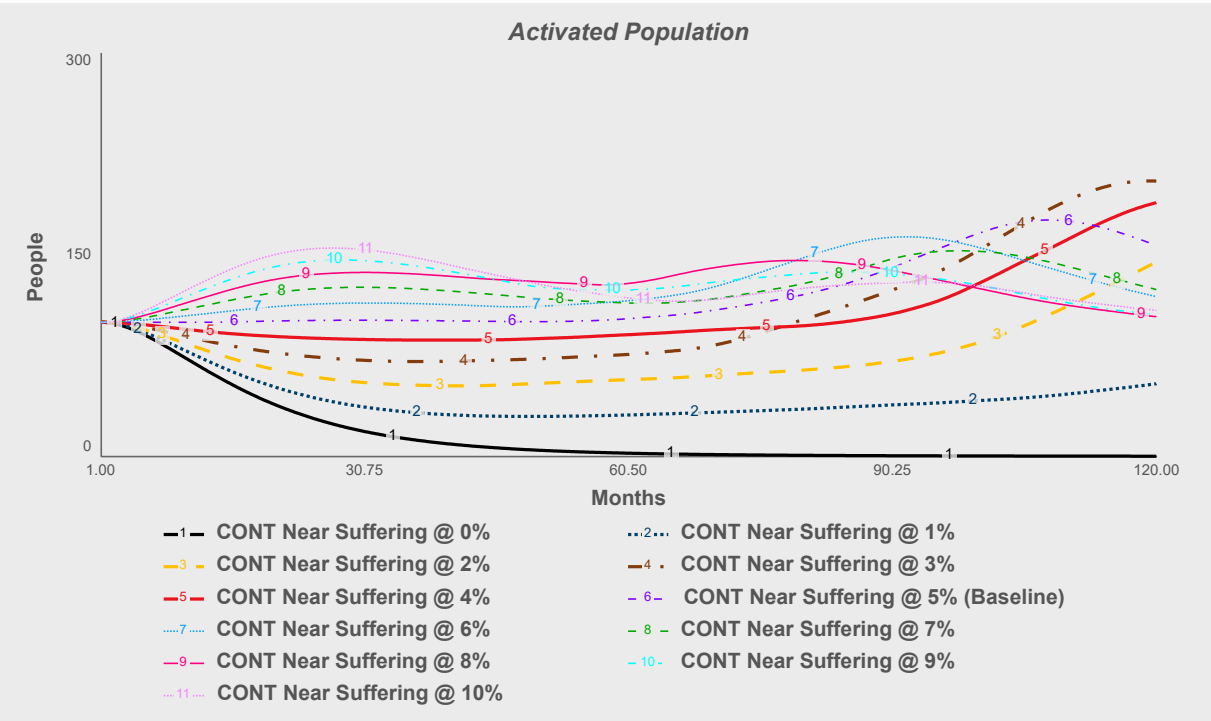
Undecided Population



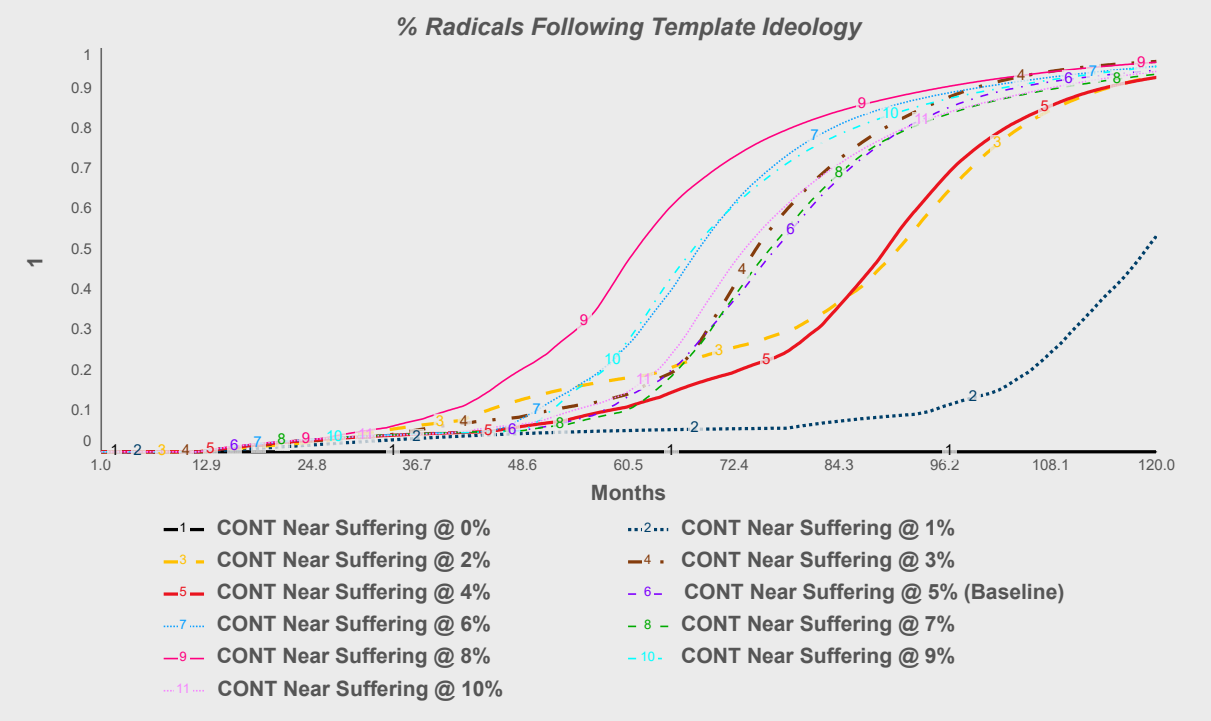
Radical Population



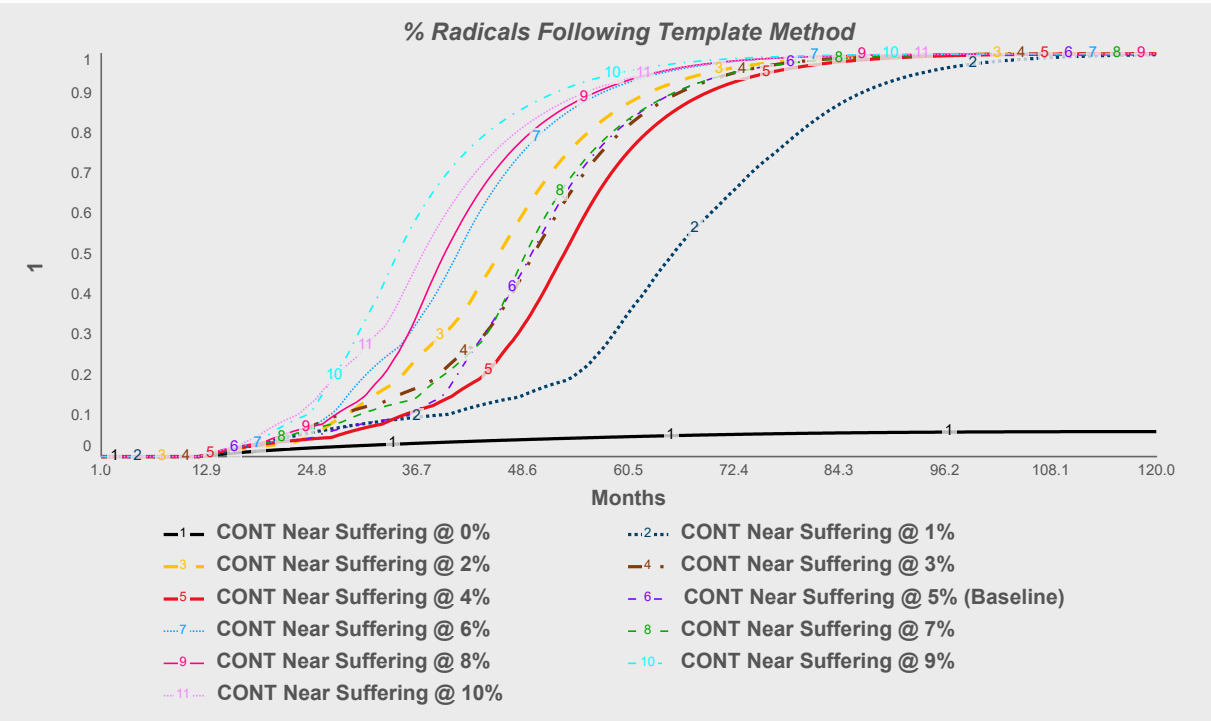
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

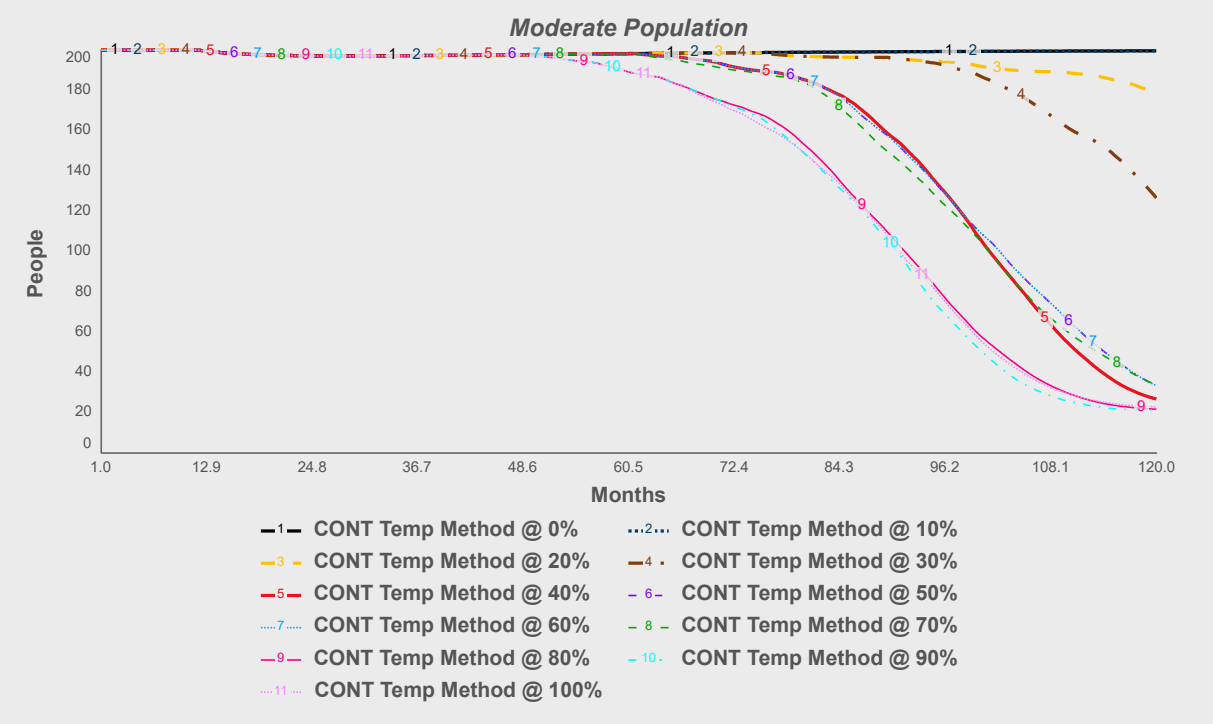
PROPOSITION #2: NEAR SUFFERING			

RUN VALUE	***Total Attempted Incidents***	***Failed Incidents***	***Total Contagion Incidents***
CONT Near Suffering @ 0%: Model Testing Structure.ZCB Att Incidents Total	98	97	0
CONT Near Suffering @ 1%: Model Testing Structure.ZCB Att Incidents Total	262	169.8	22
CONT Near Suffering @ 2%: Model Testing Structure.ZCB Att Incidents Total	436	219.7	113
CONT Near Suffering @ 3%: Model Testing Structure.ZCB Att Incidents Total	627	280.9	250
CONT Near Suffering @ 4%: Model Testing Structure.ZCB Att Incidents Total	629	315	157
CONT Near Suffering @ 5% (Baseline): Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT Near Suffering @ 6%: Model Testing Structure.ZCB Att Incidents Total	750	339.1	260
CONT Near Suffering @ 7%: Model Testing Structure.ZCB Att Incidents Total	751	380.7	224
CONT Near Suffering @ 8%: Model Testing Structure.ZCB Att Incidents Total	765	337.7	277
CONT Near Suffering @ 9%: Model Testing Structure.ZCB Att Incidents Total	765	331.3	229
CONT Near Suffering @ 10%: Model Testing Structure.ZCB Att Incidents Total	763	363.6	182

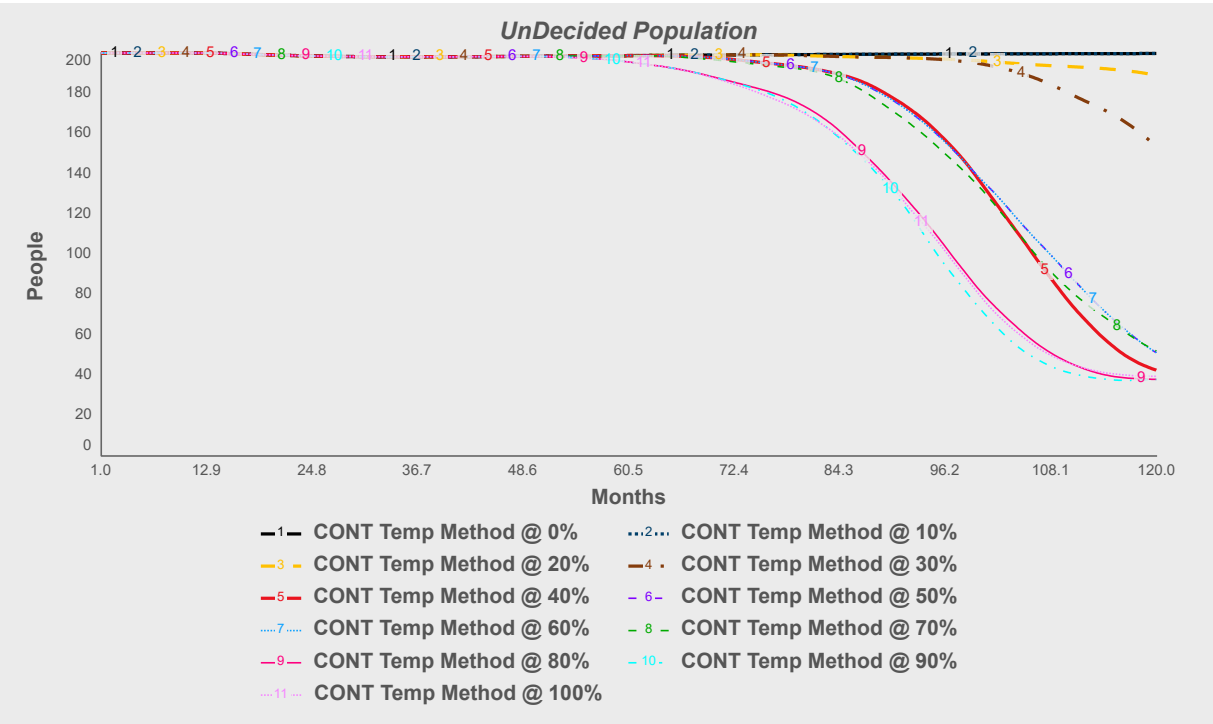
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-3.3 Proposition #3: Template Method Adoption Power

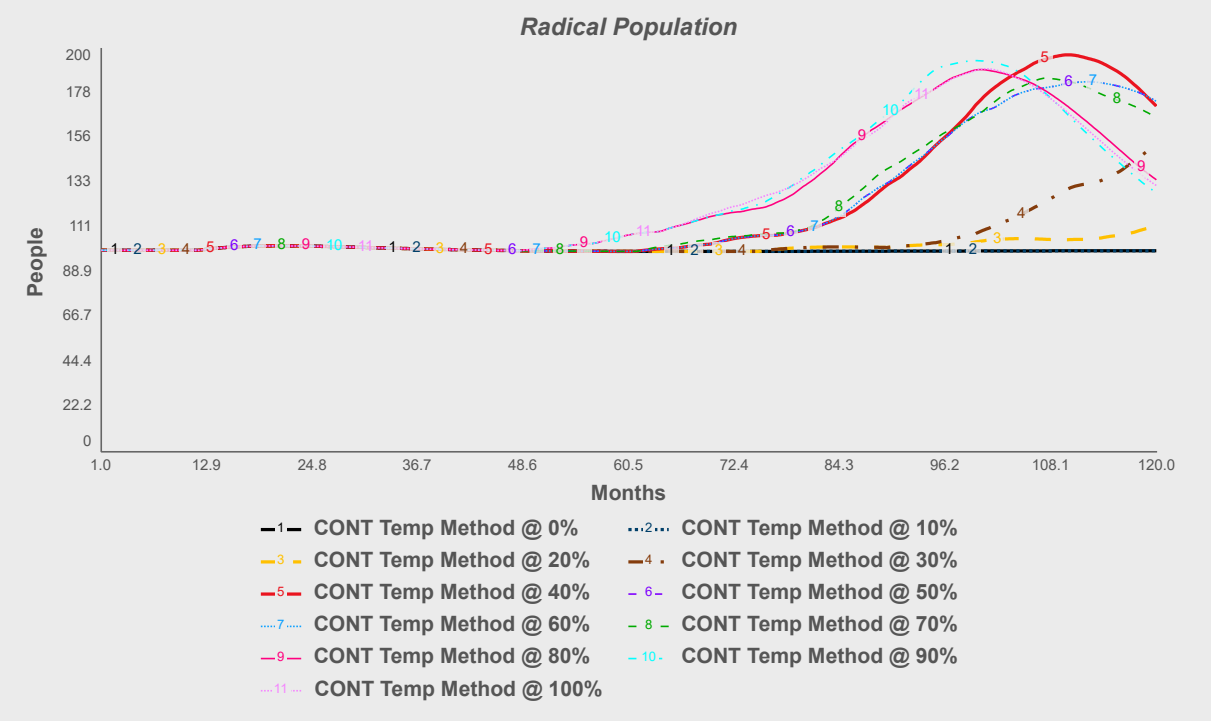
Moderate Population



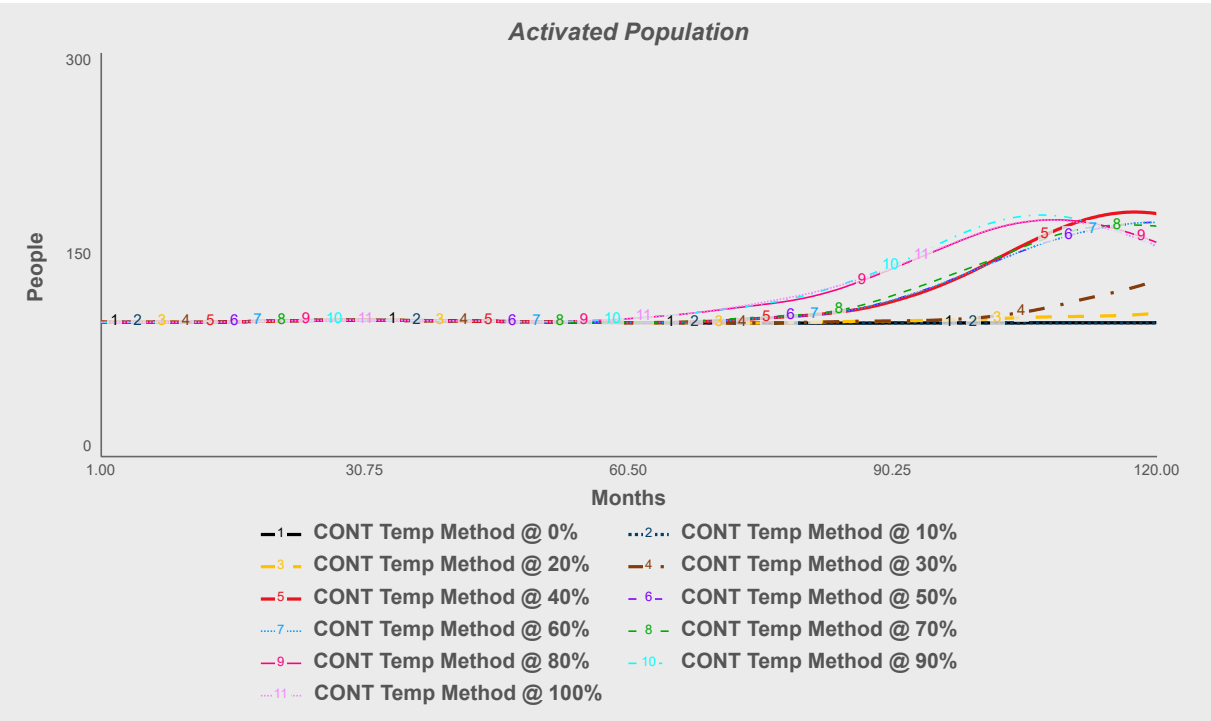
Undecided Population



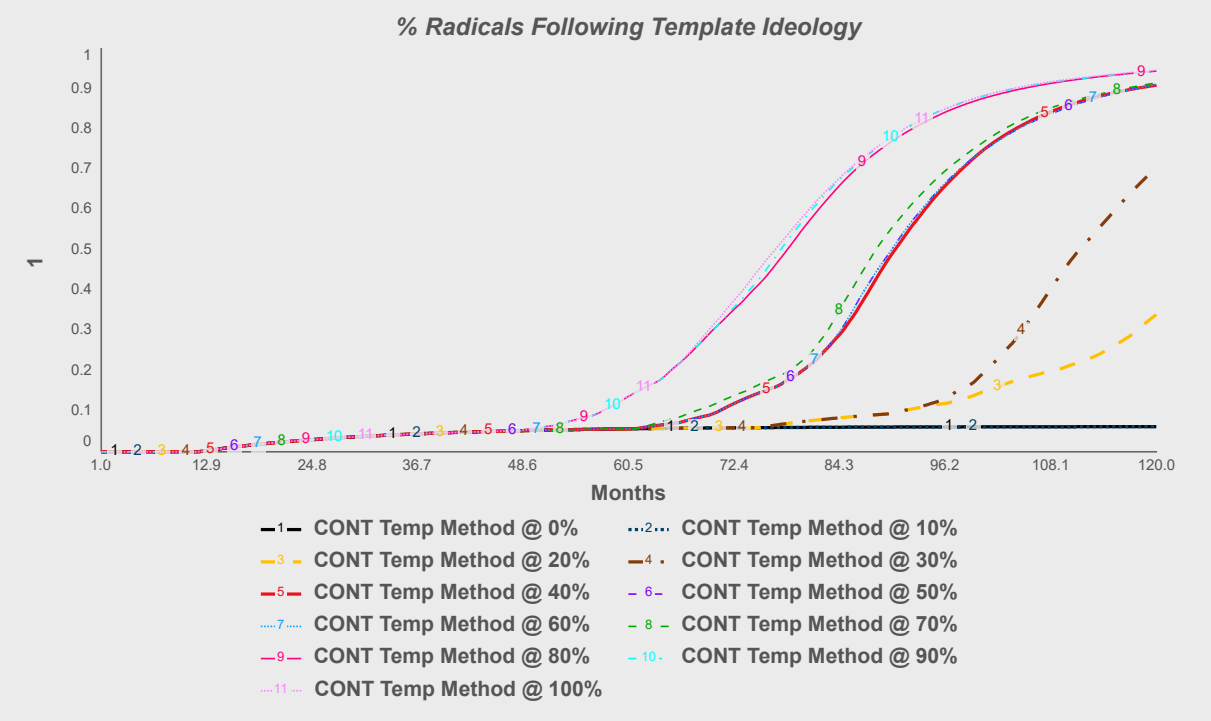
Radical Population



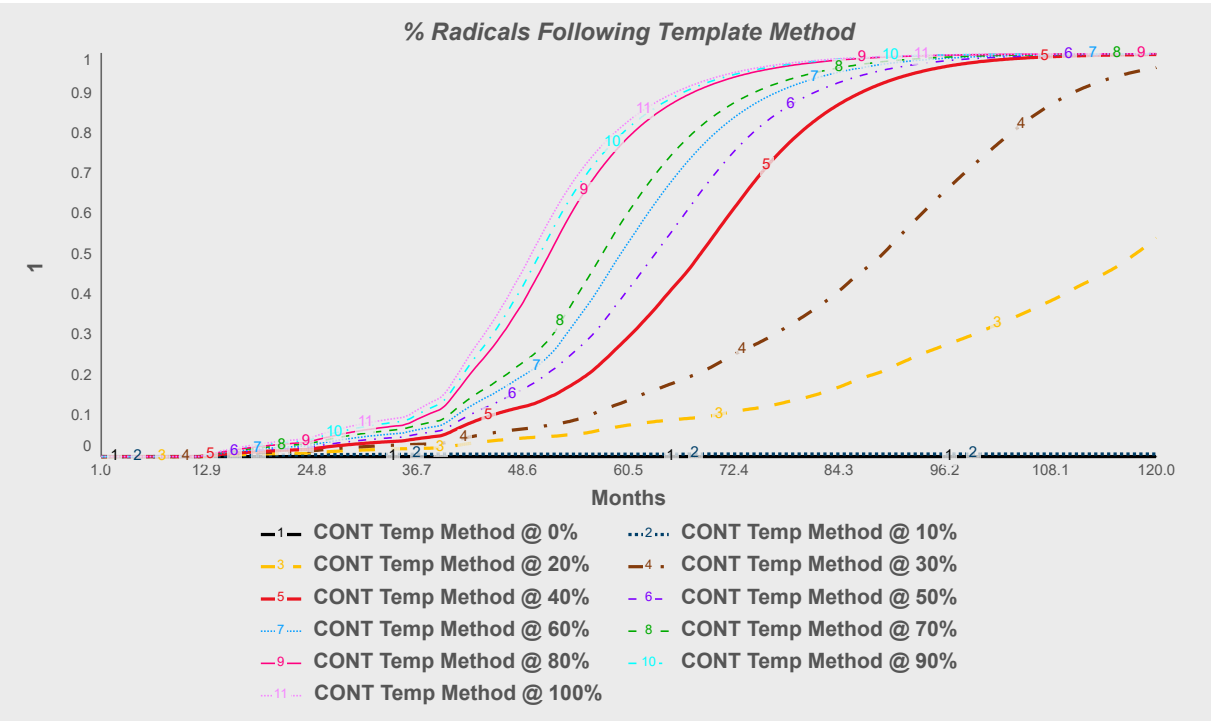
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

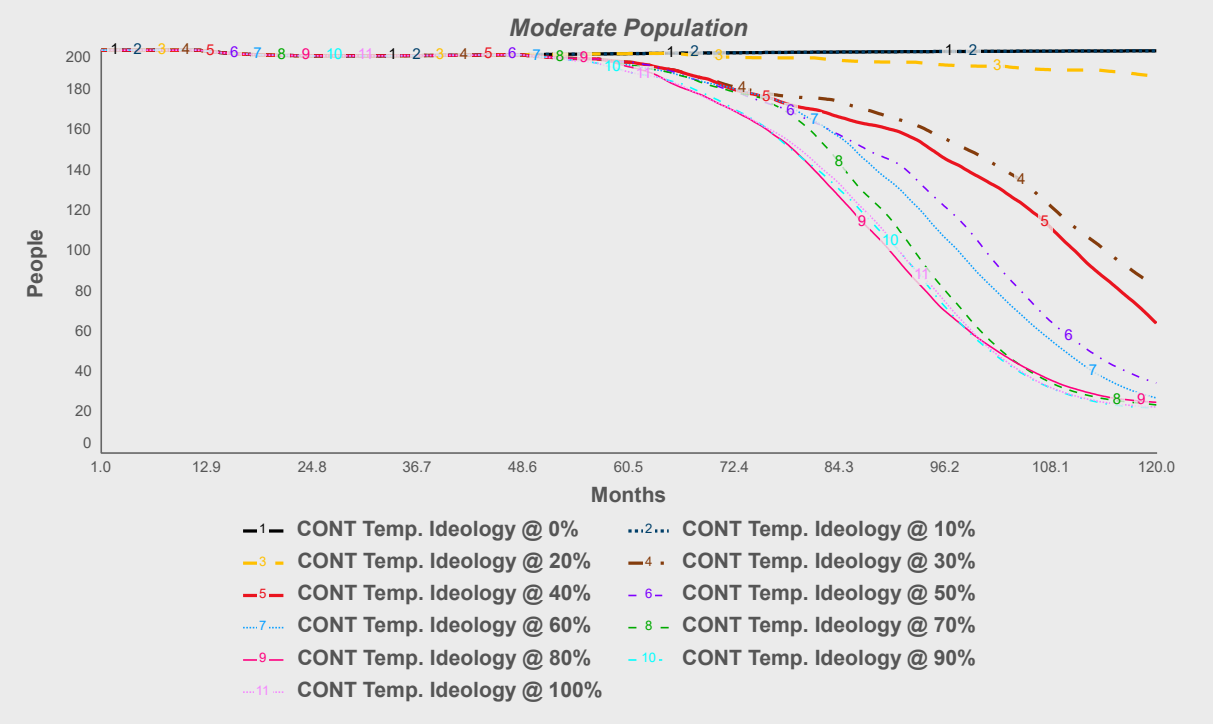
Template Method Adoption Power			

Run	*Total Attempted Incidents*	*Failed Incidents*	*Total Contagion Incidents*
CONT Temp Method @ 0%: Model Testing Structure.ZCB Att Incidents Total	595	589.5	0
CONT Temp Method @ 10%: Model Testing Structure.ZCB Att Incidents Total	595	589.5	0
CONT Temp Method @ 20%: Model Testing Structure.ZCB Att Incidents Total	601	534.5	10
CONT Temp Method @ 30%: Model Testing Structure.ZCB Att Incidents Total	612	456.2	45
CONT Temp Method @ 40%: Model Testing Structure.ZCB Att Incidents Total	684	395	175
CONT Temp Method @ 50%: Model Testing Structure.ZCB Att Incidents Total	678	388.2	160
CONT Temp Method @ 60%: Model Testing Structure.ZCB Att Incidents Total	678	375.7	160
CONT Temp Method @ 70%: Model Testing Structure.ZCB Att Incidents Total	683	374.6	160
CONT Temp Method @ 80%: Model Testing Structure.ZCB Att Incidents Total	717	339.2	235
CONT Temp Method @ 90%: Model Testing Structure.ZCB Att Incidents Total	722	335.3	247
CONT Temp Method @ 100%: Model Testing Structure.ZCB Att Incidents Total	719	342.4	234

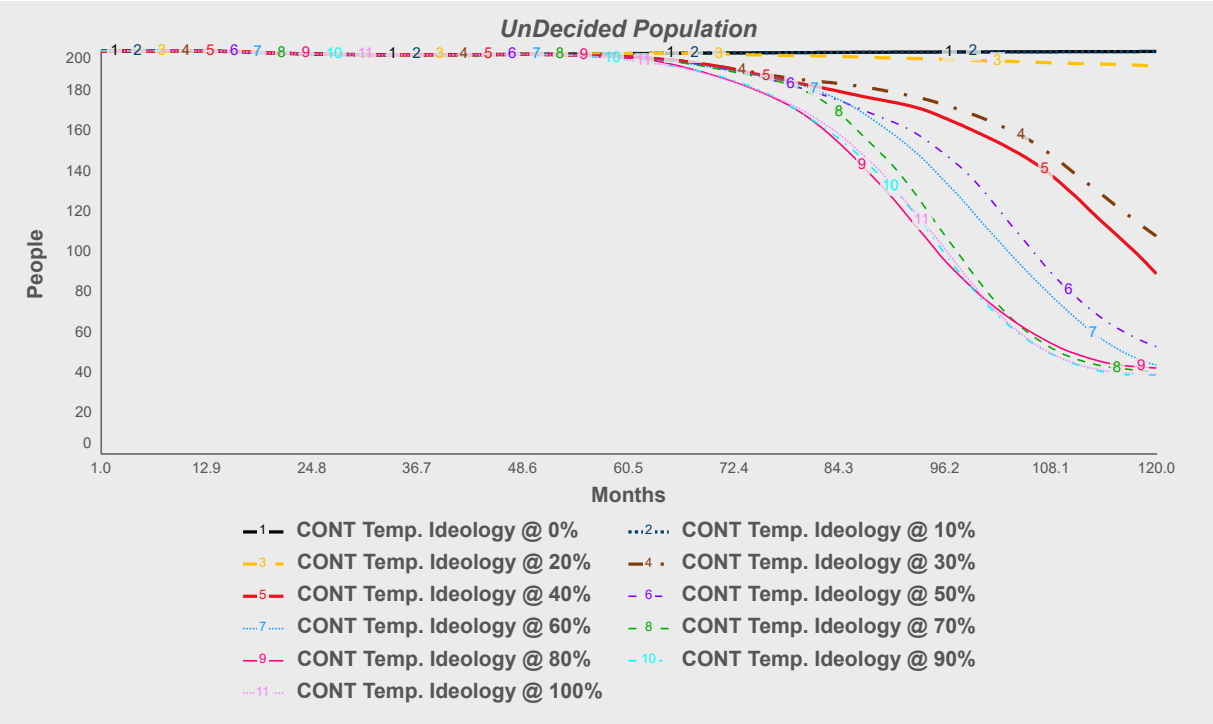
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-3.4 Proposition #4: Template Ideology Adoption Power

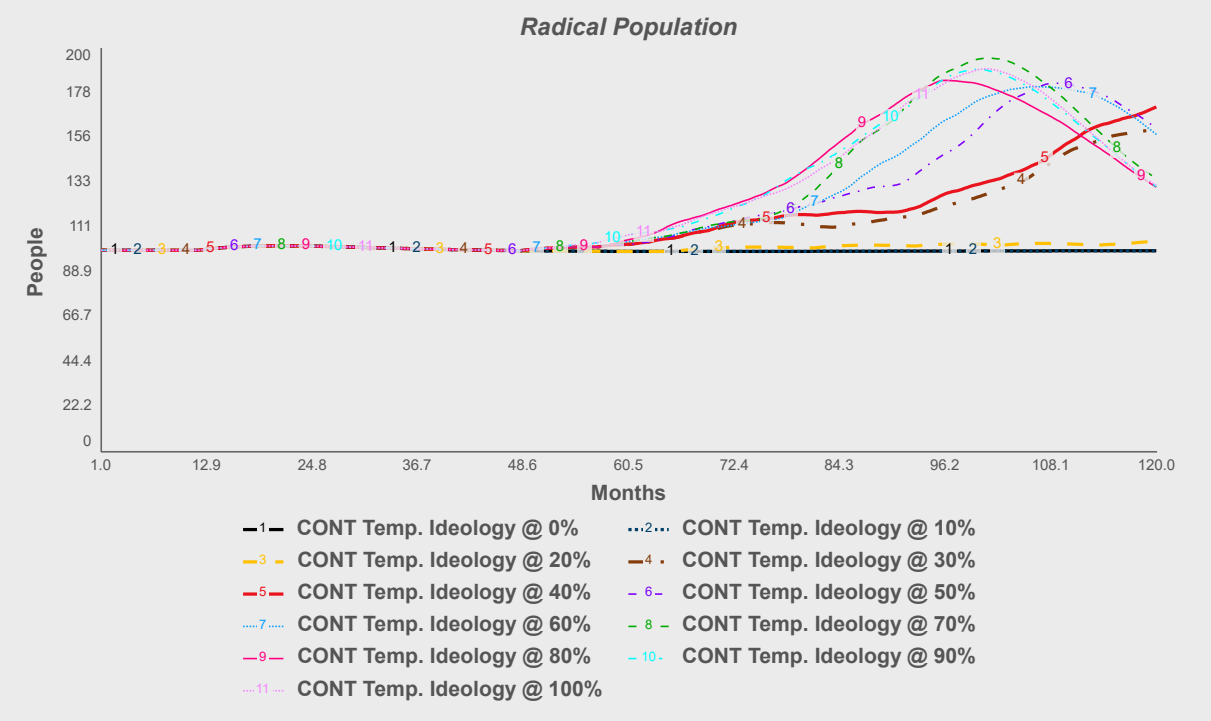
Moderate Population



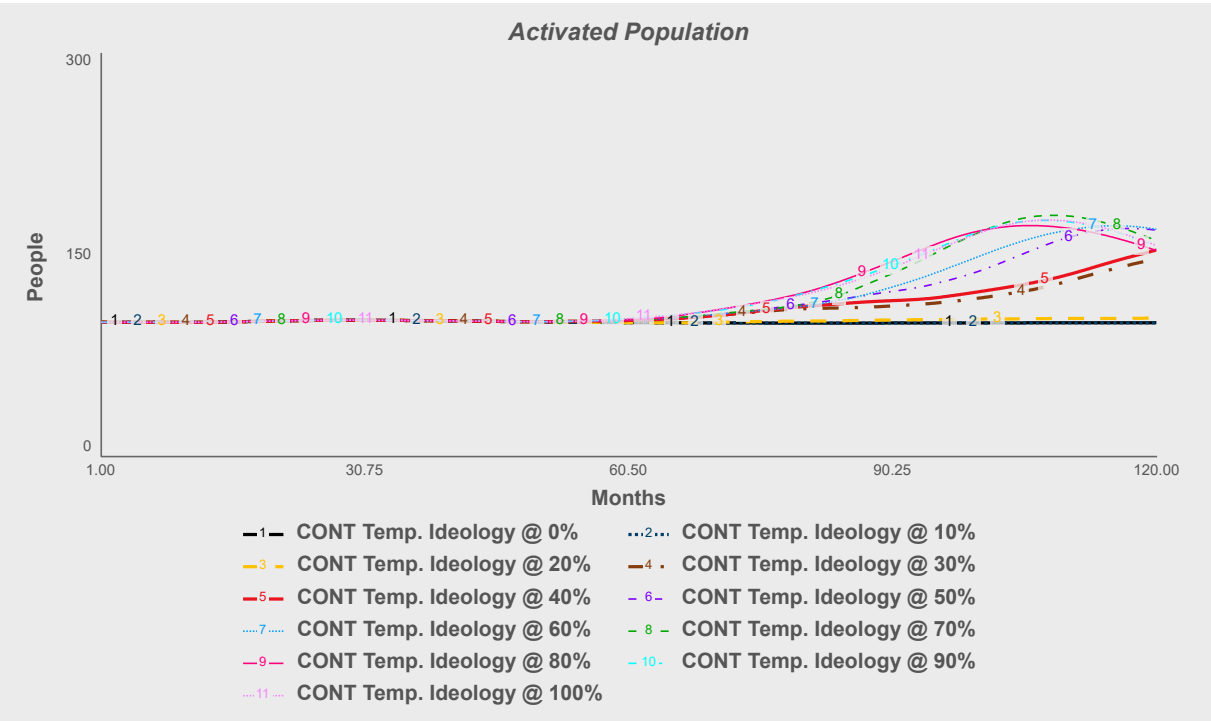
Undecided Population



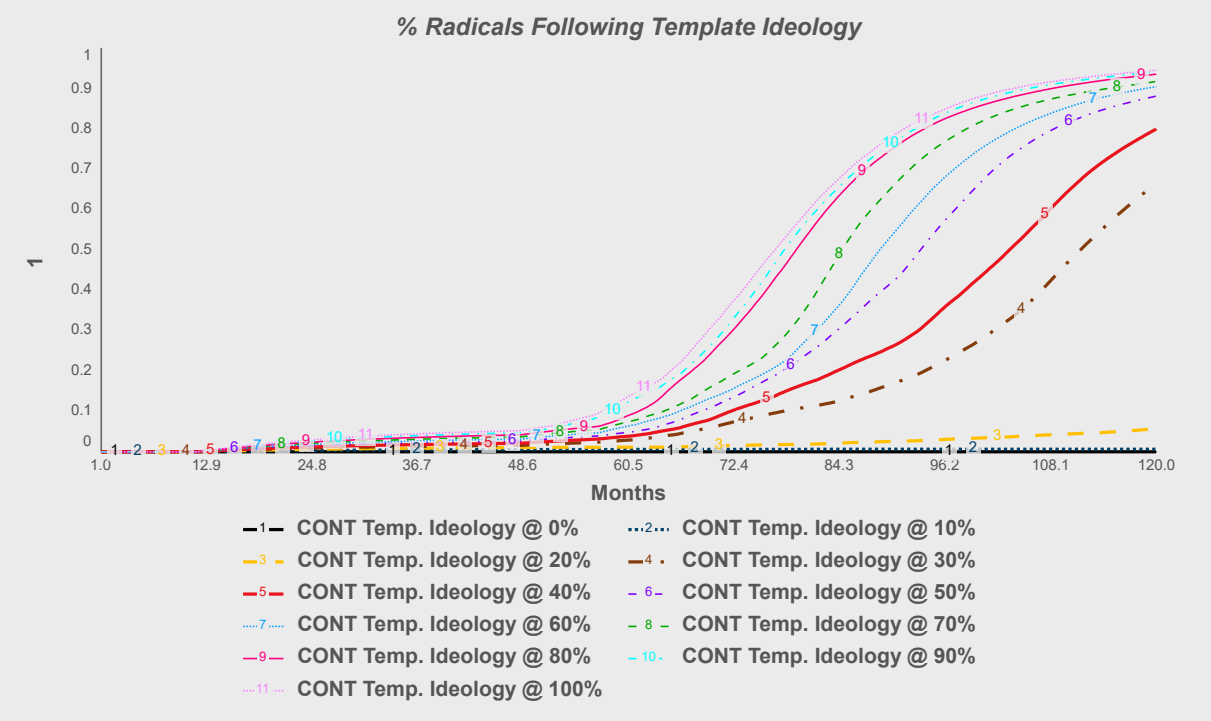
Radical Population



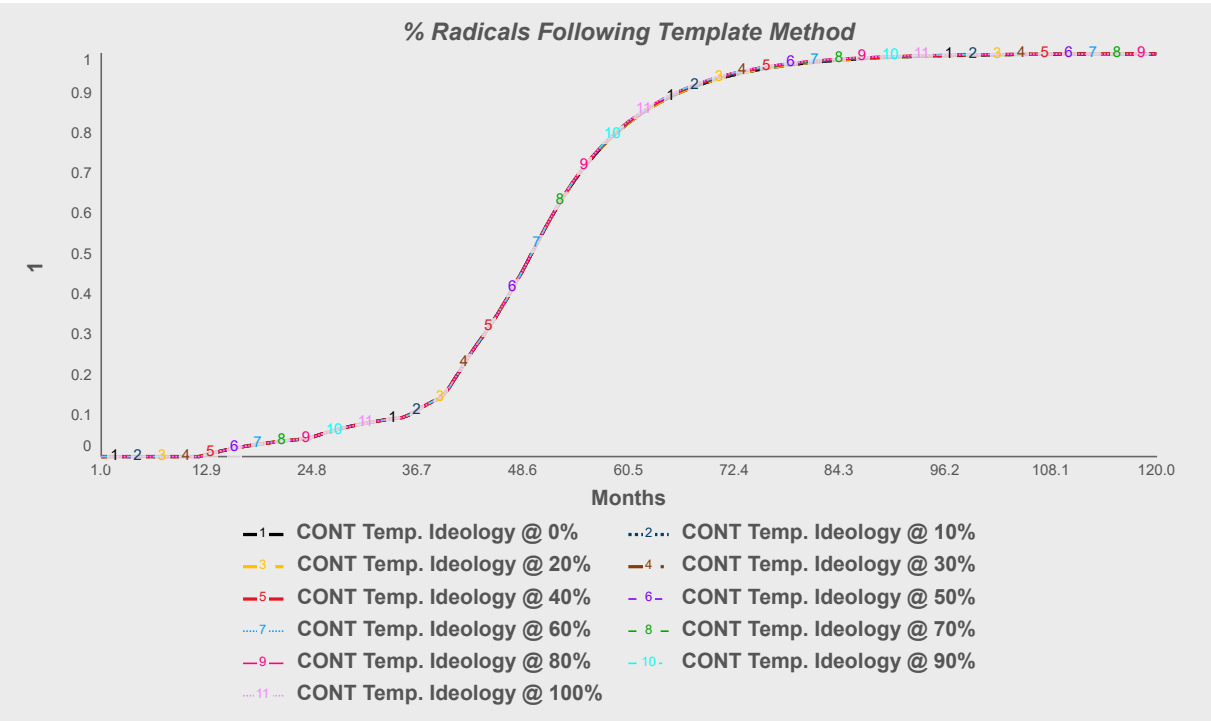
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

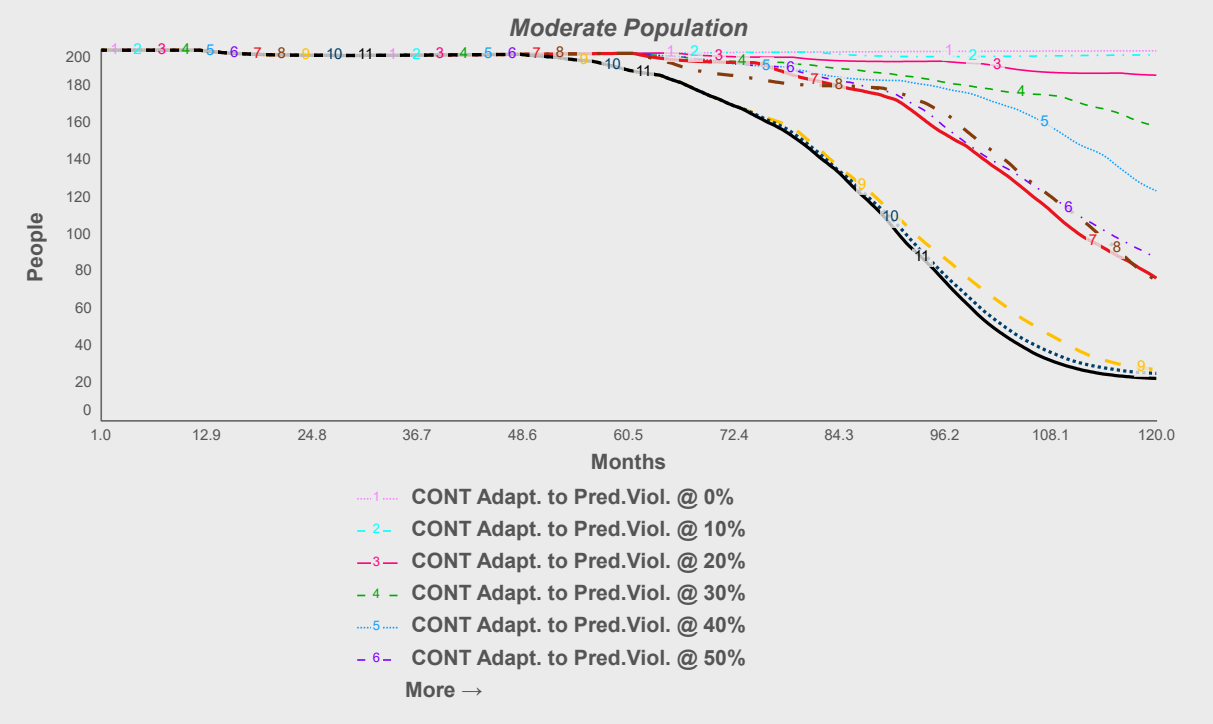
Template Ideology Adoption Power			

Run	*Total Attempted Incidents*	*Failed Incidents*	*Total Contagion Incidents*
CONT Temp. Ideology @ 0%: Model Testing Structure.ZCB Att Incidents Total	595	322.3	0
CONT Temp. Ideology @ 10%: Model Testing Structure.ZCB Att Incidents Total	595	322.3	0
CONT Temp. Ideology @ 20%: Model Testing Structure.ZCB Att Incidents Total	601	328.2	6
CONT Temp. Ideology @ 30%: Model Testing Structure.ZCB Att Incidents Total	646	318.5	80
CONT Temp. Ideology @ 40%: Model Testing Structure.ZCB Att Incidents Total	655	328.5	107
CONT Temp. Ideology @ 50%: Model Testing Structure.ZCB Att Incidents Total	686	332.5	159
CONT Temp. Ideology @ 60%: Model Testing Structure.ZCB Att Incidents Total	695	345.4	186
CONT Temp. Ideology @ 70%: Model Testing Structure.ZCB Att Incidents Total	714	332.4	222
CONT Temp. Ideology @ 80%: Model Testing Structure.ZCB Att Incidents Total	718	343.5	222
CONT Temp. Ideology @ 90%: Model Testing Structure.ZCB Att Incidents Total	720	334.4	237
CONT Temp. Ideology @ 100%: Model Testing Structure.ZCB Att Incidents Total	719	342.4	234

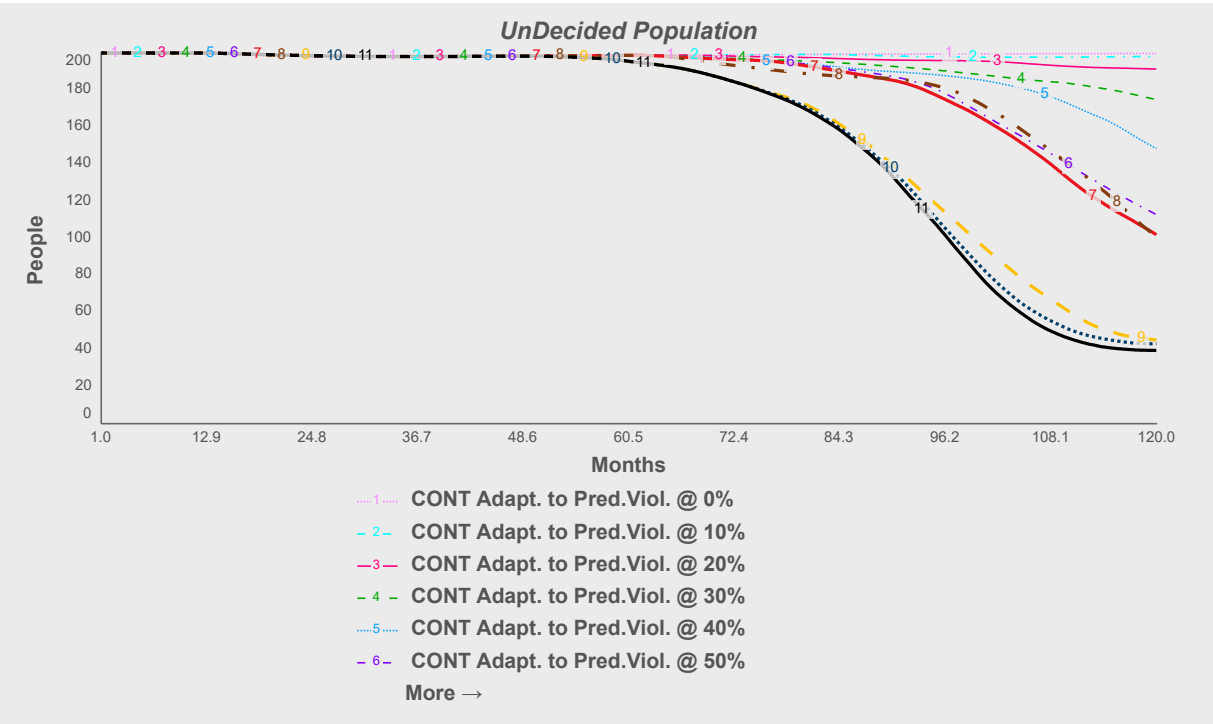
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-3.5 Proposition #5: Biological Adaptation to Predatory Mass Violence

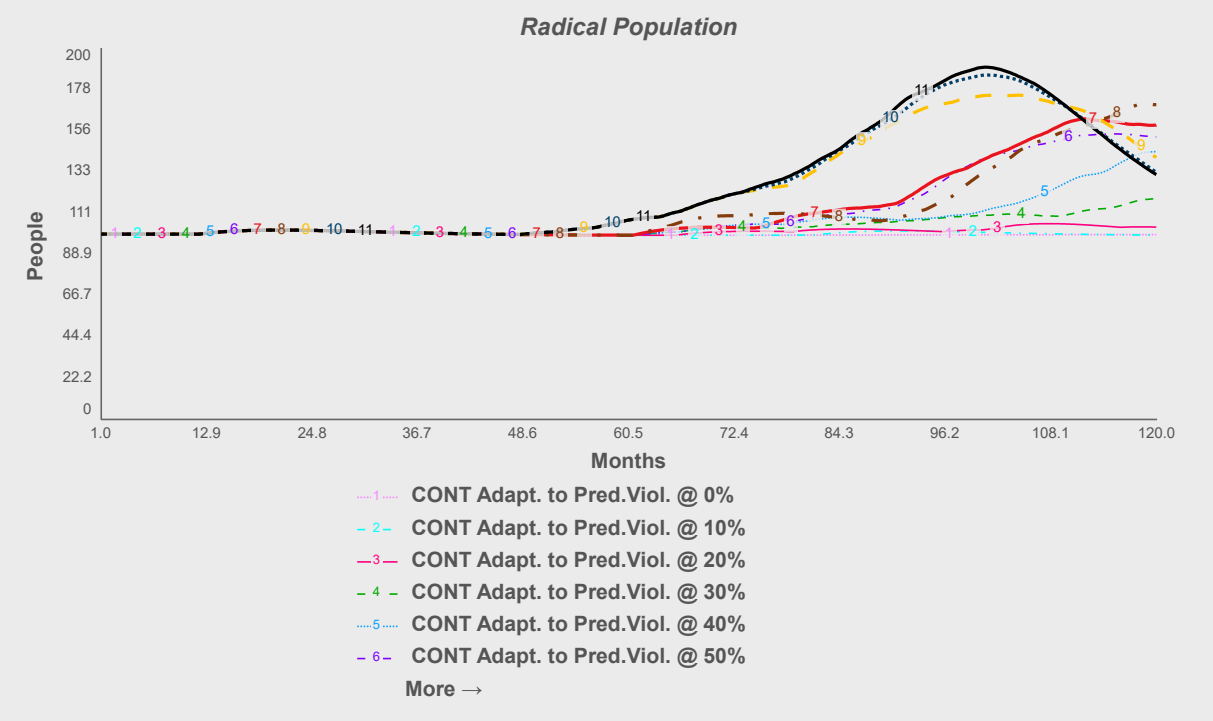
Moderate Population



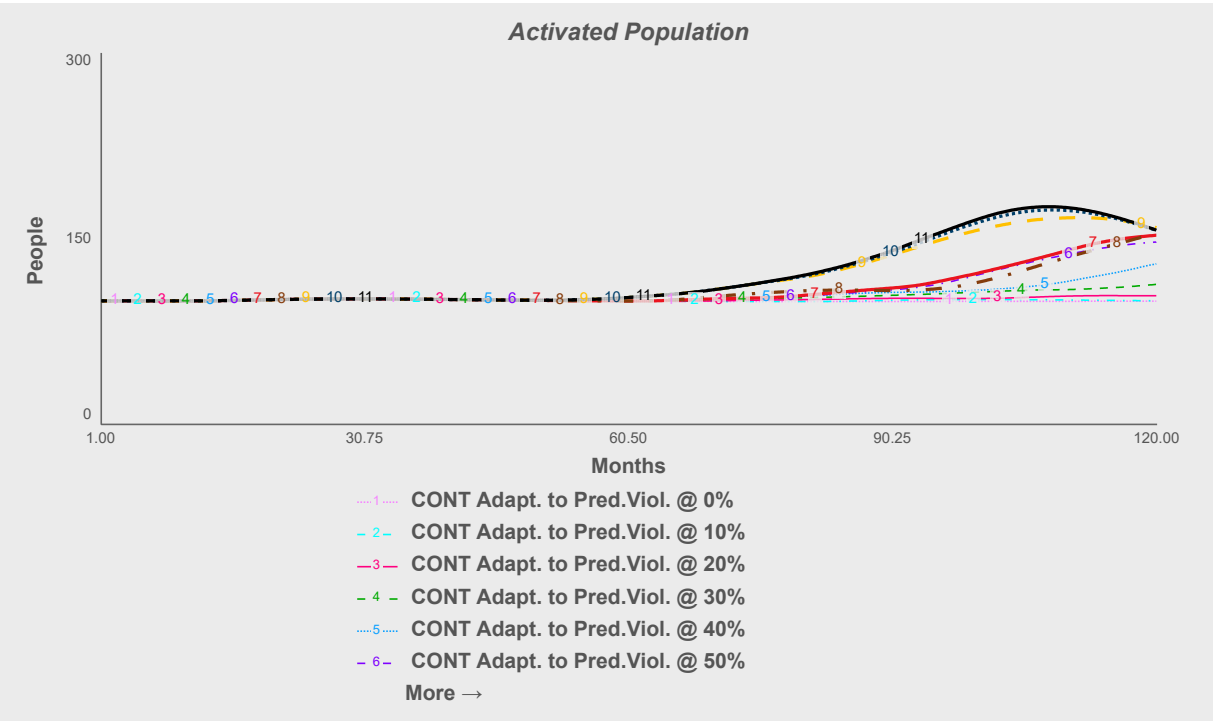
Undecided Population



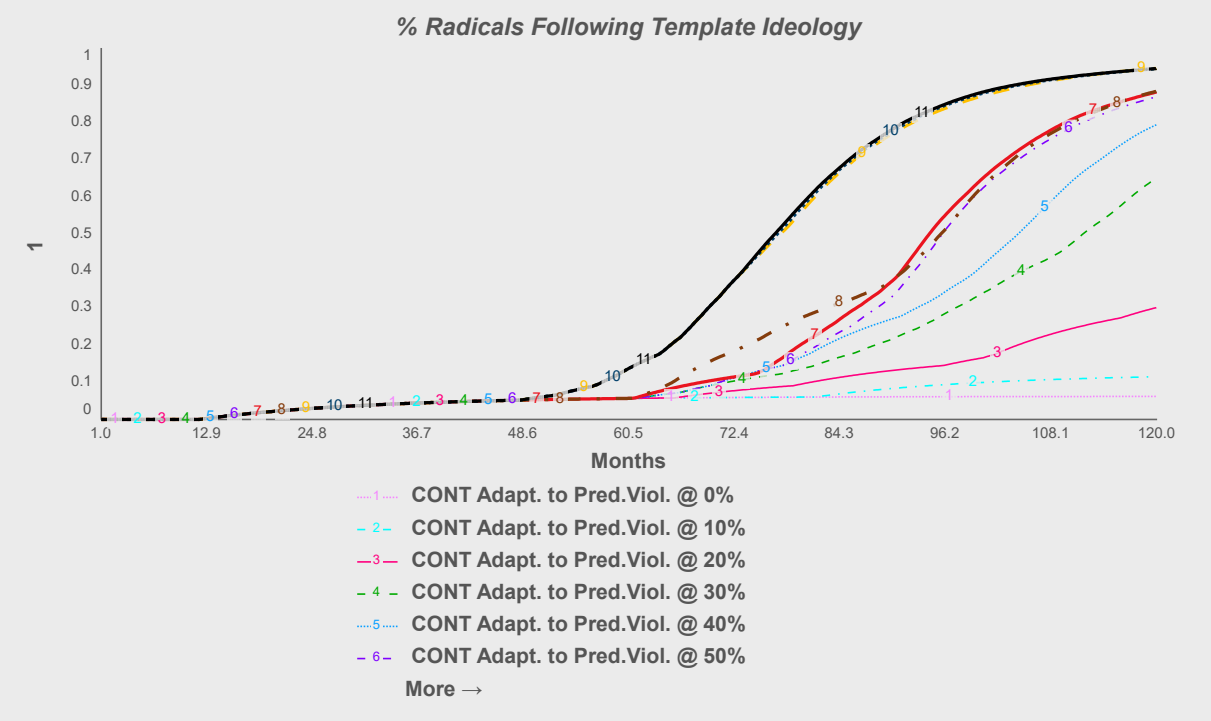
Radical Population



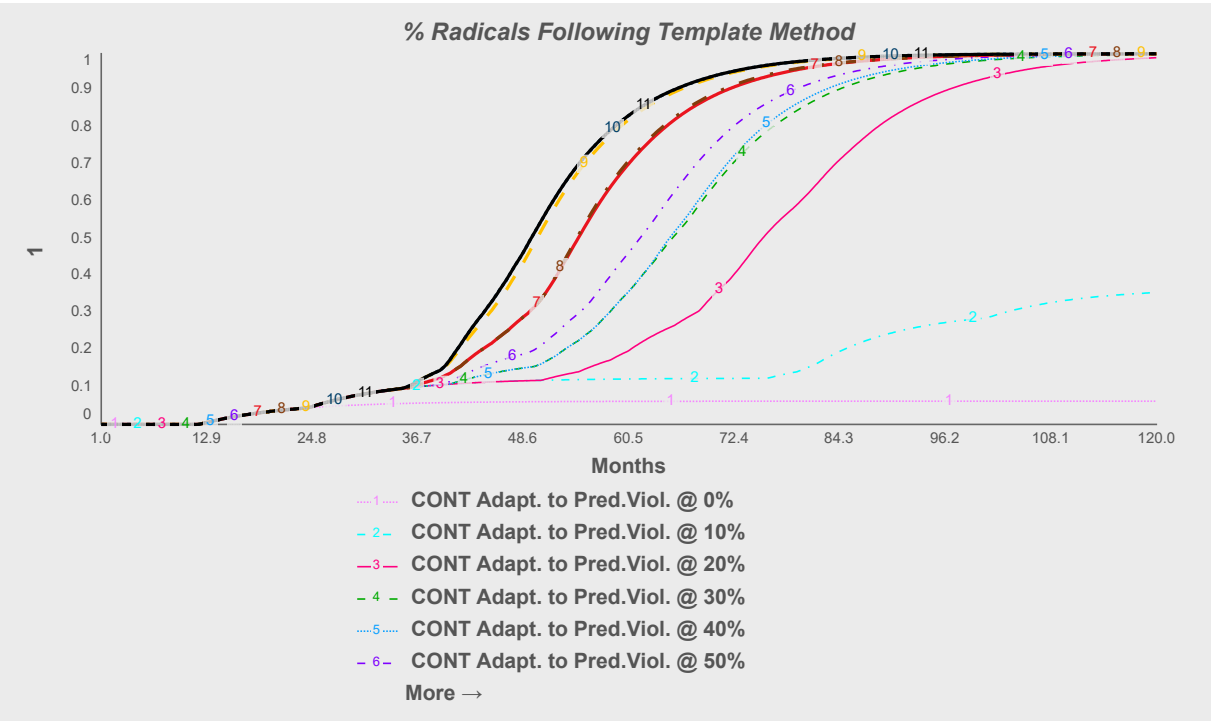
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

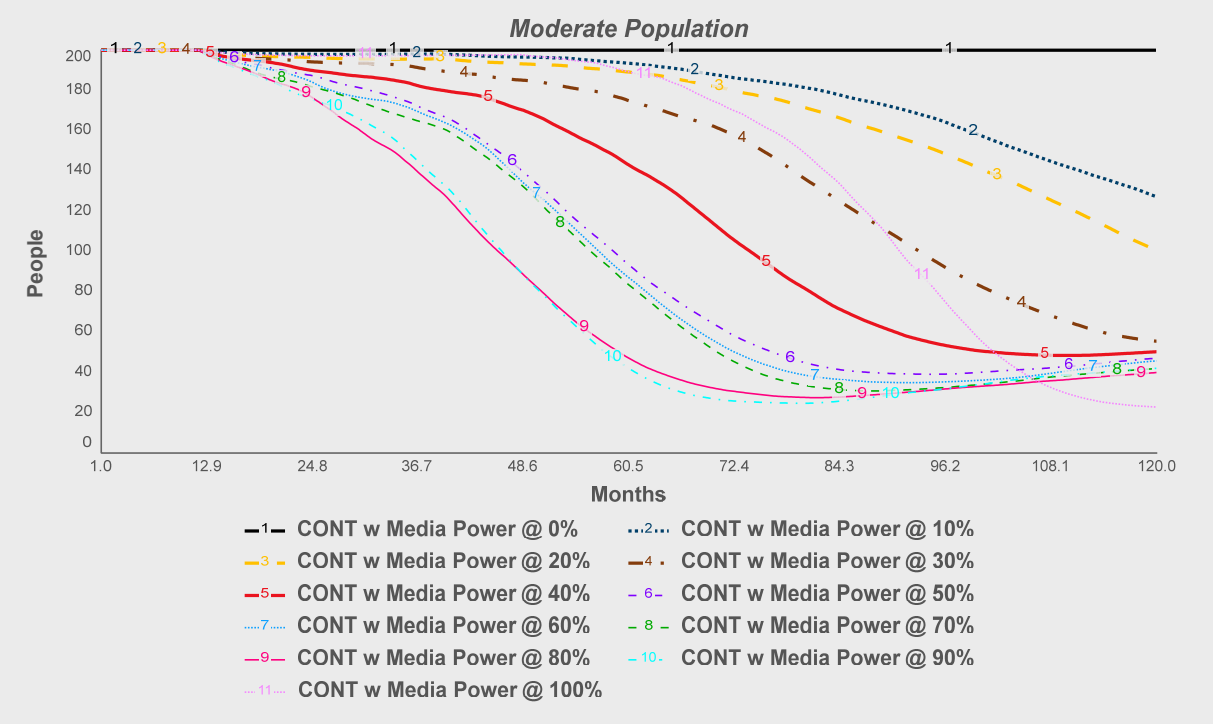
PROPOSITION #5 Adaptation to Predatory mass Violence			

RUN VALUE	***Total Attempted Incidents***	***Failed Incidents***	***Total Contagion Incidents***
CONT Adapt. to Pred.Viol. @ 0%: Model Testing Structure.ZCB Att Incidents Total	595	589.9	0
CONT Adapt. to Pred.Viol. @ 10%: Model Testing Structure.ZCB Att Incidents Total	597	587.8	1
CONT Adapt. to Pred.Viol. @ 20%: Model Testing Structure.ZCB Att Incidents Total	602	561	6
CONT Adapt. to Pred.Viol. @ 30%: Model Testing Structure.ZCB Att Incidents Total	611	530.2	20
CONT Adapt. to Pred.Viol. @ 40%: Model Testing Structure.ZCB Att Incidents Total	621	509.3	41
CONT Adapt. to Pred.Viol. @ 50%: Model Testing Structure.ZCB Att Incidents Total	644	488.4	70
CONT Adapt. to Pred.Viol. @ 60%: Model Testing Structure.ZCB Att Incidents Total	649	467.8	85
CONT Adapt. to Pred.Viol. @ 70%: Model Testing Structure.ZCB Att Incidents Total	644	431.8	85
CONT Adapt. to Pred.Viol. @ 80%: Model Testing Structure.ZCB Att Incidents Total	708	390.3	201
CONT Adapt. to Pred.Viol. @ 90%: Model Testing Structure.ZCB Att Incidents Total	715	379.4	214
CONT Adapt. to Pred.Viol. @ 100% (Baseline): Model Testing Structure.ZCB Att Incidents Total	719	342.4	234

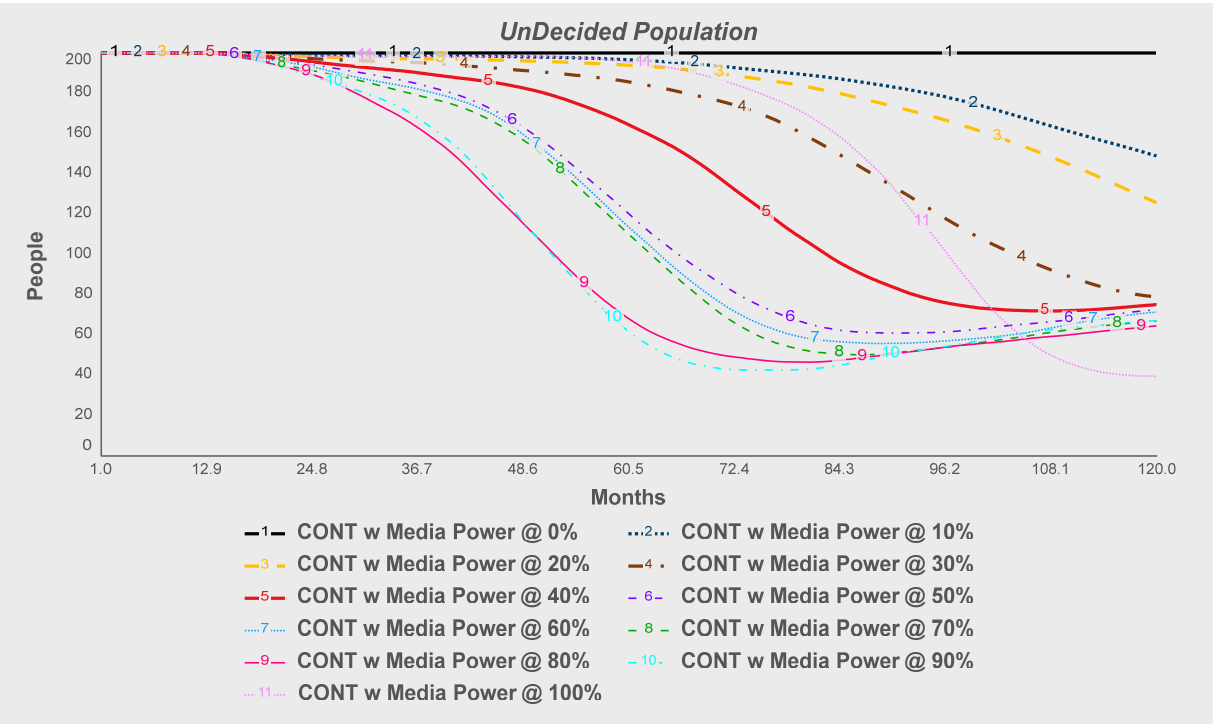
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-3.6 Proposition #6: Media Reach

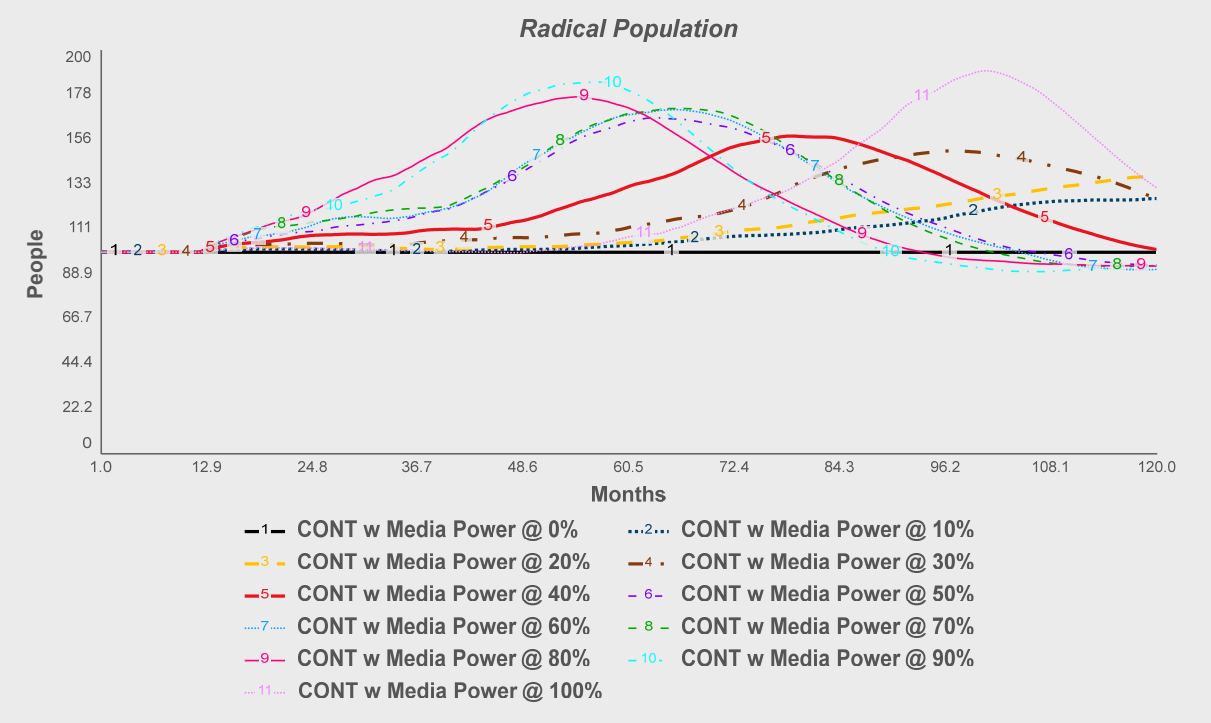
Moderate Population



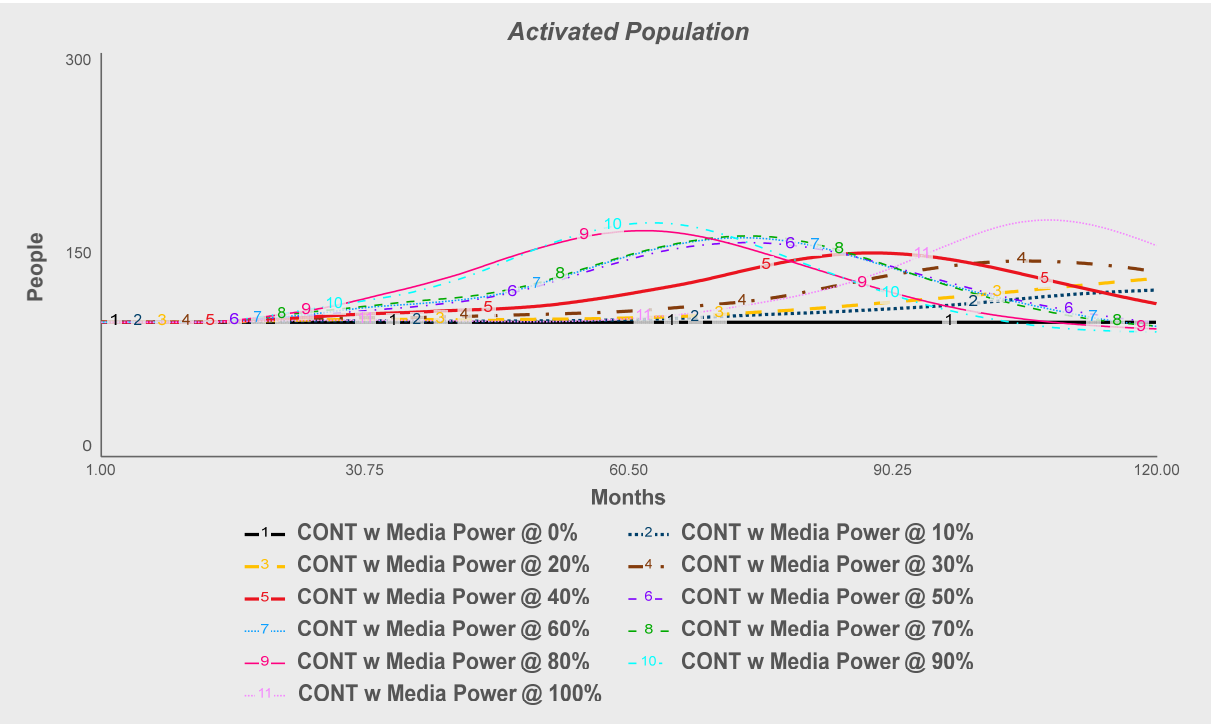
Undecided Population



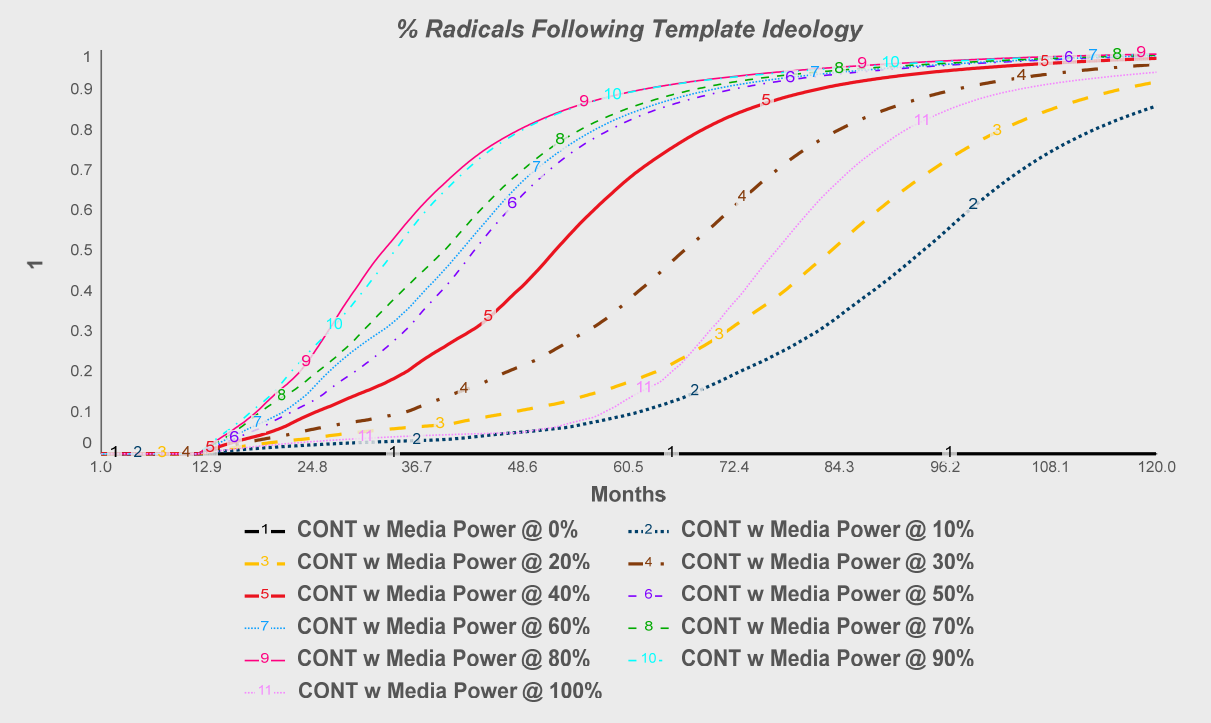
Radical Population



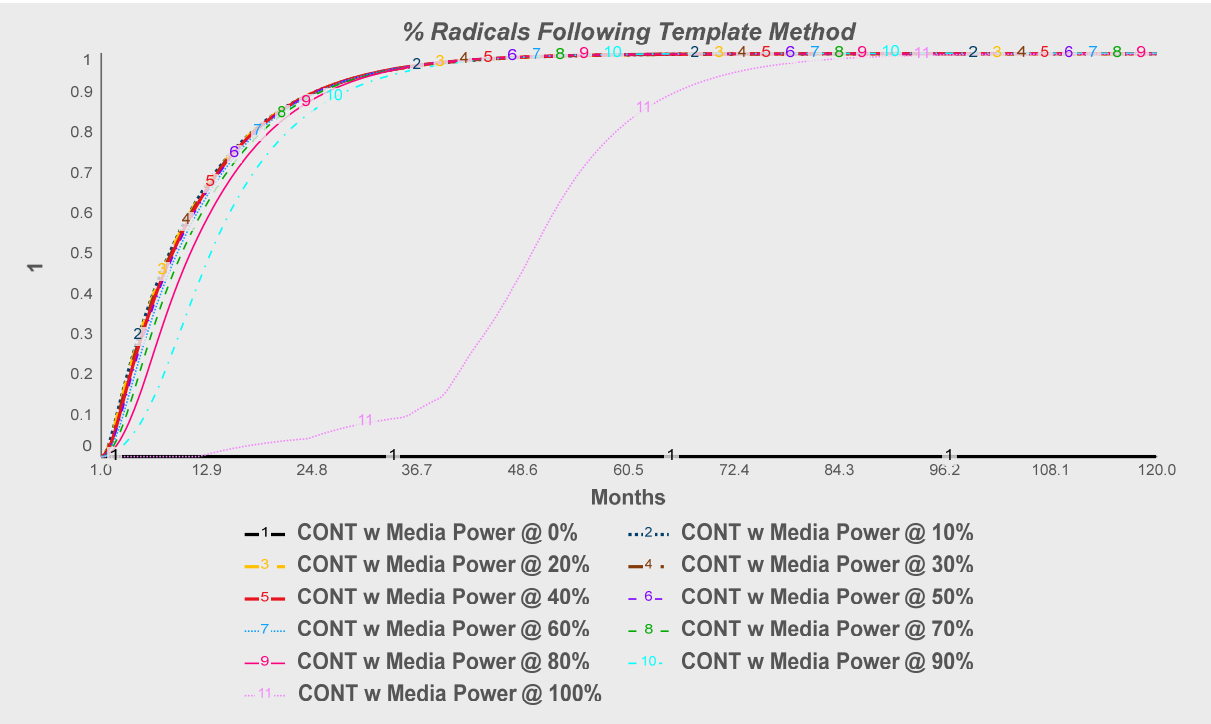
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

PROPOSITION #6 Media Reach	*Total Attempted Incidents*	*Failed Incidents*	*Total Contagion Incidents*
CONT Media Reach @ 0%: Model Testing Structure.ZCB Att Incidents Total	594	589.2	0
CONT Media Reach @ 1%: Model Testing Structure.ZCB Att Incidents Total	600	168.2	30
CONT Media Reach @ 2%: Model Testing Structure.ZCB Att Incidents Total	607	172.4	61
CONT Media Reach @ 3%: Model Testing Structure.ZCB Att Incidents Total	610	168.5	76
CONT Media Reach @ 4%: Model Testing Structure.ZCB Att Incidents Total	607	176.5	52
CONT Media Reach @ 5%: Model Testing Structure.ZCB Att Incidents Total	609	173.4	63
CONT Media Reach @ 6%: Model Testing Structure.ZCB Att Incidents Total	602	179.3	27
CONT Media Reach @ 7%: Model Testing Structure.ZCB Att Incidents Total	619	164.4	101
CONT Media Reach @ 8%: Model Testing Structure.ZCB Att Incidents Total	627	172.4	130
CONT Media Reach @ 9%: Model Testing Structure.ZCB Att Incidents Total	622	187.5	113
CONT Media Reach @ 10%: Model Testing Structure.ZCB Att Incidents Total	631	189.3	128
CONT Media Reach @ 20%: Model Testing Structure.ZCB Att Incidents Total	646	185.3	163
CONT Media Reach @ 30%: Model Testing Structure.ZCB Att Incidents Total	695	180.4	278
CONT Media Reach @ 40%: Model Testing Structure.ZCB Att Incidents Total	724	208.5	340
CONT Media Reach @ 50%: Model Testing Structure.ZCB Att Incidents Total	738	164.5	420
CONT Media Reach @ 60%: Model Testing Structure.ZCB Att Incidents Total	742	196.3	404
CONT Media Reach @ 70%: Model Testing Structure.ZCB Att Incidents Total	745	213.4	400
CONT Media Reach @ 80%: Model Testing Structure.ZCB Att Incidents Total	748	194.4	444
CONT Media Reach @ 90%: Model Testing Structure.ZCB Att Incidents Total	747	223.2	416

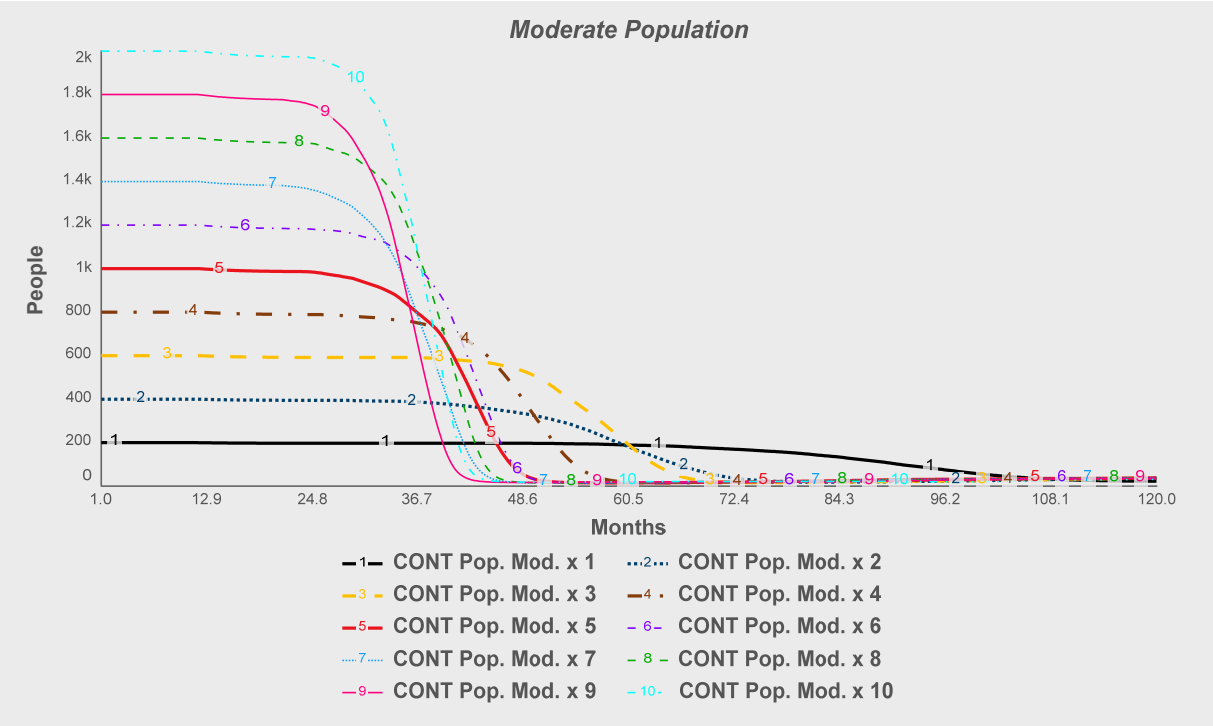
CONT Media Reach @ 100%: Model Testing Structure.ZCB Att Incidents Total	719	342.4	234

Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

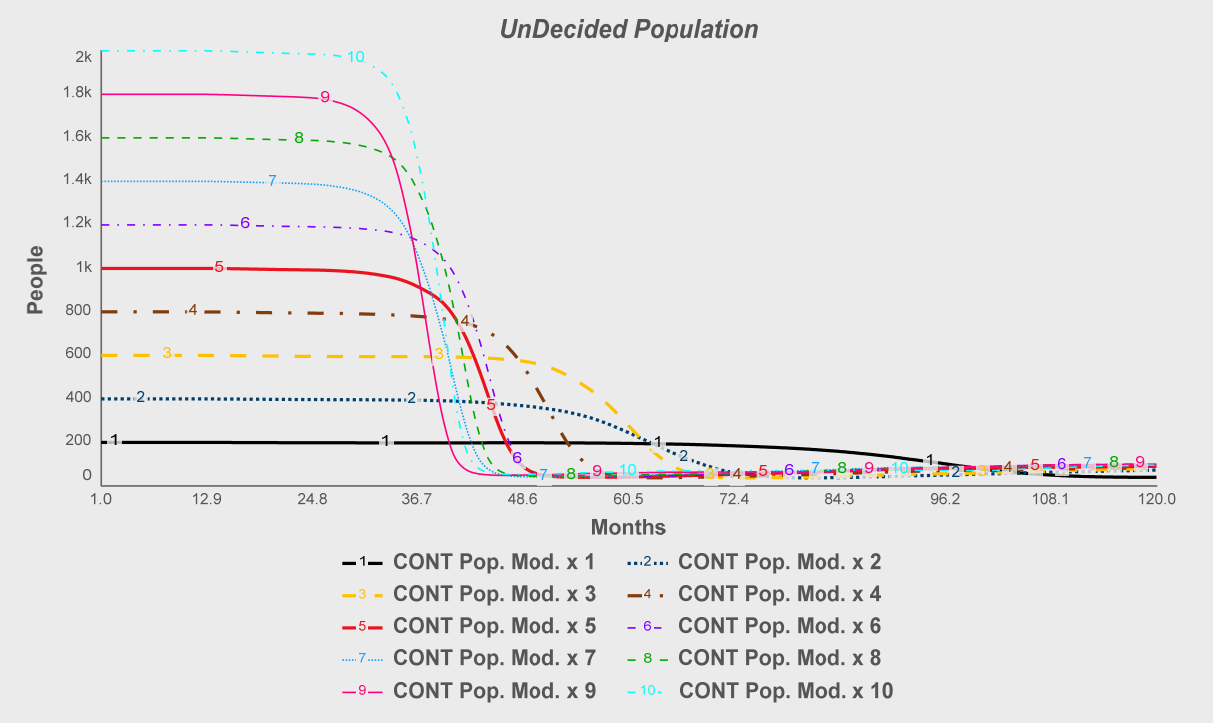
Media effect of 0% results in EQ behavior.

D-3.7A Proposition #7A: At-Risk Population (Multiplier x.1-1)

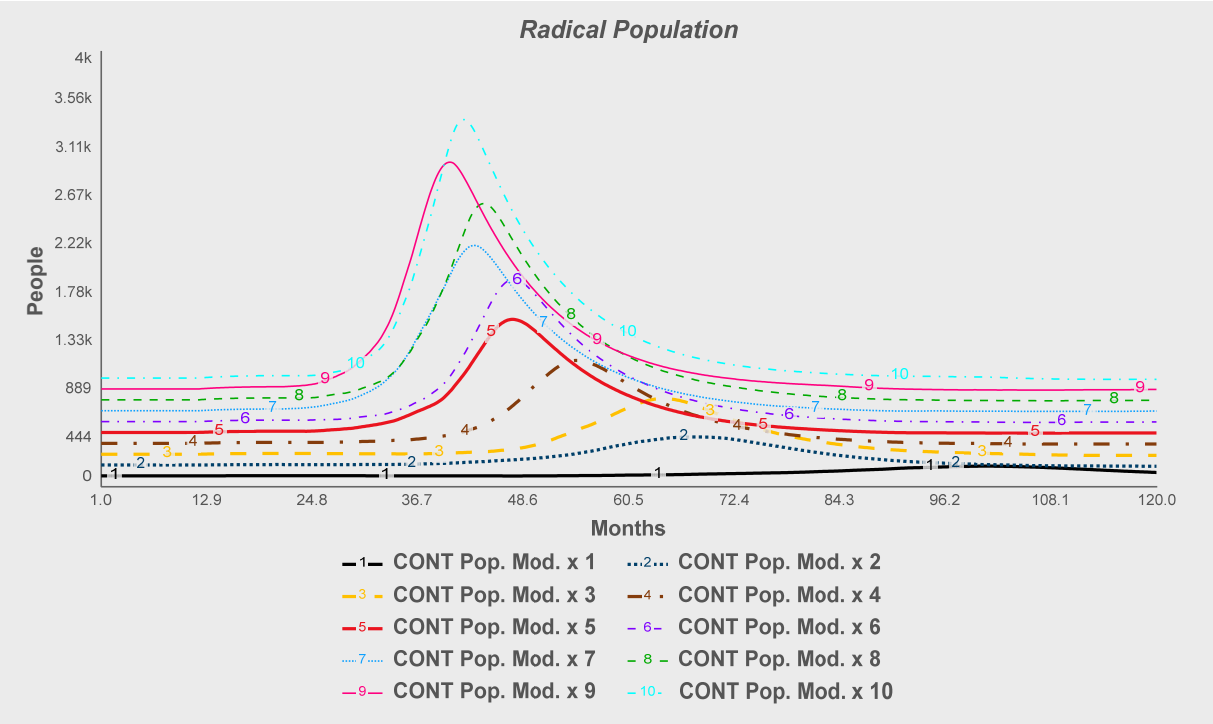
Moderate Population



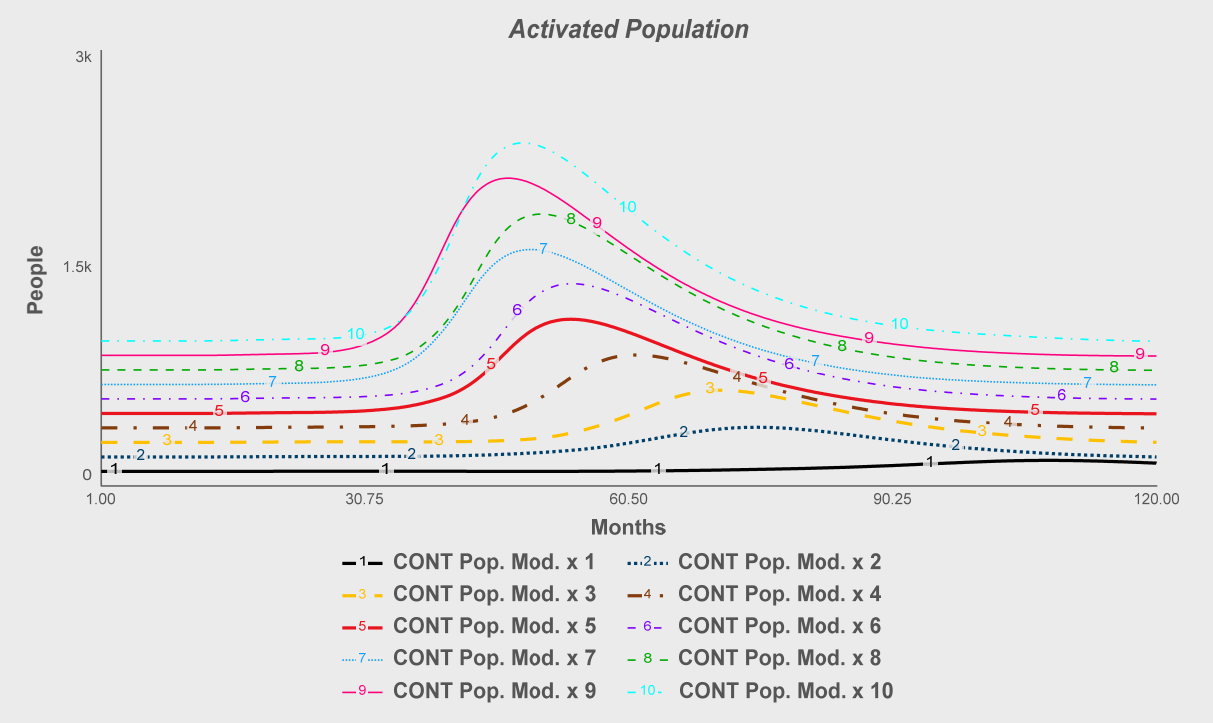
Undecided Population



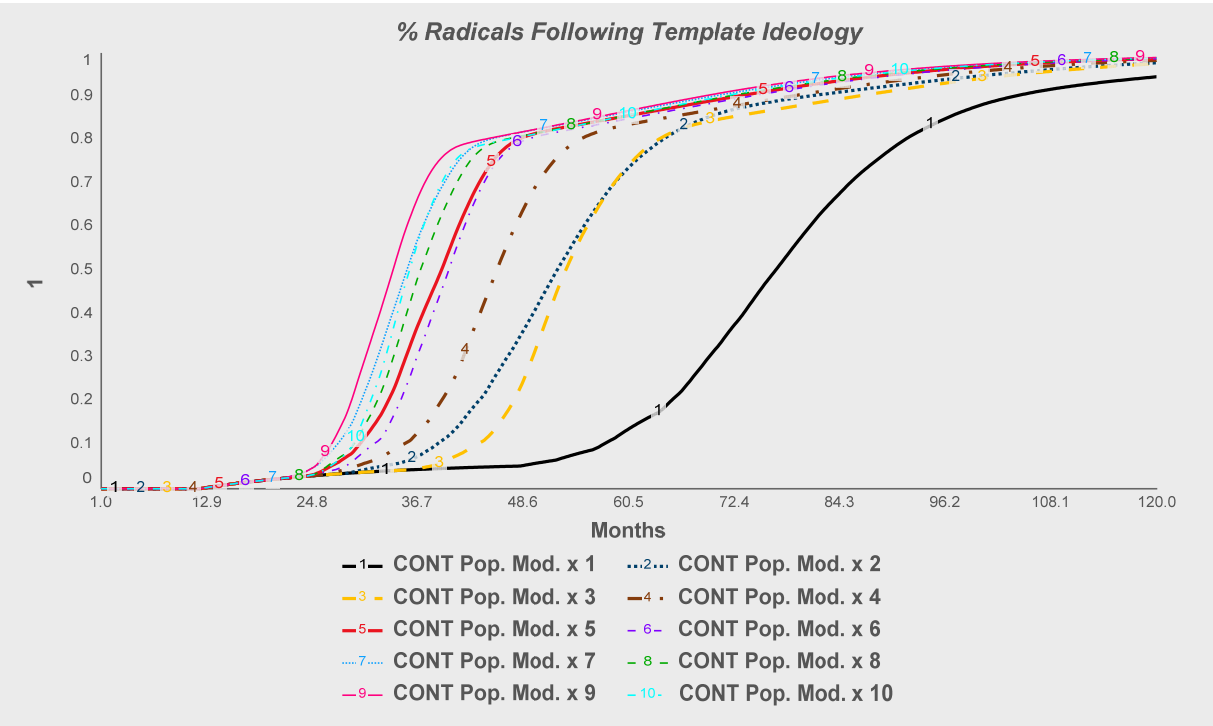
Radical Population



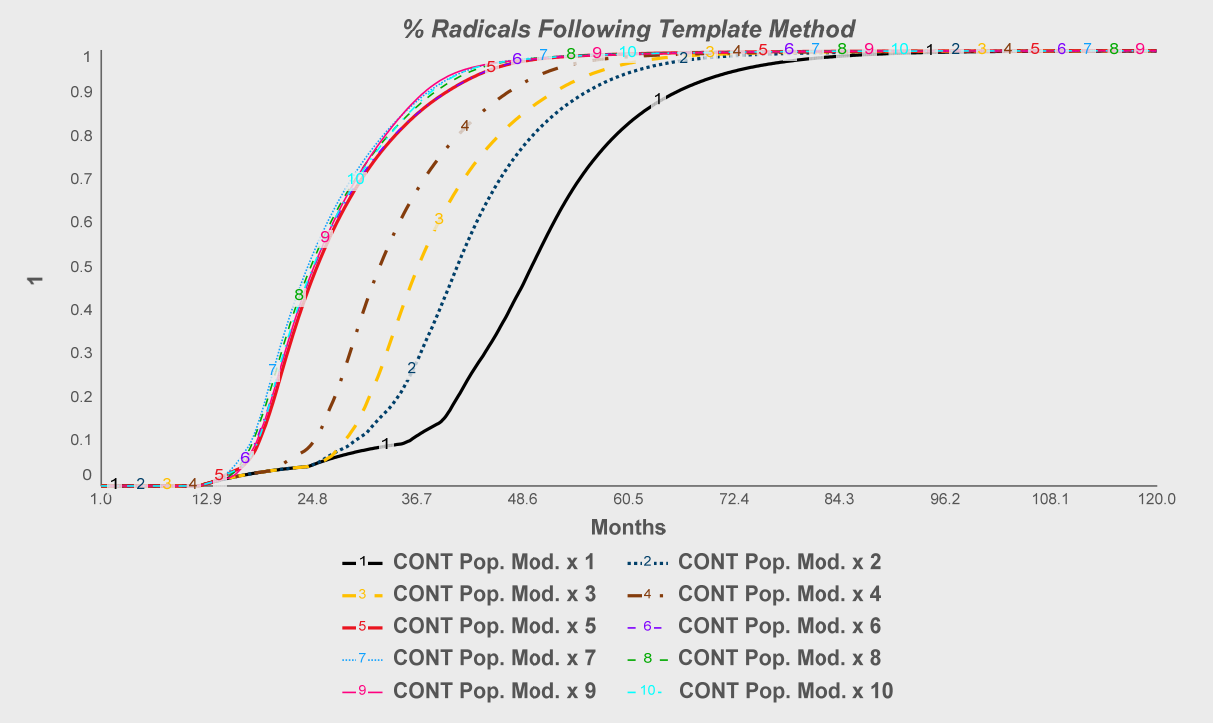
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

POPULATION MODIFIER			
Run	***Total Attempted Incidents***	***Failed Incidents***	***Total Contagion Incidents***
CONT Pop. Mod x .1: Model Testing Structure.ZCB Att Incidents Total	59	57.5	0
CONT Pop. Mod x .2: Model Testing Structure.ZCB Att Incidents Total	119	101.9	1
CONT Pop. Mod x .3: Model Testing Structure.ZCB Att Incidents Total	178	121.1	1
CONT Pop. Mod x .4: Model Testing Structure.ZCB Att Incidents Total	247	145.6	37
CONT Pop. Mod x .5: Model Testing Structure.ZCB Att Incidents Total	318	186.6	60
CONT Pop. Mod x .6: Model Testing Structure.ZCB Att Incidents Total	386	225.9	72
CONT Pop. Mod x .7: Model Testing Structure.ZCB Att Incidents Total	487	237.3	153
CONT Pop. Mod x .8: Model Testing Structure.ZCB Att Incidents Total	551	281	161
CONT Pop. Mod x .9: Model Testing Structure.ZCB Att Incidents Total	641	305.2	202
CONT Pop. Mod x 1: Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT Pop. Mod. x 1: Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT Pop. Mod. x 2: Model Testing Structure.ZCB Att Incidents Total	1540	665.1	695
CONT Pop. Mod. x 3: Model Testing Structure.ZCB Att Incidents Total	2331	910.5	1084
CONT Pop. Mod. x 4: Model Testing Structure.ZCB Att Incidents Total	3123	1161.1	1581
CONT Pop. Mod. x 5: Model Testing Structure.ZCB Att Incidents Total	3914	1324.1	2080
CONT Pop. Mod. x 6: Model Testing Structure.ZCB Att Incidents Total	4707	1611.8	2482
CONT Pop. Mod. x 7: Model Testing Structure.ZCB Att Incidents Total	5501	1838.8	3003
CONT Pop. Mod. x 8: Model Testing Structure.ZCB Att Incidents Total	6295	2133.7	3386

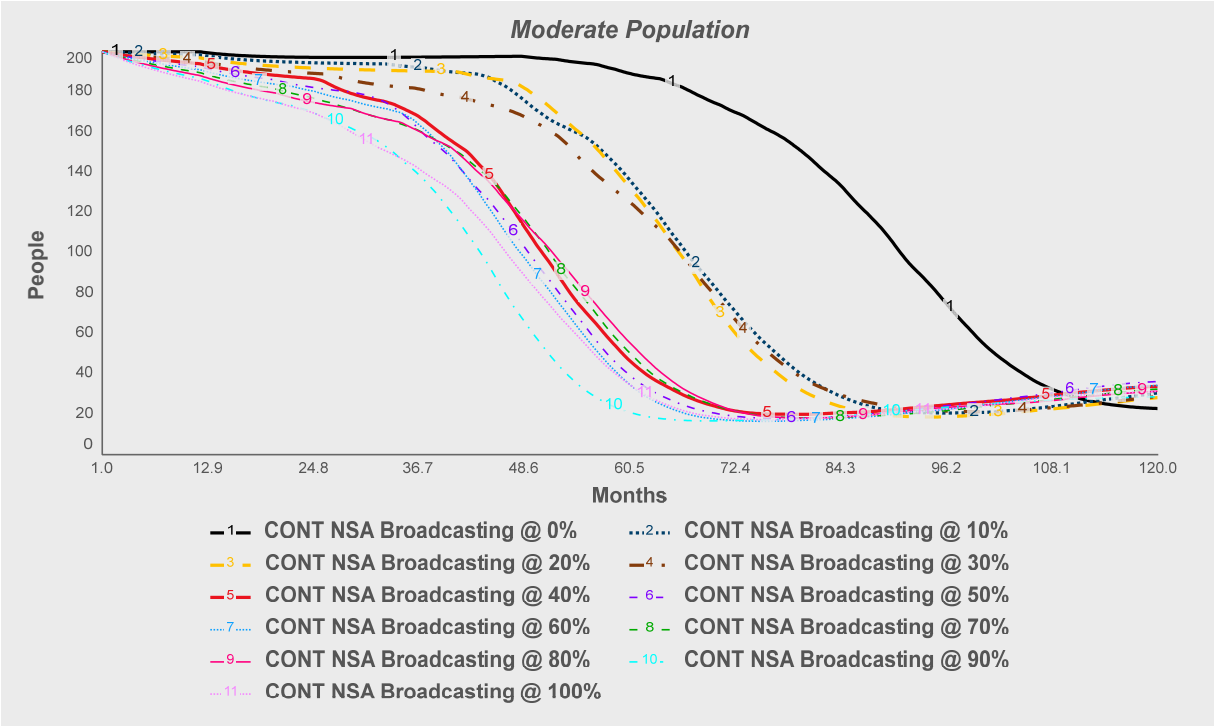
CONT Pop. Mod. x 9: Model Testing Structure.ZCB Att Incidents Total	7091	2387.8	3947
CONT Pop. Mod. x 10: Model Testing Structure.ZCB Att Incidents Total	7893	2654.5	4364

Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

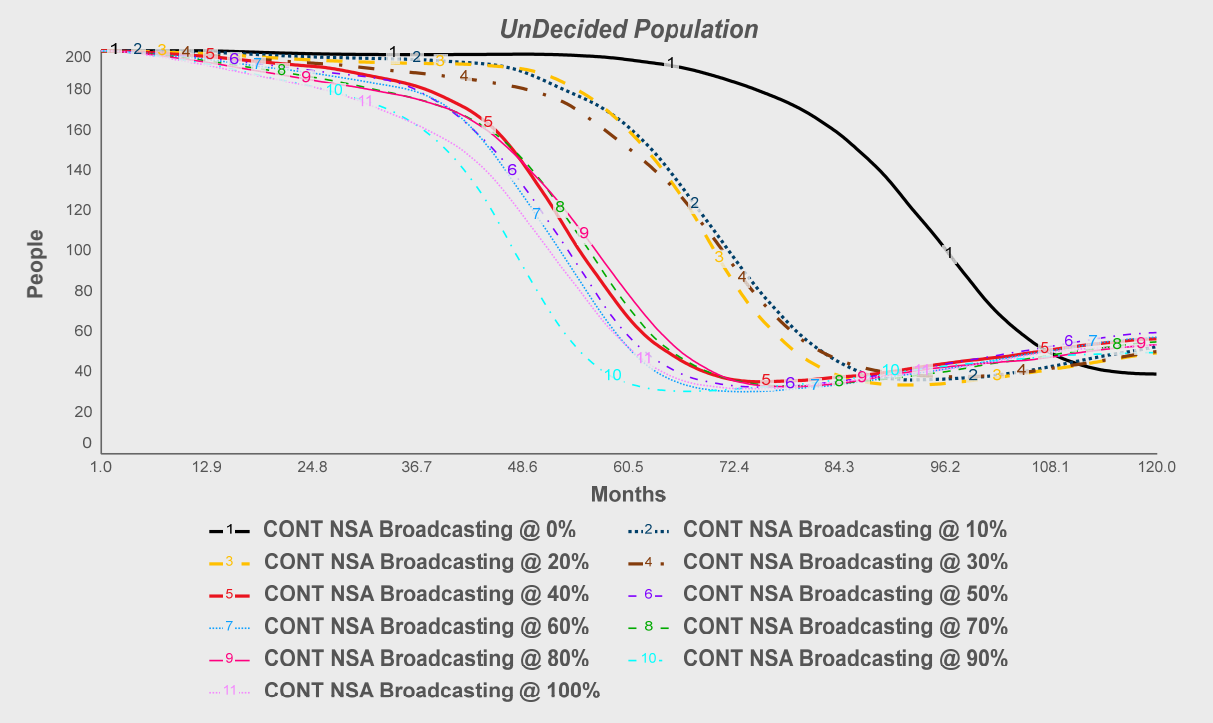
D-4 PROPOSITION ANALYSIS LEVEL 4: SYSTEM OF SPACES

D-4.1A Proposition #8A: Non-State Actor Broadcasting Cultural Scripts from Safe Haven

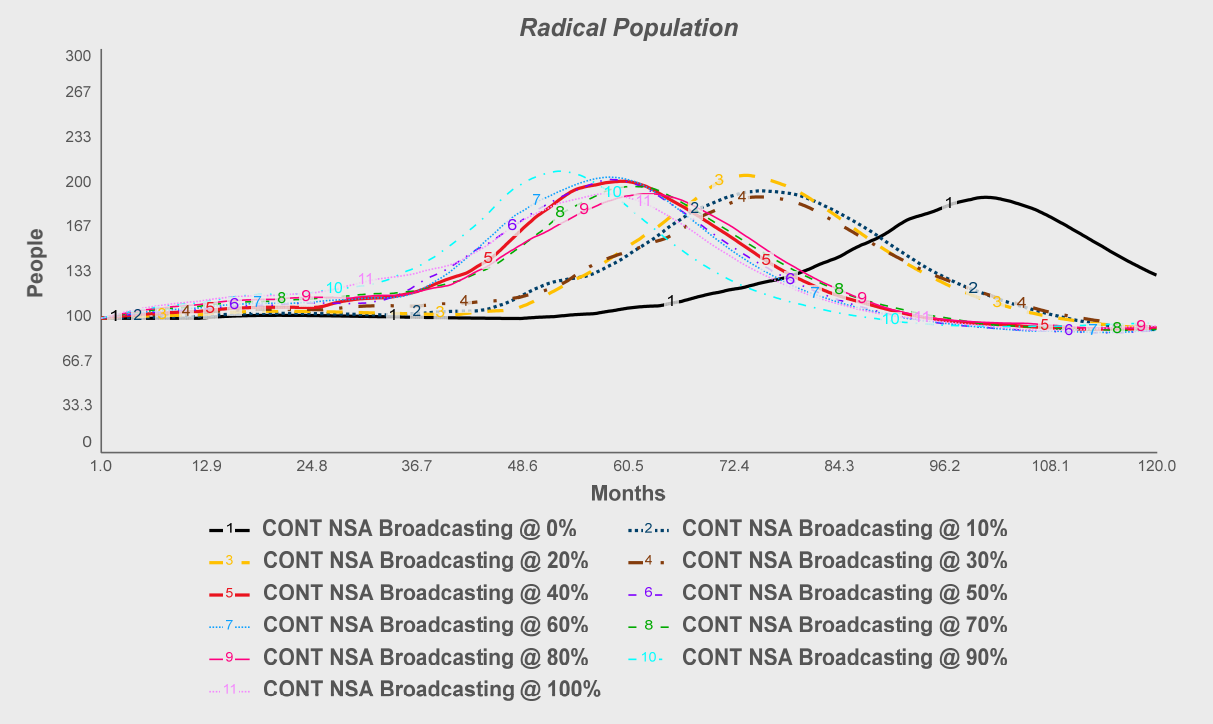
Moderate Population



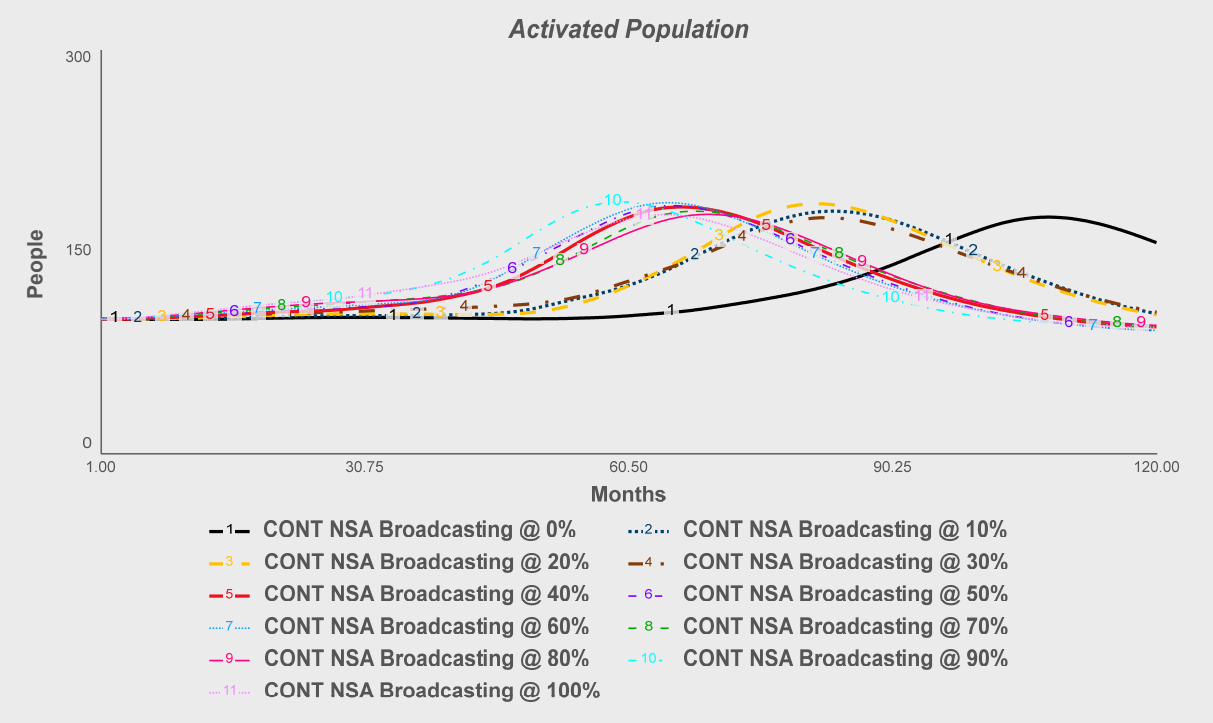
Undecided Population



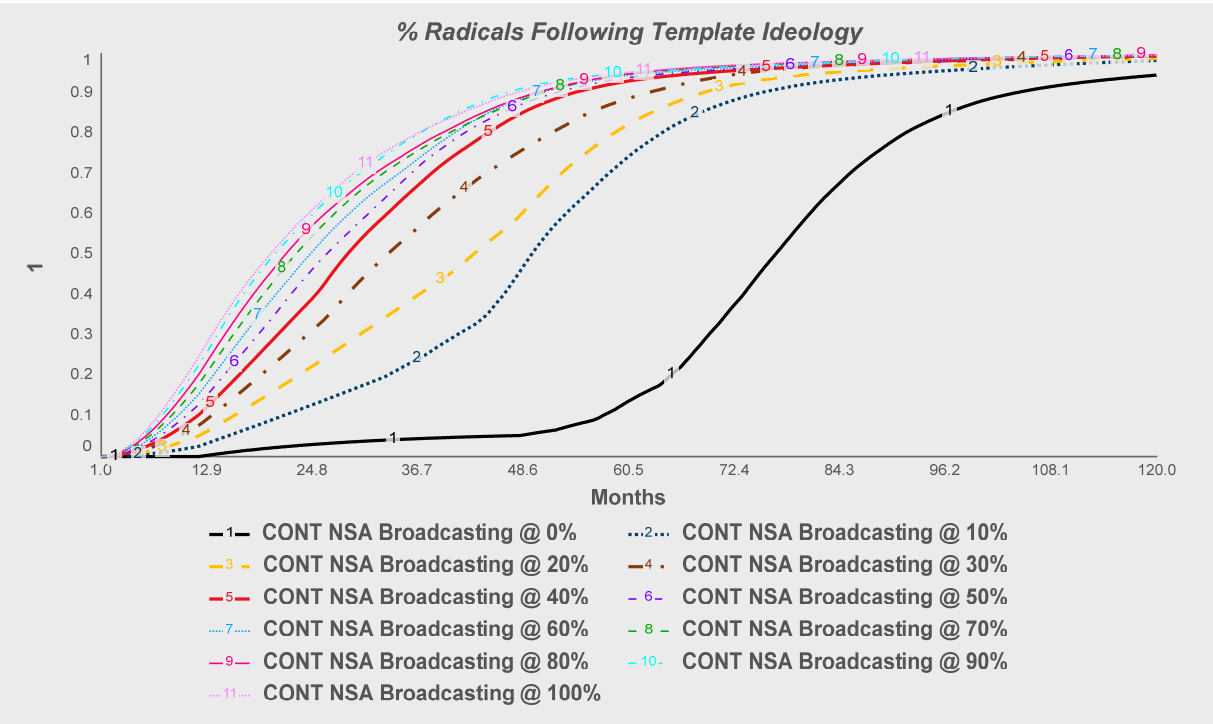
Radical Population



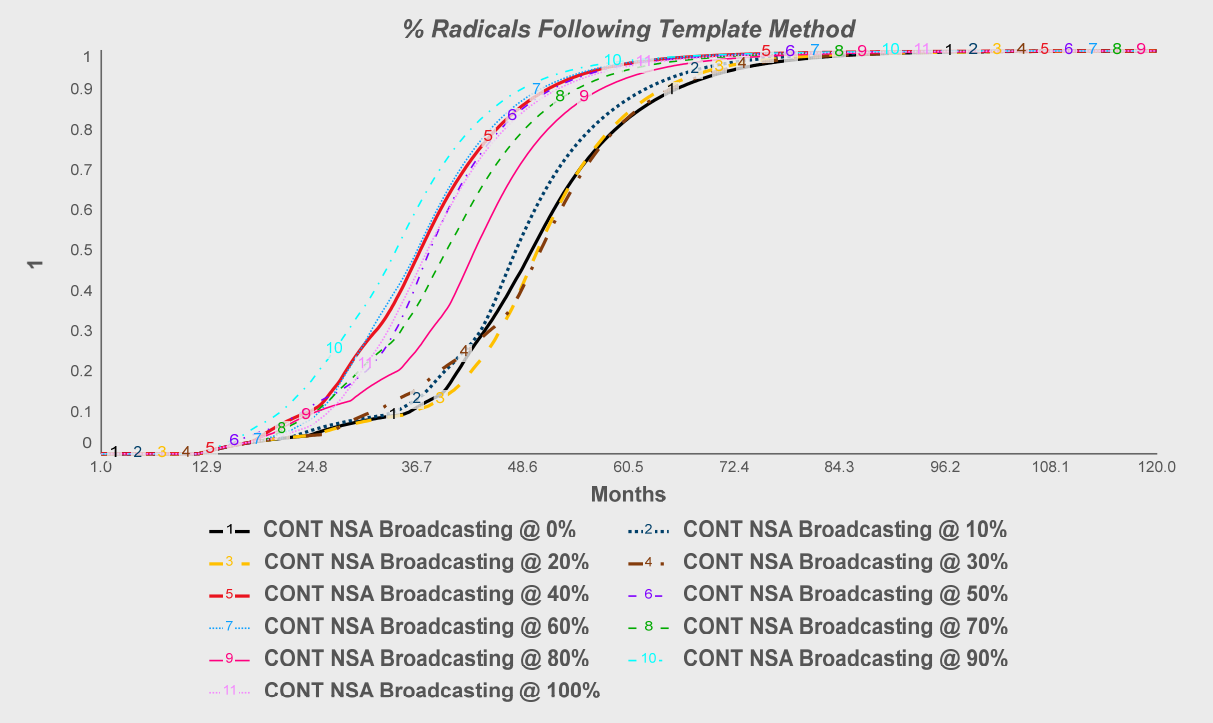
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

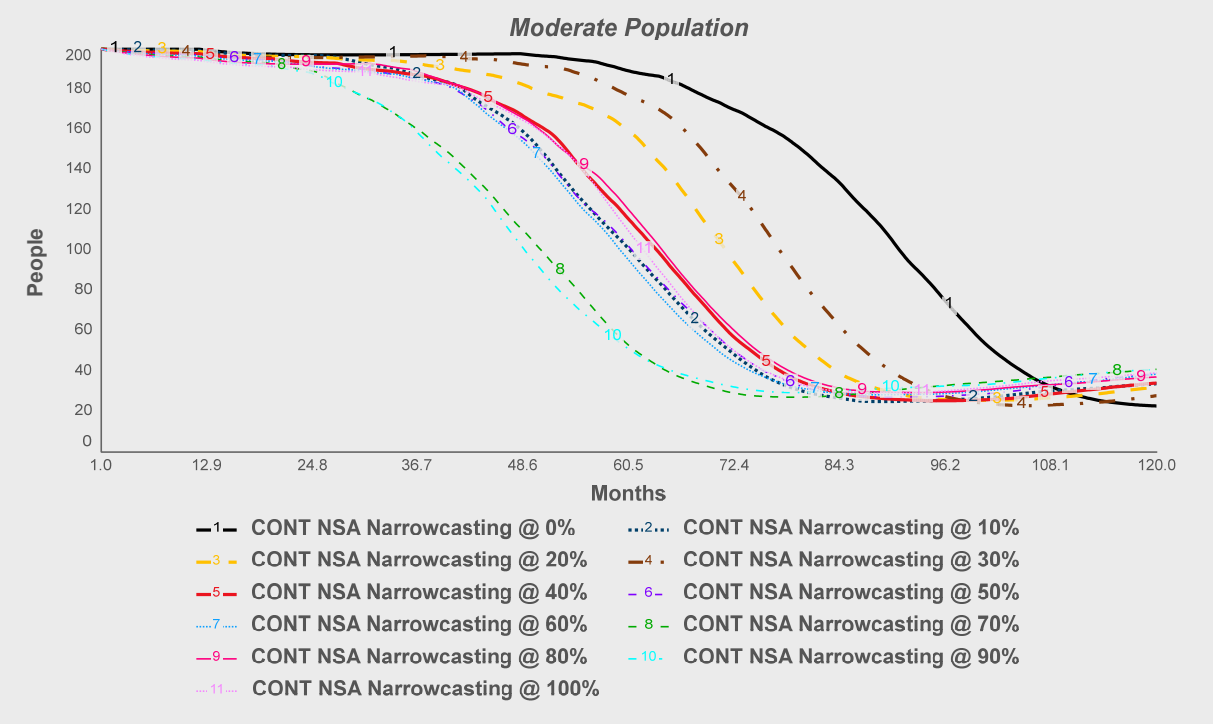
Proposition Safe Haven Broadcasting			
Run	***Total Attempted Incidents***	***Failed Incidents***	***Total Contagion Incidents***
CONT NSA Broadcasting @ 0%: Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT NSA Broadcasting @ 10% : Model Testing Structure.ZCB Att Incidents Total	755	350.6	346
CONT NSA Broadcasting @ 20%: Model Testing Structure.ZCB Att Incidents Total	757	344.3	369
CONT NSA Broadcasting @ 30%: Model Testing Structure.ZCB Att Incidents Total	755	391.2	339
CONT NSA Broadcasting @ 40%: Model Testing Structure.ZCB Att Incidents Total	755	317.1	401
CONT NSA Broadcasting @ 50%: Model Testing Structure.ZCB Att Incidents Total	755	313.8	405
CONT NSA Broadcasting @ 60%: Model Testing Structure.ZCB Att Incidents Total	757	294	427
CONT NSA Broadcasting @ 70%: Model Testing Structure.ZCB Att Incidents Total	757	340.6	391
CONT NSA Broadcasting @ 80%: Model Testing Structure.ZCB Att Incidents Total	757	361.9	377

CONT NSA Broadcasting @ 90%: Model Testing Structure.ZCB Att Incidents Total	759	284.5	452
CONT NSA Broadcasting @ 100%: Model Testing Structure.ZCB Att Incidents Total	758	339	396

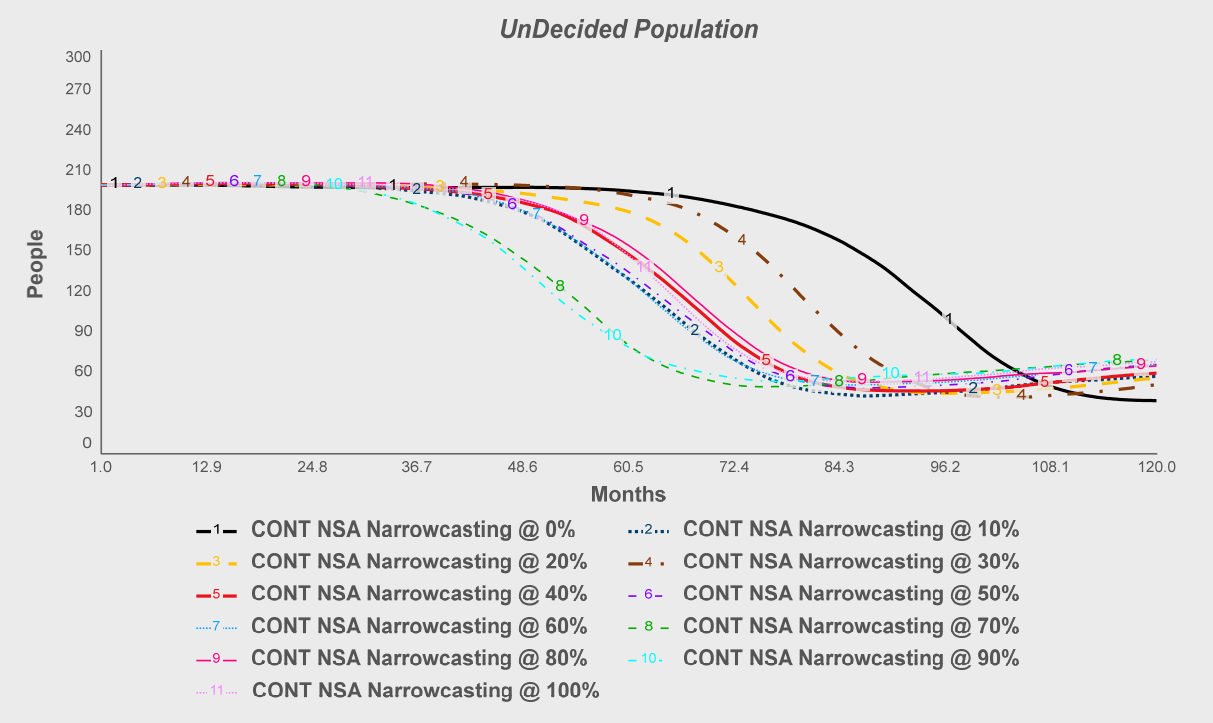
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-4.1B Proposition #8B: Non-State Actor Narrowcasting Cultural Scripts from Safe Haven

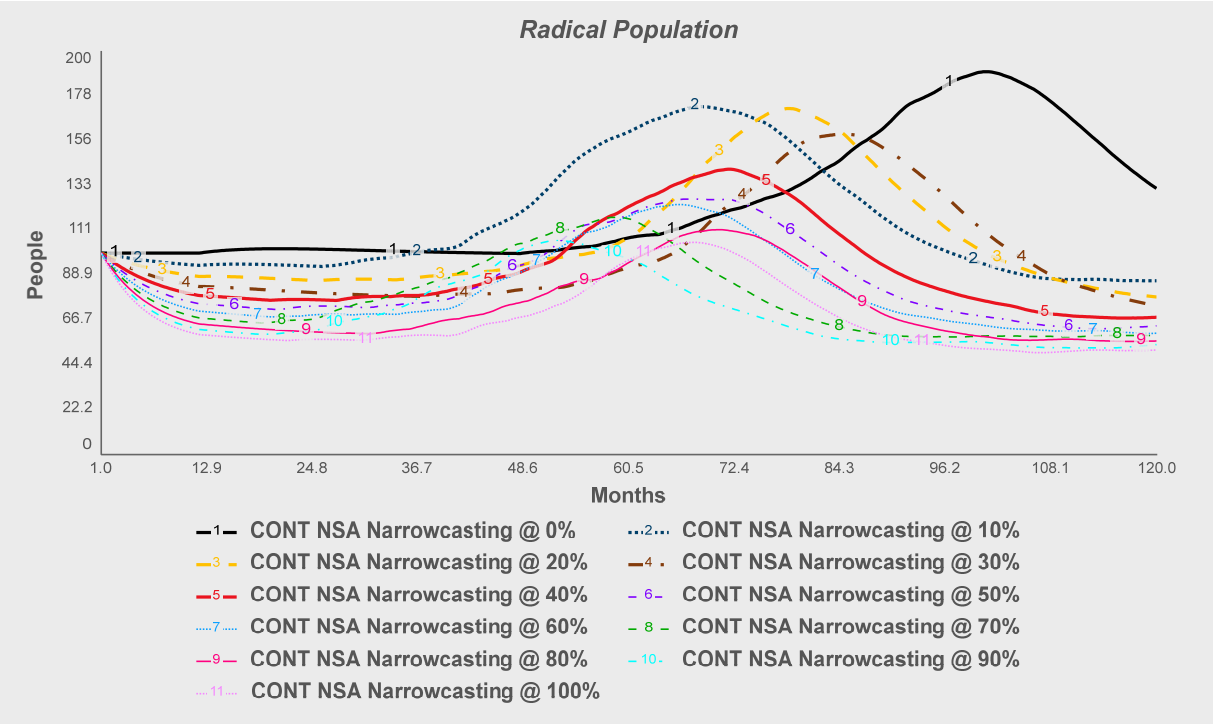
Moderate Population



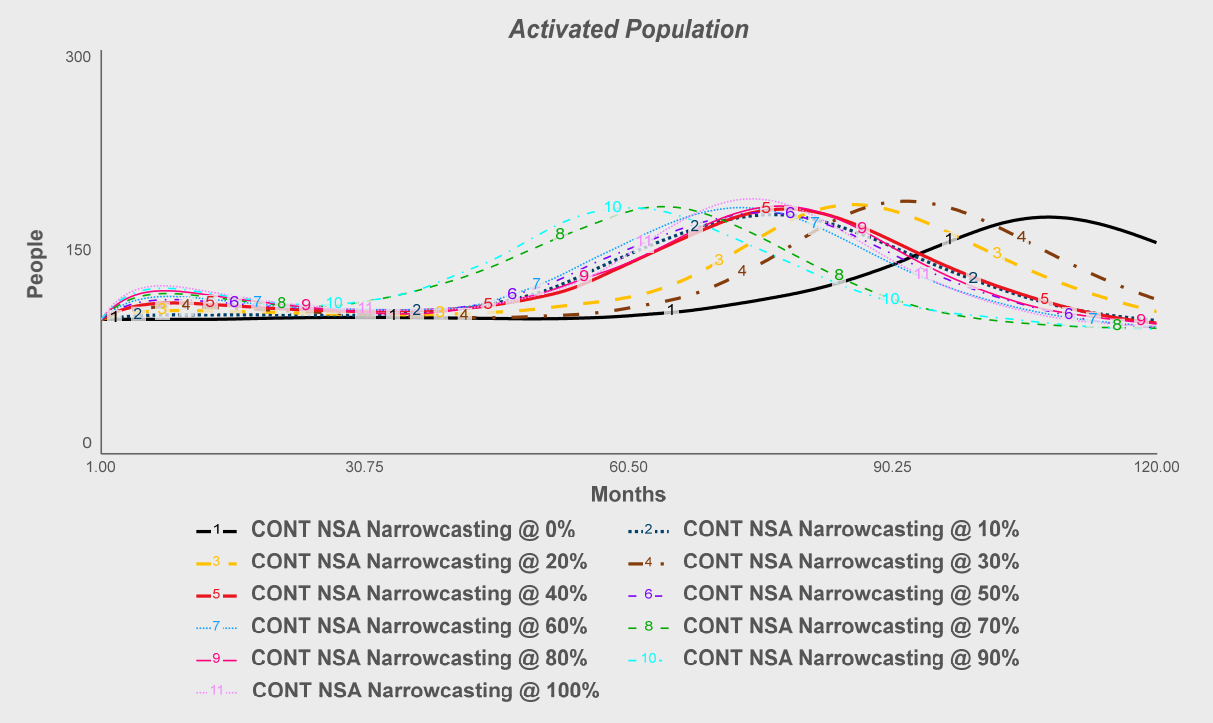
Undecided Population



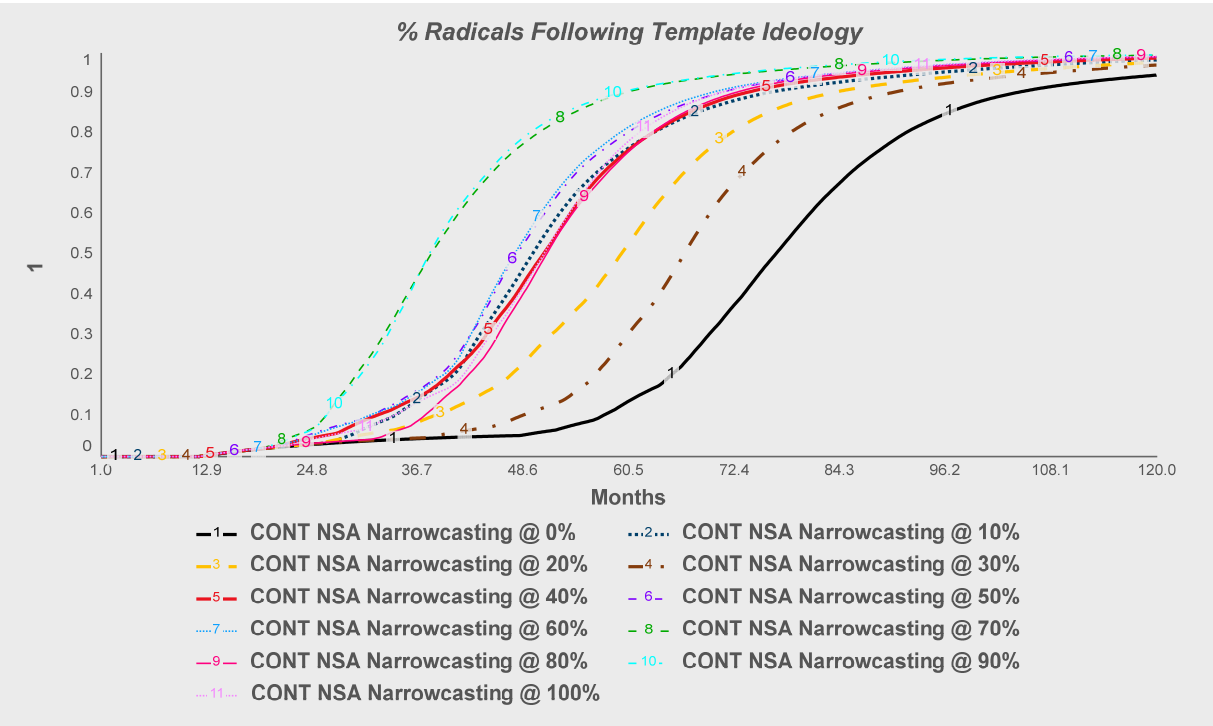
Radical Population



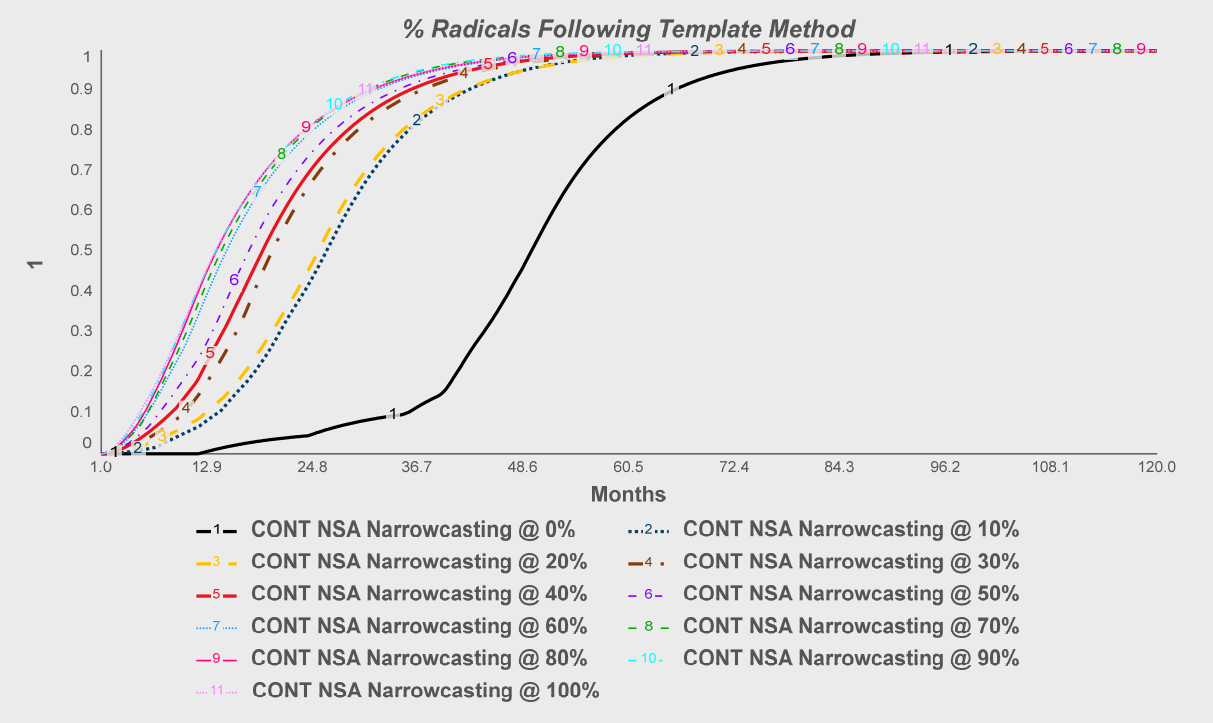
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

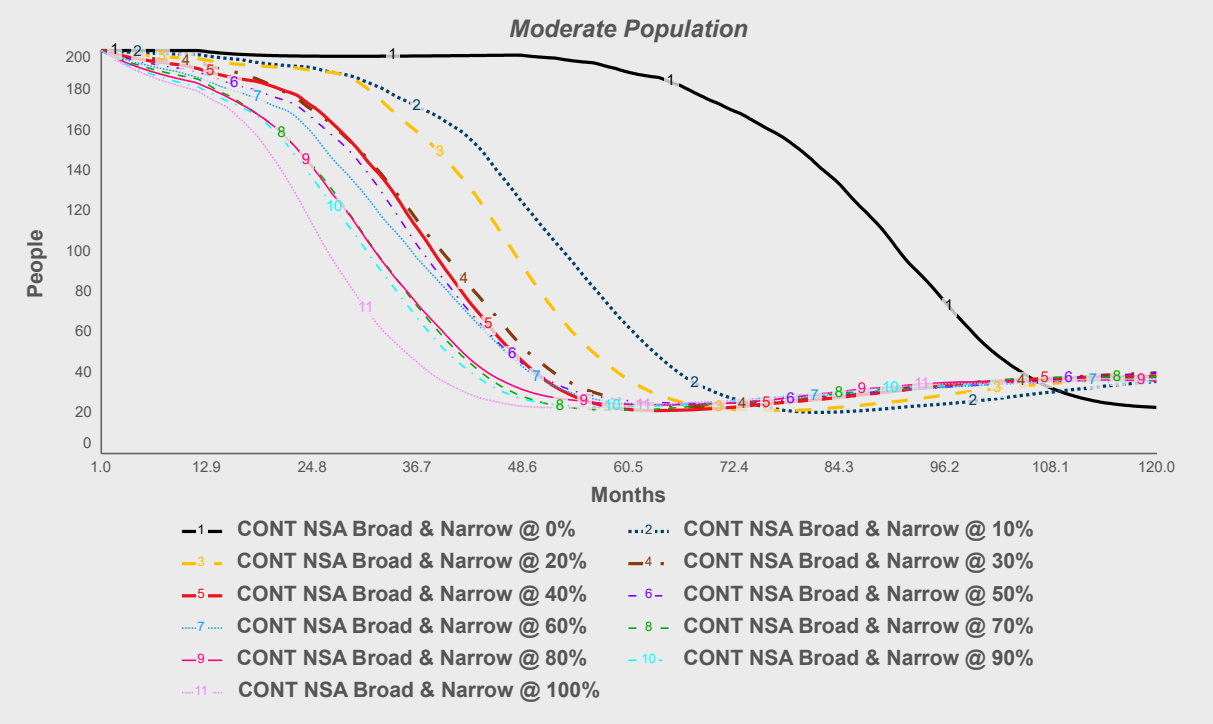
Proposition Narrowcasting			
Run	***Total Attempted Incidents***	***Failed Incidents***	***Total Contagion Incidents***
CONT NSA Narrowcasting @ 0%: Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT NSA Narrowcasting @ 10%: Model Testing Structure.ZCB Att Incidents Total	756	259.6	368
CONT NSA Narrowcasting @ 20%: Model Testing Structure.ZCB Att Incidents Total	758	277.7	327
CONT NSA Narrowcasting @ 30%: Model Testing Structure.ZCB Att Incidents Total	760	233	326
CONT NSA Narrowcasting @ 40%: Model Testing Structure.ZCB Att Incidents Total	765	226.6	385
CONT NSA Narrowcasting @ 50%: Model Testing Structure.ZCB Att Incidents Total	763	248.6	374
CONT NSA Narrowcasting @ 60%: Model Testing Structure.ZCB Att Incidents Total	764	247	379
CONT NSA Narrowcasting @ 70%: Model Testing Structure.ZCB Att Incidents Total	763	223.5	420
CONT NSA Narrowcasting @ 80%: Model Testing Structure.ZCB Att Incidents Total	766	240	362

CONT NSA Narrowcasting @ 90%: Model Testing Structure.ZCB Att Incidents Total	765	228.1	424
CONT NSA Narrowcasting @ 100%: Model Testing Structure.ZCB Att Incidents Total	767	225.5	368

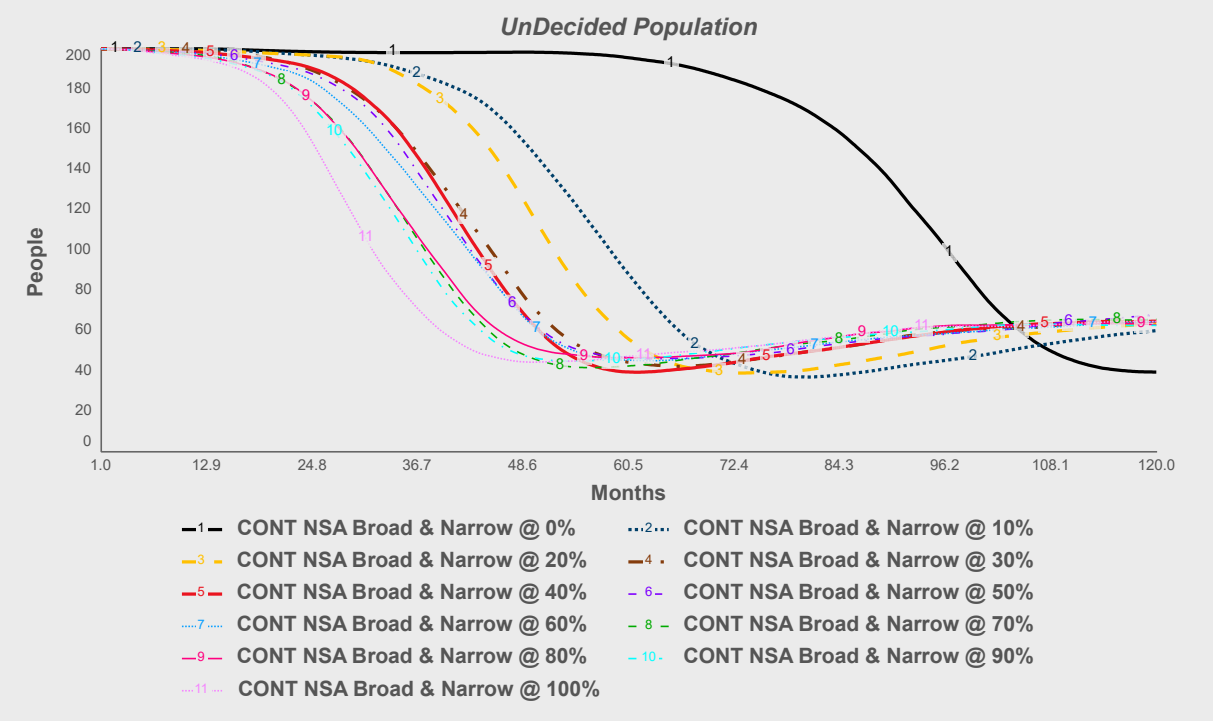
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-4.1C Proposition #8C: Non-State Actor Broadcasting & Narrowcasting Cultural Scripts from Safe Haven on CONT Run

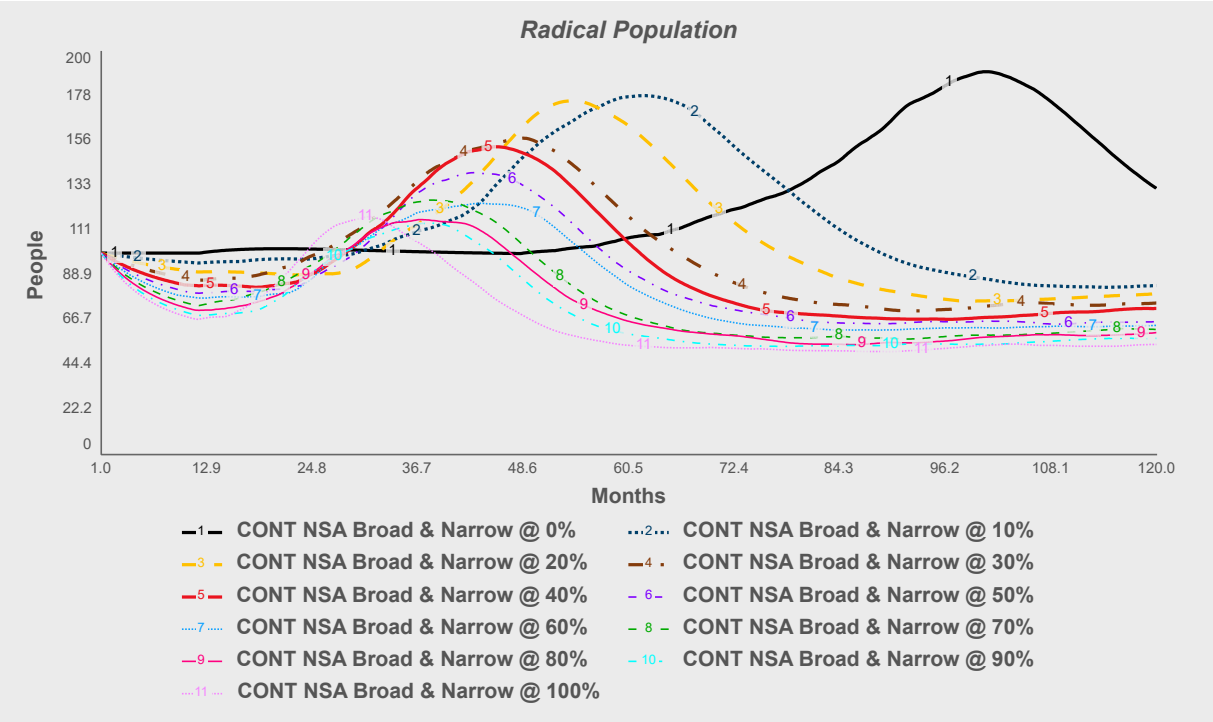
Moderate Population



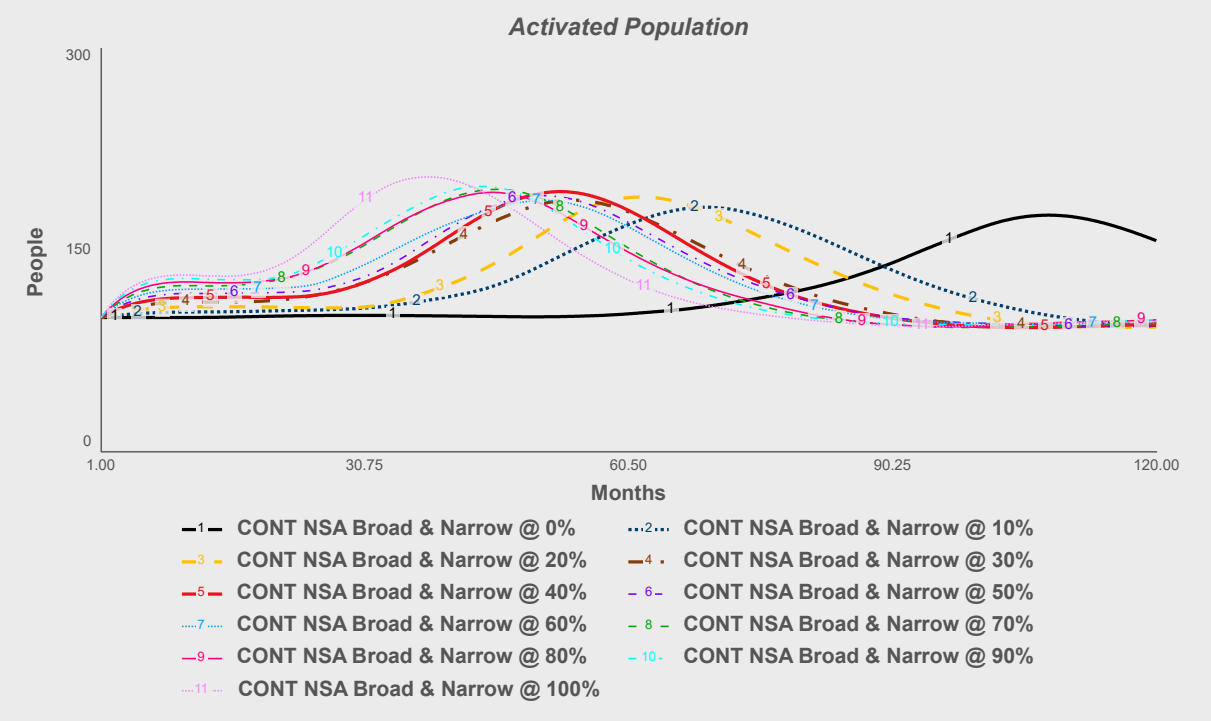
Undecided Population



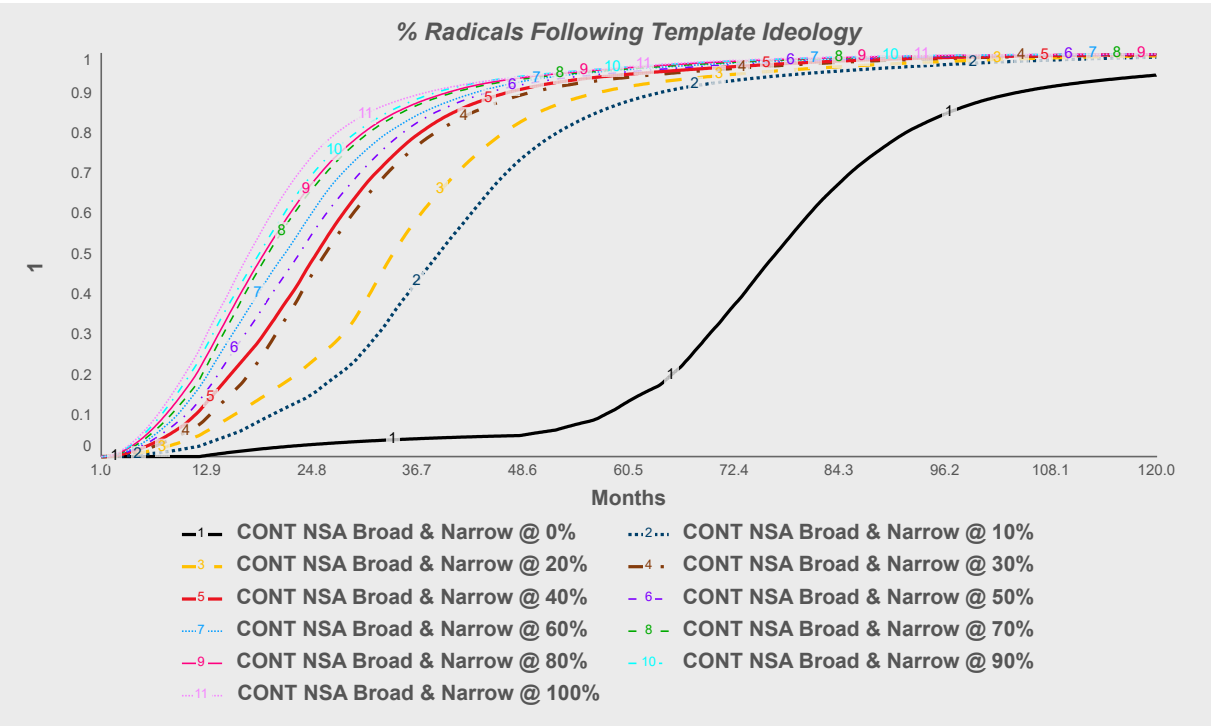
Radical Population



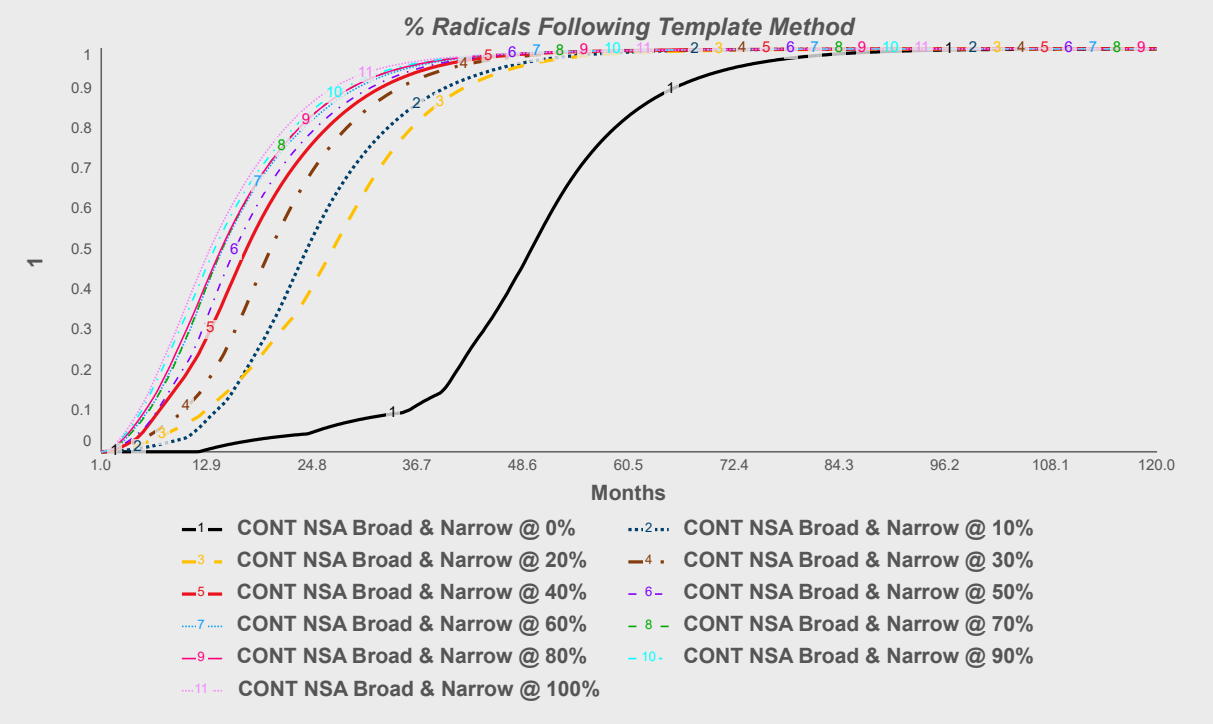
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

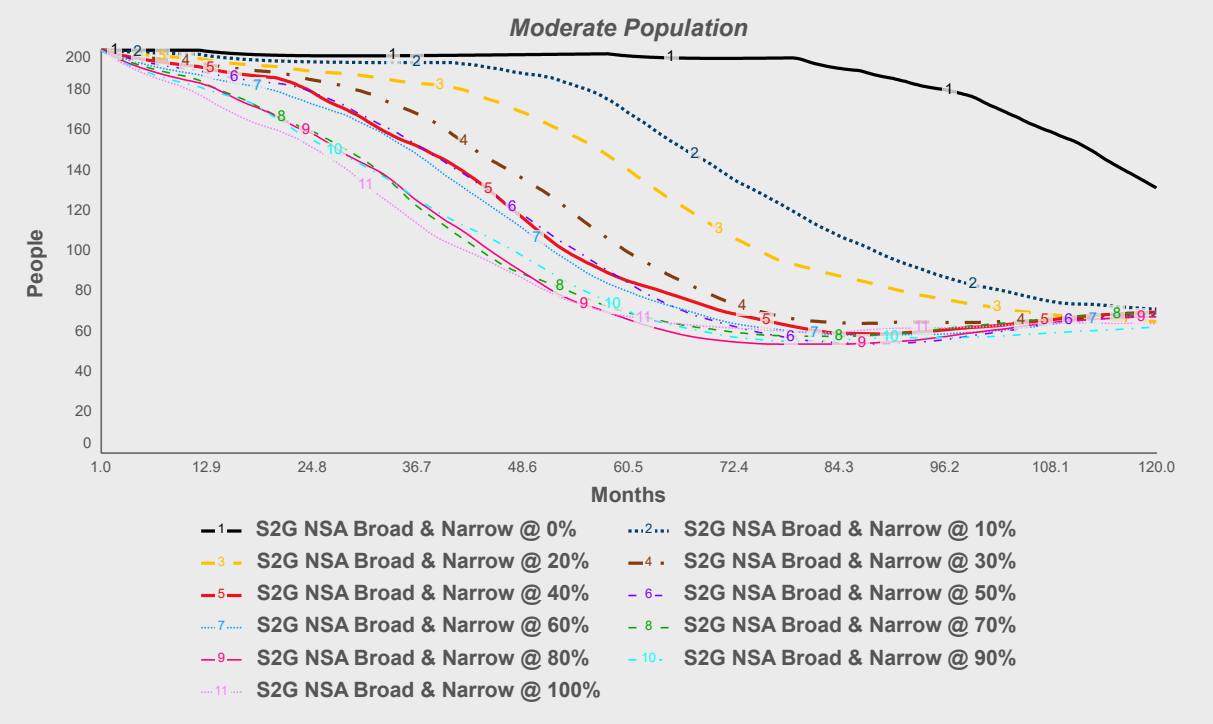
Proposition Both Broad & Narrow Casting			
Run	***Total Attempted Incidents***	***Failed Incidents***	***Total Contagion Incidents***
CONT NSA Broad & Narrow @ 0%: Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT NSA Broad & Narrow @ 10%: Model Testing Structure.ZCB Att Incidents Total	758	252.2	418
CONT NSA Broad & Narrow @ 20%: Model Testing Structure.ZCB Att Incidents Total	757	260.5	434
CONT NSA Broad & Narrow @ 30%: Model Testing Structure.ZCB Att Incidents Total	756	265.5	443
CONT NSA Broad & Narrow @ 40%: Model Testing Structure.ZCB Att Incidents Total	759	236.1	467
CONT NSA Broad & Narrow @ 50%: Model Testing Structure.ZCB Att Incidents Total	761	243.2	446
CONT NSA Broad & Narrow @ 60%: Model Testing Structure.ZCB Att Incidents Total	764	240.5	458
CONT NSA Broad & Narrow @ 70%: Model Testing Structure.ZCB Att Incidents Total	763	220.3	483
CONT NSA Broad & Narrow @ 80%: Model Testing Structure.ZCB Att Incidents Total	766	246.2	471

CONT NSA Broad & Narrow @ 90%: Model Testing Structure.ZCB Att Incidents Total	767	225.2	479
CONT NSA Broad & Narrow @ 100%: Model Testing Structure.ZCB Att Incidents Total	768	231.1	492

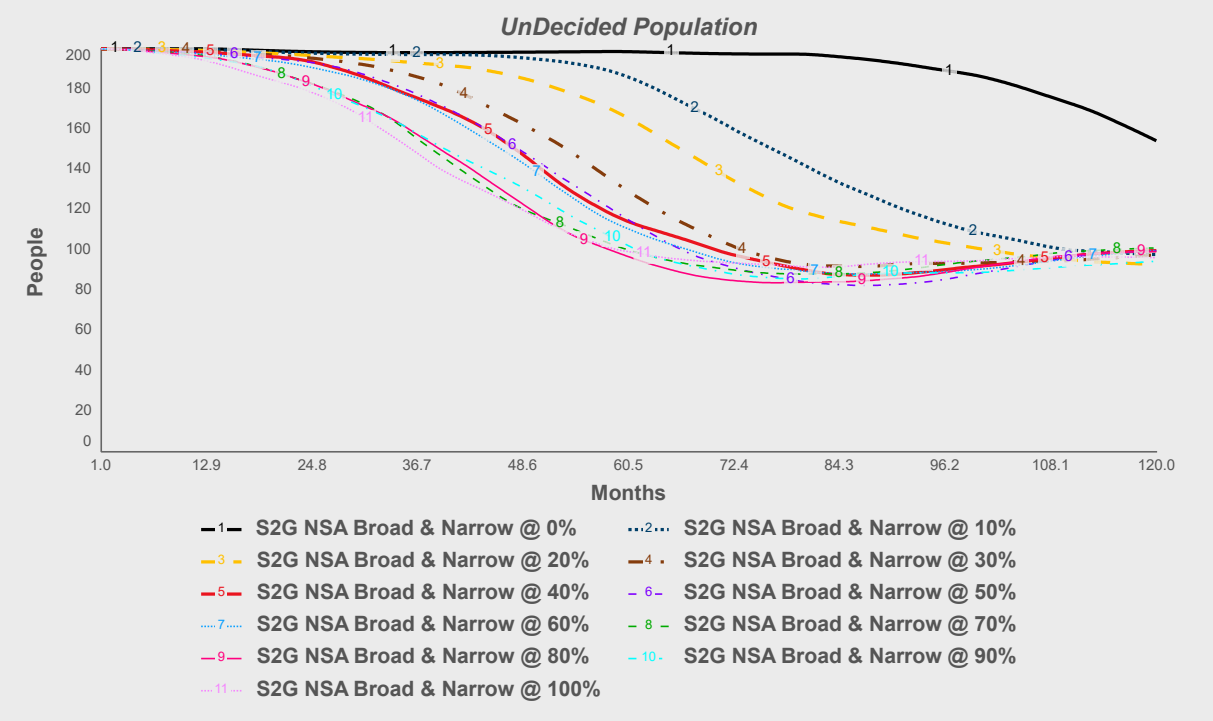
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-4.2 Proposition #8C: Non-State Actor Broadcasting & Narrowcasting Cultural Scripts from Safe Haven

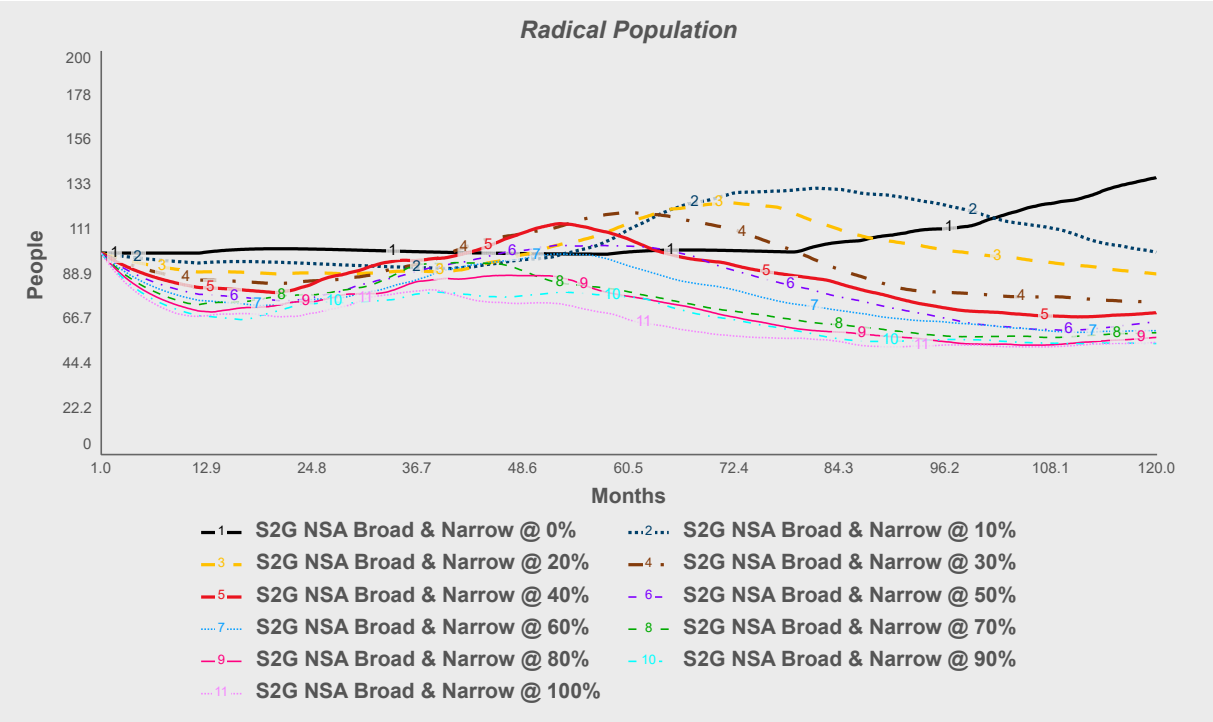
Moderate Population



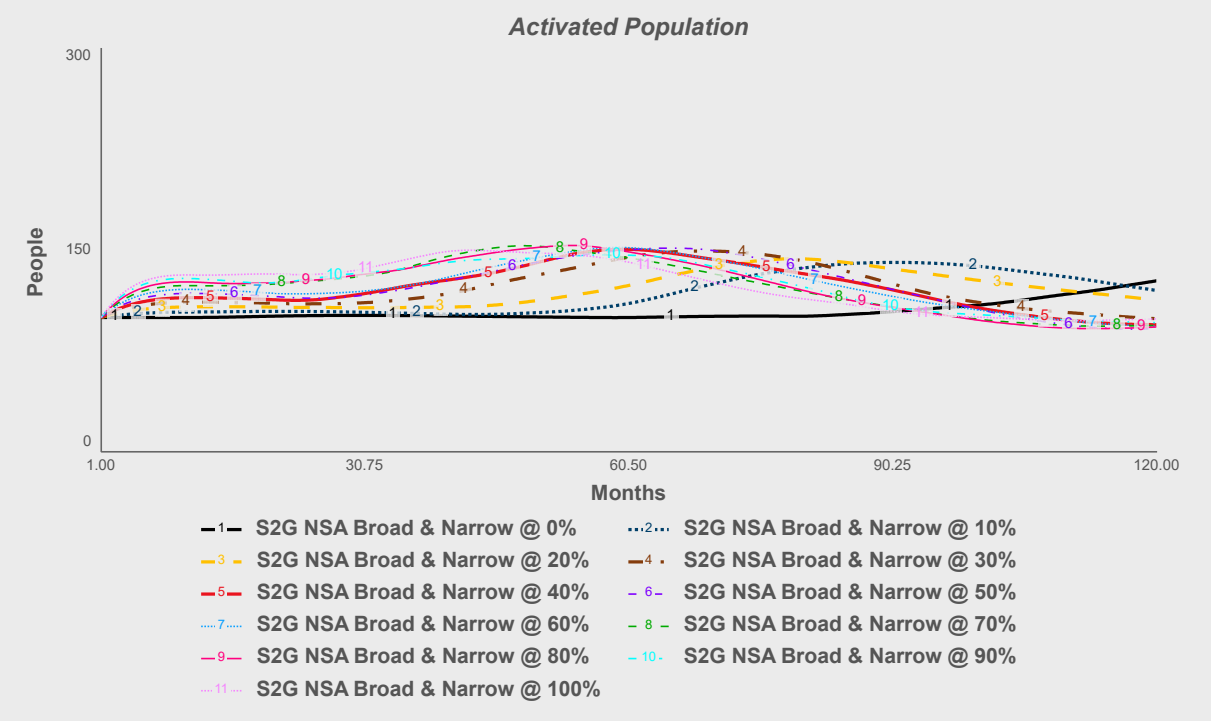
Undecided Population



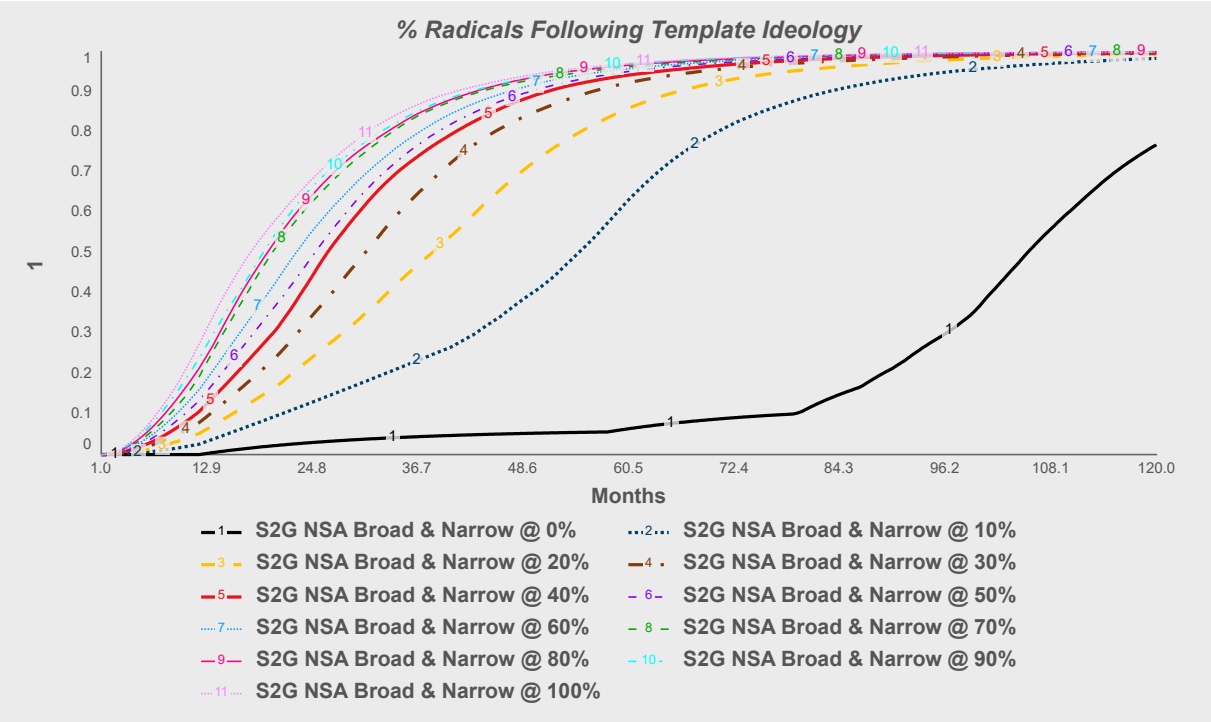
Radical Population



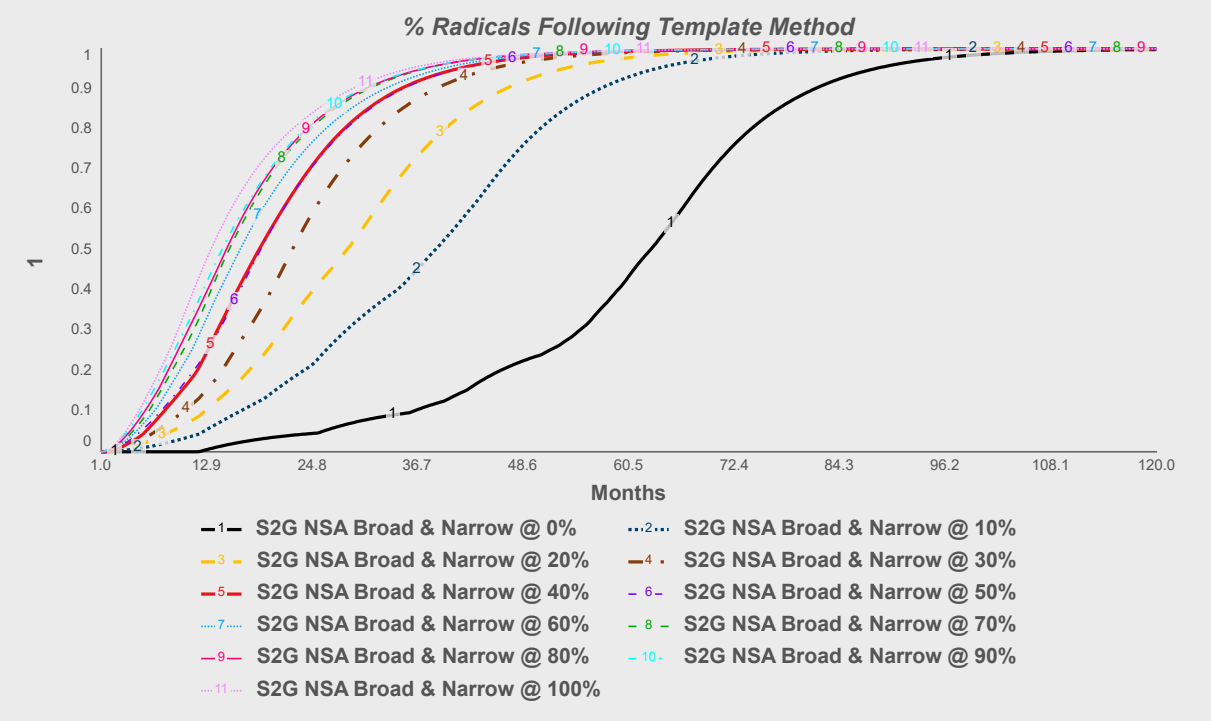
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

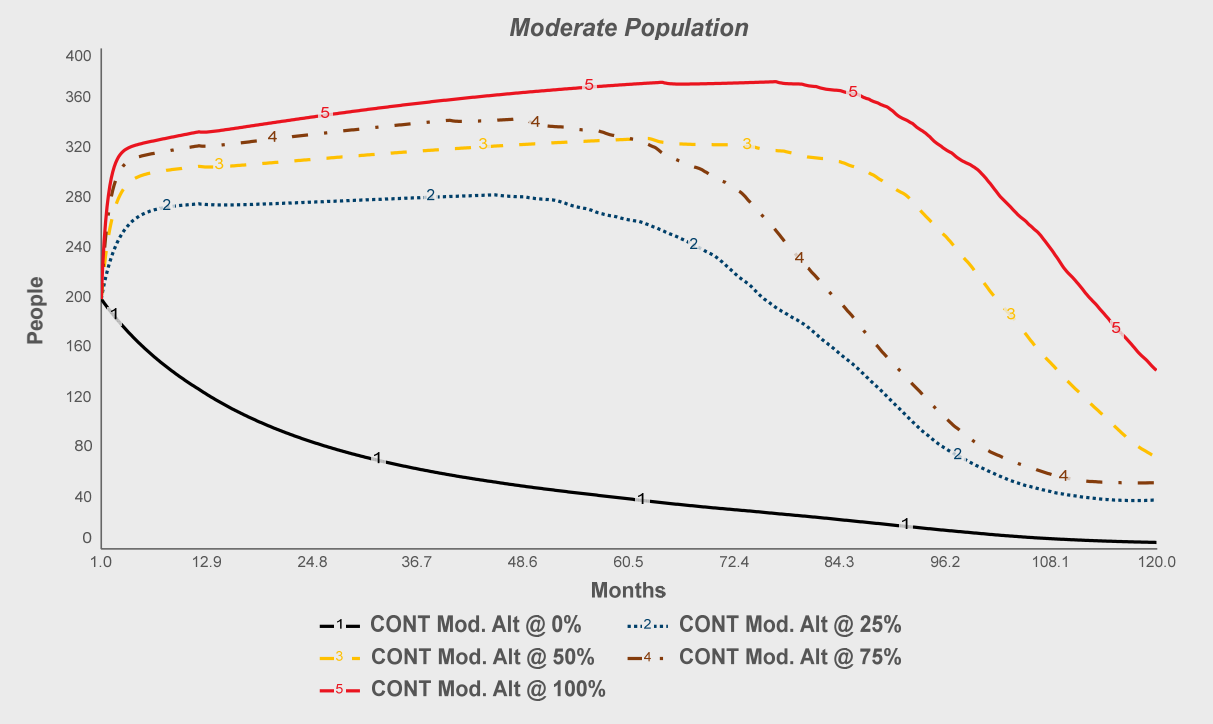
Proposition Both Broad & Narrow Casting on S2G Run			
Run	***Total Attempted Incidents***	***Failed Incidents***	***Total Contagion Incidents***
S2G NSA Broad & Narrow @ 0%: Model Testing Structure.ZCB Att Incidents Total	247	145.6	37
S2G NSA Broad & Narrow @ 10%: Model Testing Structure.ZCB Att Incidents Total	279	123.8	114
S2G NSA Broad & Narrow @ 20%: Model Testing Structure.ZCB Att Incidents Total	285	108.1	141
S2G NSA Broad & Narrow @ 30%: Model Testing Structure.ZCB Att Incidents Total	289	93.8	167
S2G NSA Broad & Narrow @ 40%: Model Testing Structure.ZCB Att Incidents Total	291	93.8	178
S2G NSA Broad & Narrow @ 50%: Model Testing Structure.ZCB Att Incidents Total	292	85.3	182
S2G NSA Broad & Narrow @ 60%: Model Testing Structure.ZCB Att Incidents Total	293	99.5	175
S2G NSA Broad & Narrow @ 70%: Model Testing Structure.ZCB Att Incidents Total	292	93.6	182
S2G NSA Broad & Narrow @ 80%: Model Testing Structure.ZCB Att Incidents Total	294	85.4	190

S2G NSA Broad & Narrow @ 90%: Model Testing Structure.ZCB Att Incidents Total	296	96.5	184
S2G NSA Broad & Narrow @ 100%: Model Testing Structure.ZCB Att Incidents Total	294	101.7	174

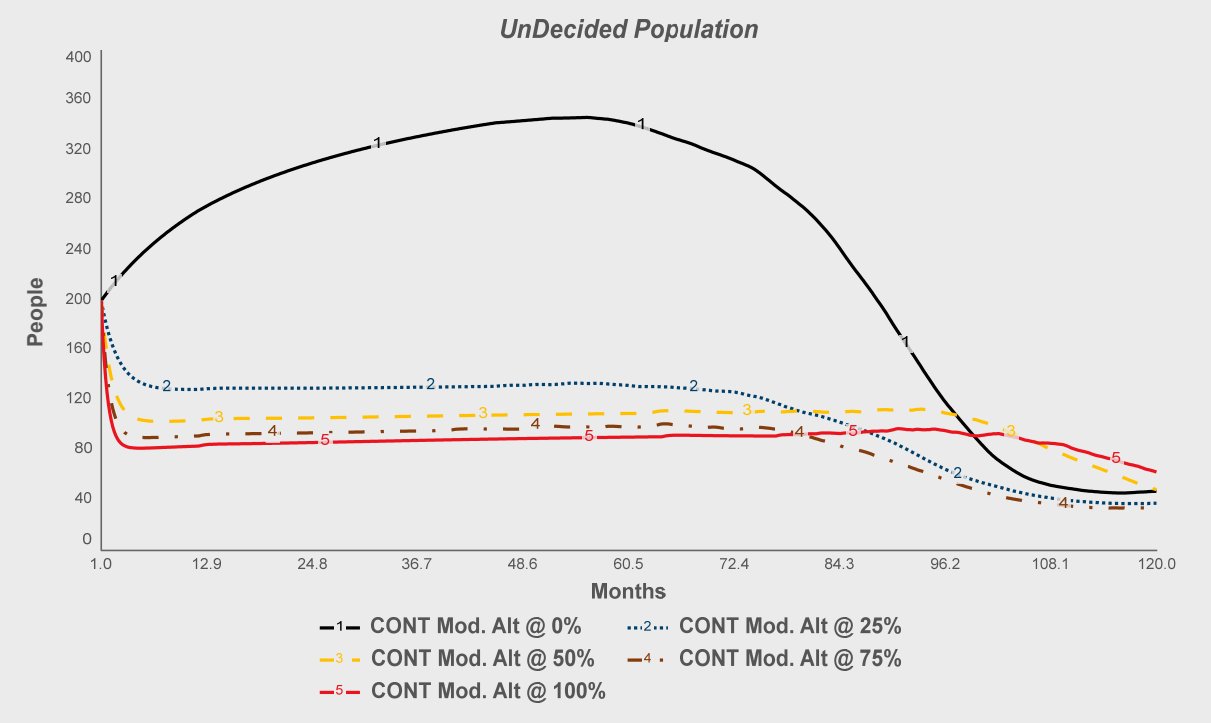
D-5 PROPOSITION ANALYSIS LEVEL 3: NETWORKS & ACTORS

D-5.1 Proposition #10: Moderating Alternatives

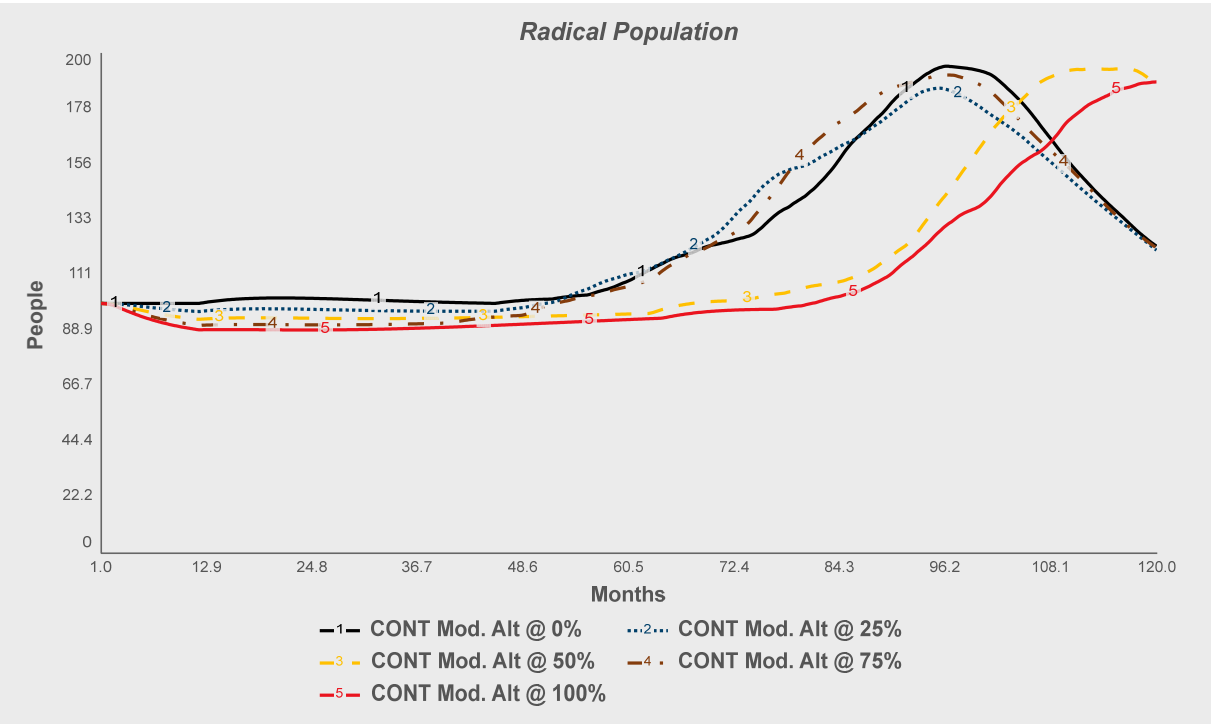
Moderate Population



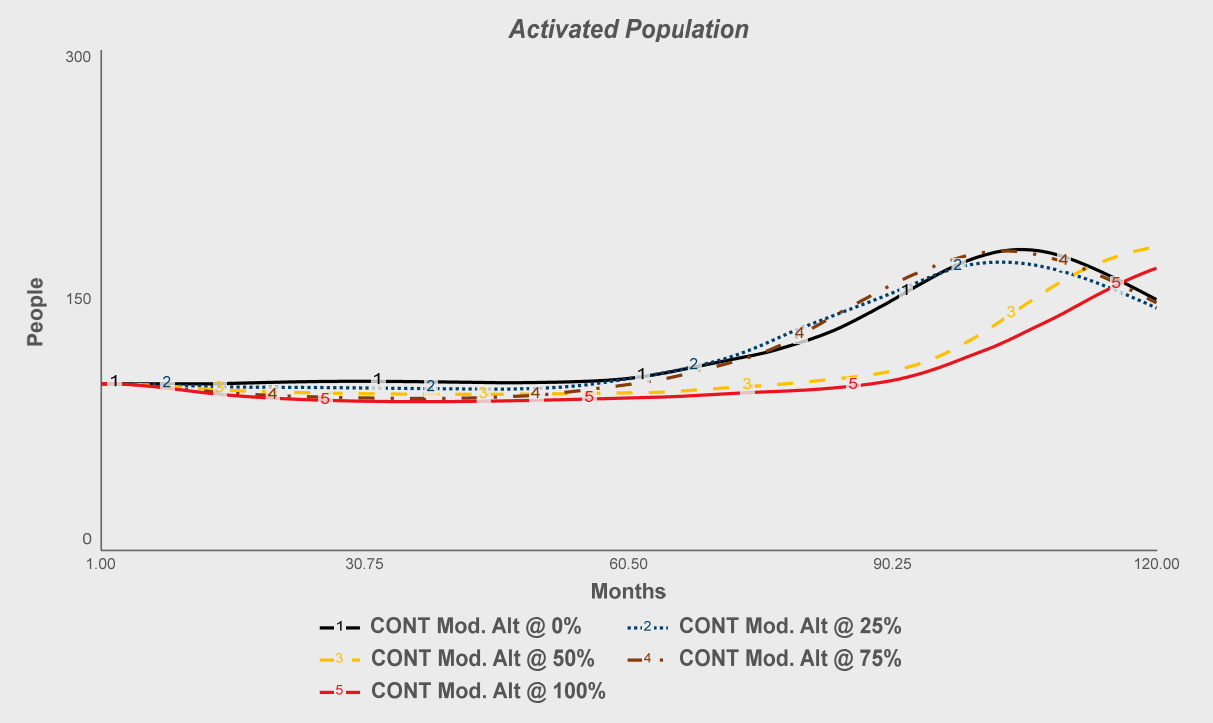
Undecided Population



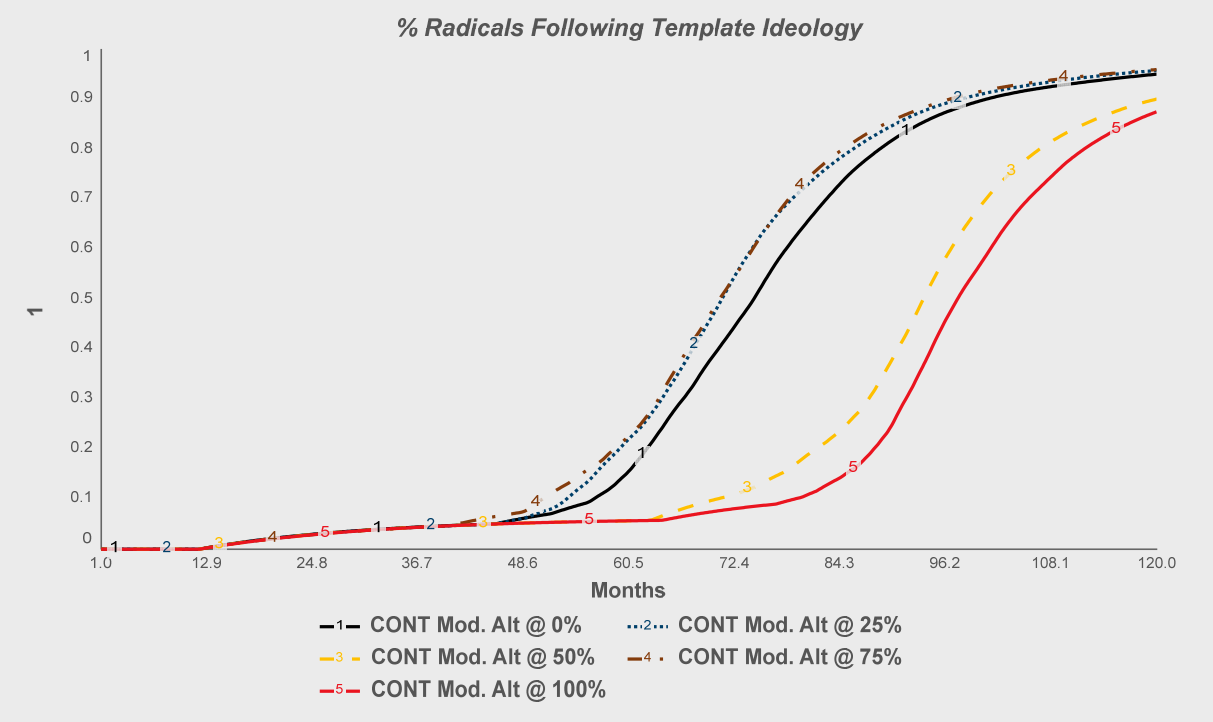
Radical Population



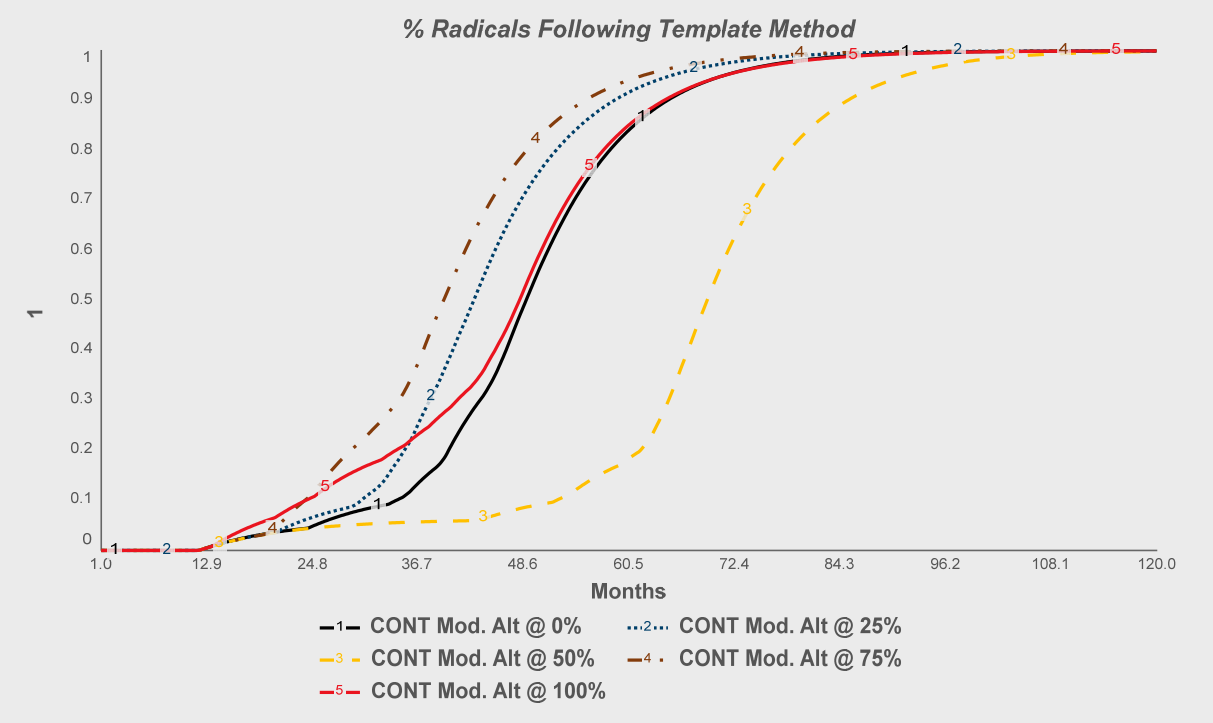
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



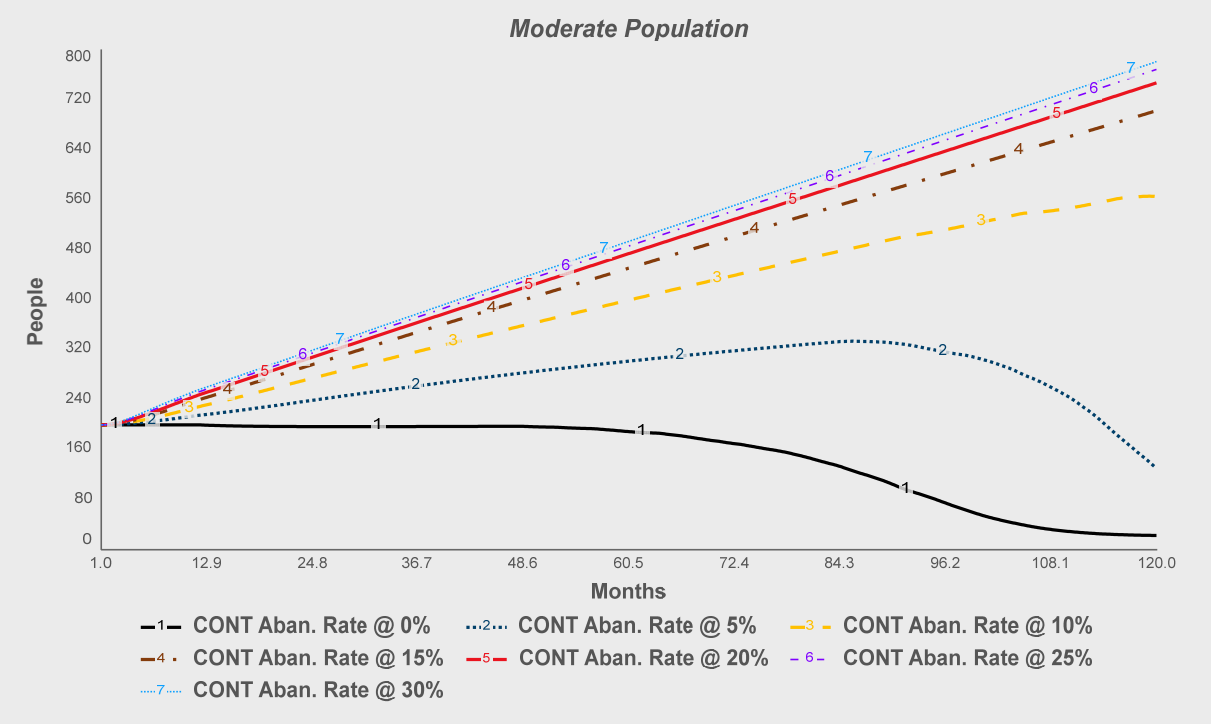
Ending Values

Moderating Alternatives			
Run	***Total Attempted Incidents***	***Failed Incidents***	***Total Contagion Incidents***
CONT Mod. Alt @ 0%: Model Testing Structure.ZCB Att Incidents Total	731	359.1	235
CONT Mod. Alt @ 25%: Model Testing Structure.ZCB Att Incidents Total	722	305.5	257
CONT Mod. Alt @ 50%: Model Testing Structure.ZCB Att Incidents Total	649	391.2	146
CONT Mod. Alt @ 75%: Model Testing Structure.ZCB Att Incidents Total	715	287	272
CONT Mod. Alt @ 100%: Model Testing Structure.ZCB Att Incidents Total	612	302.7	102

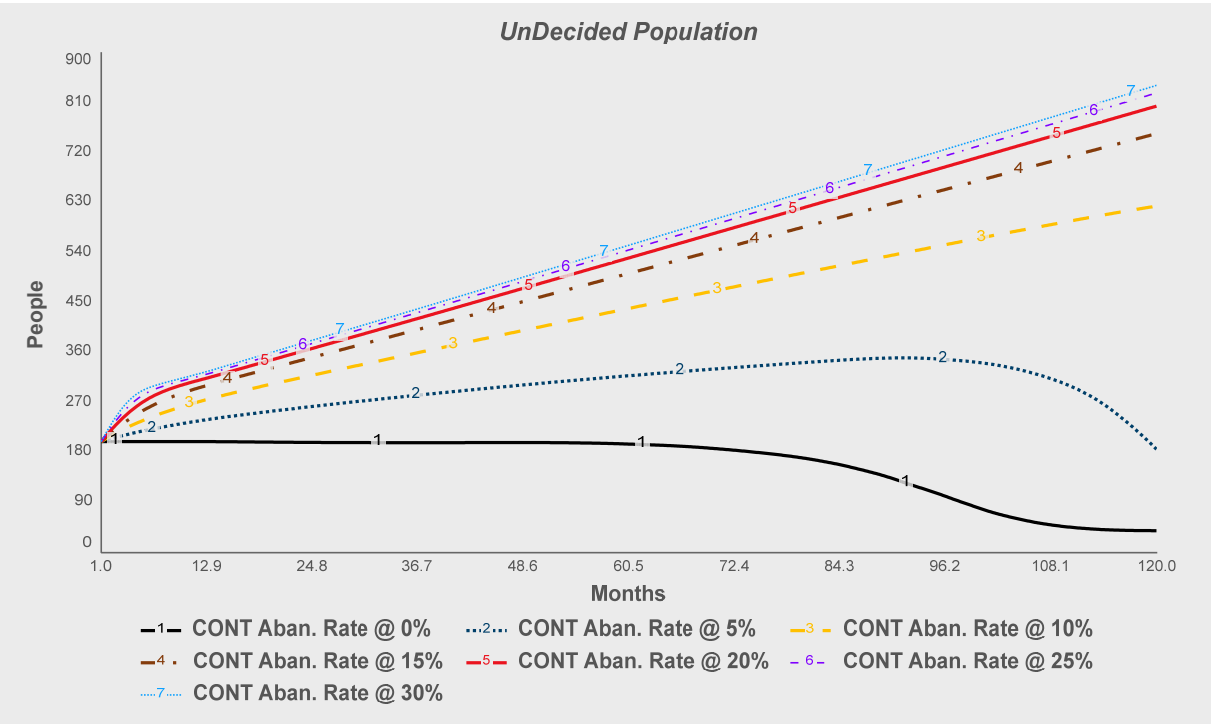
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-5.2 Proposition #11: Abandonment Rate

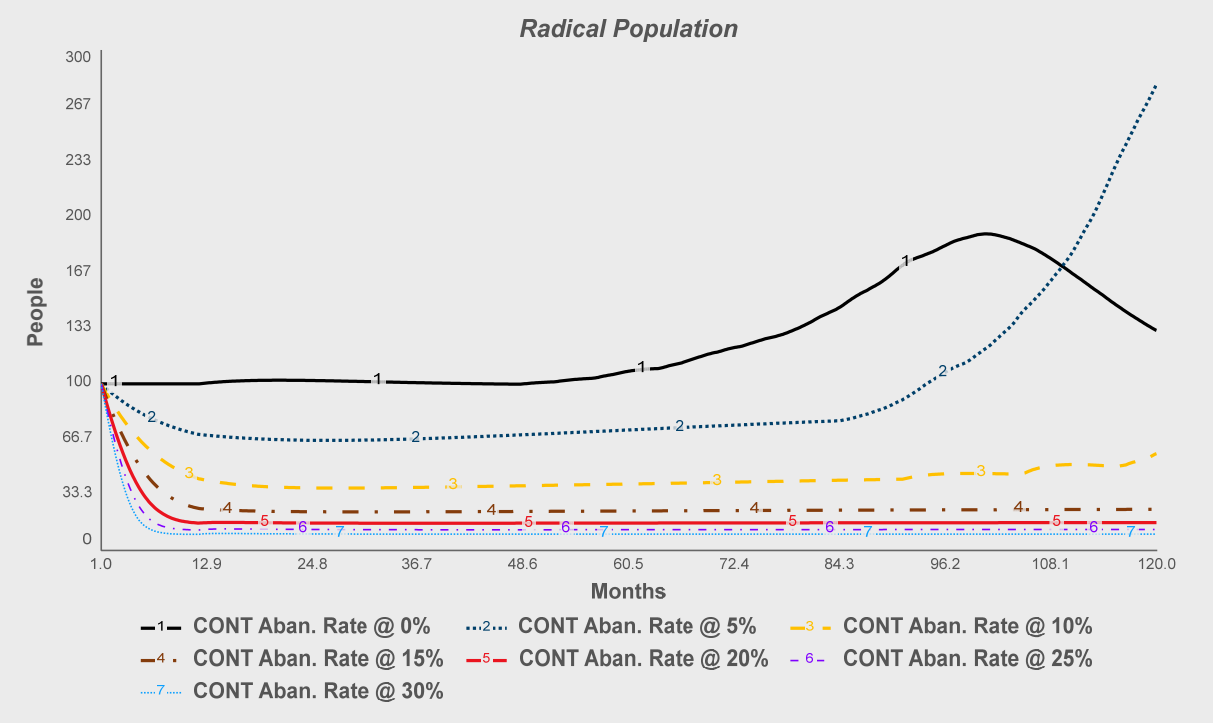
Moderate Population



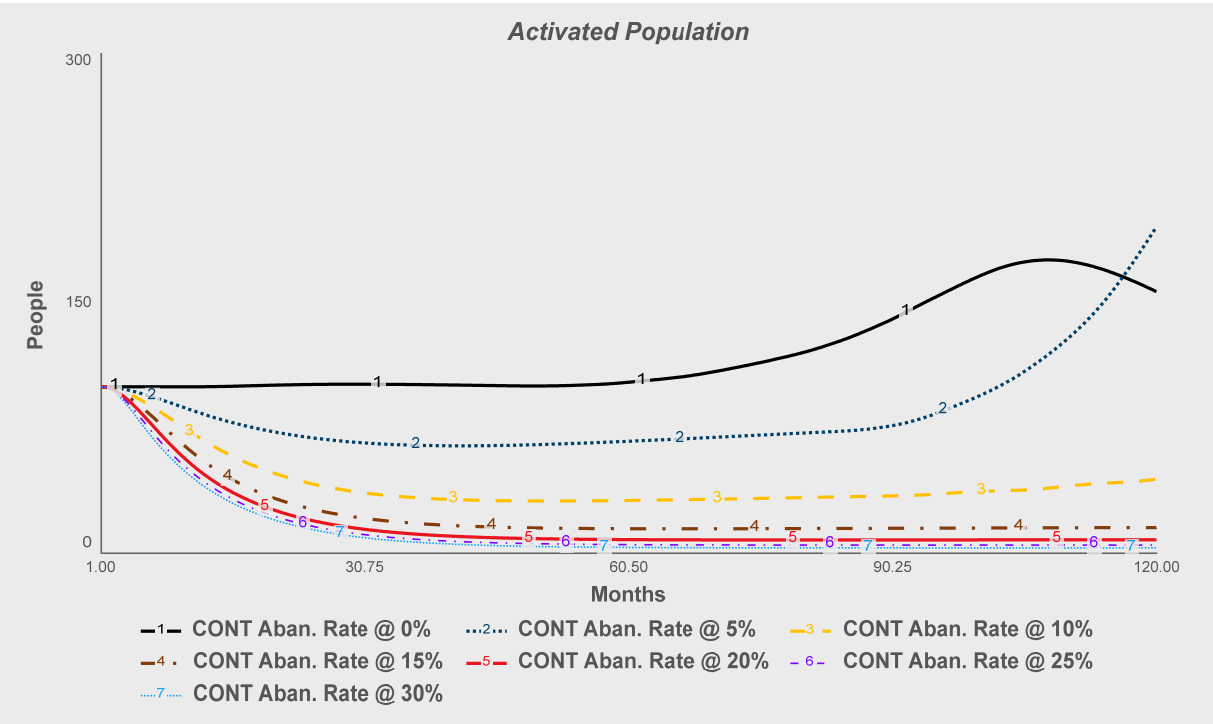
Undecided Population



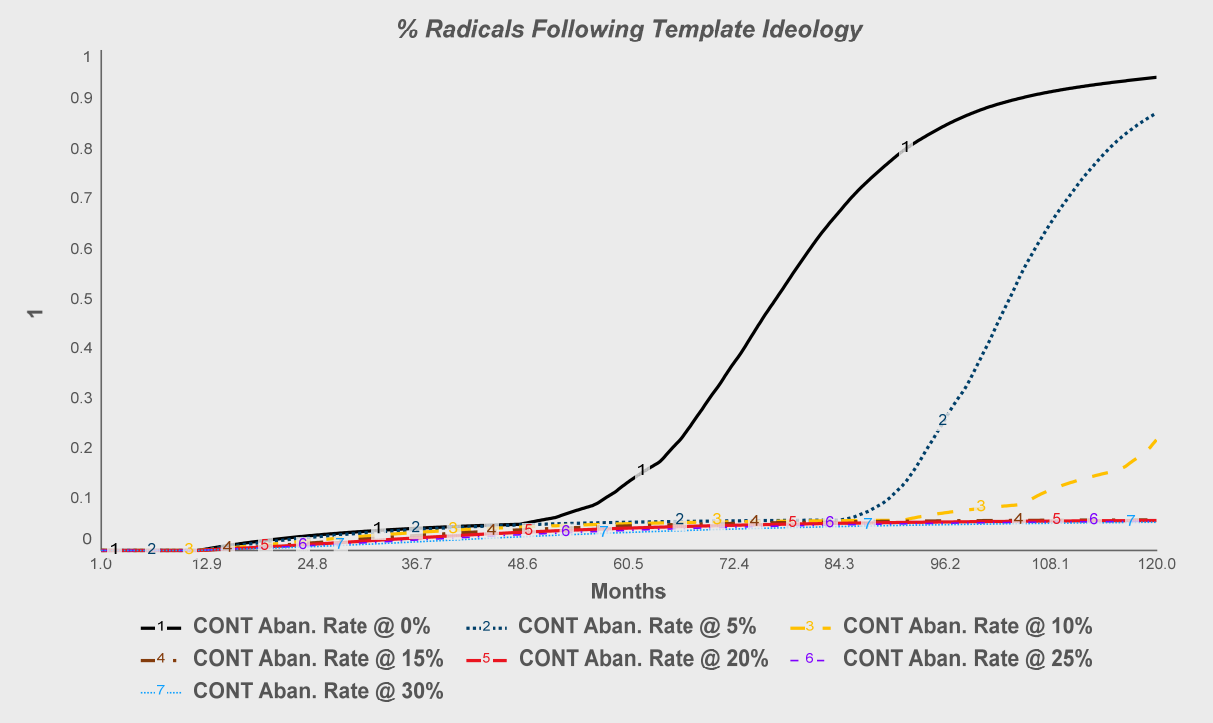
Radical Population



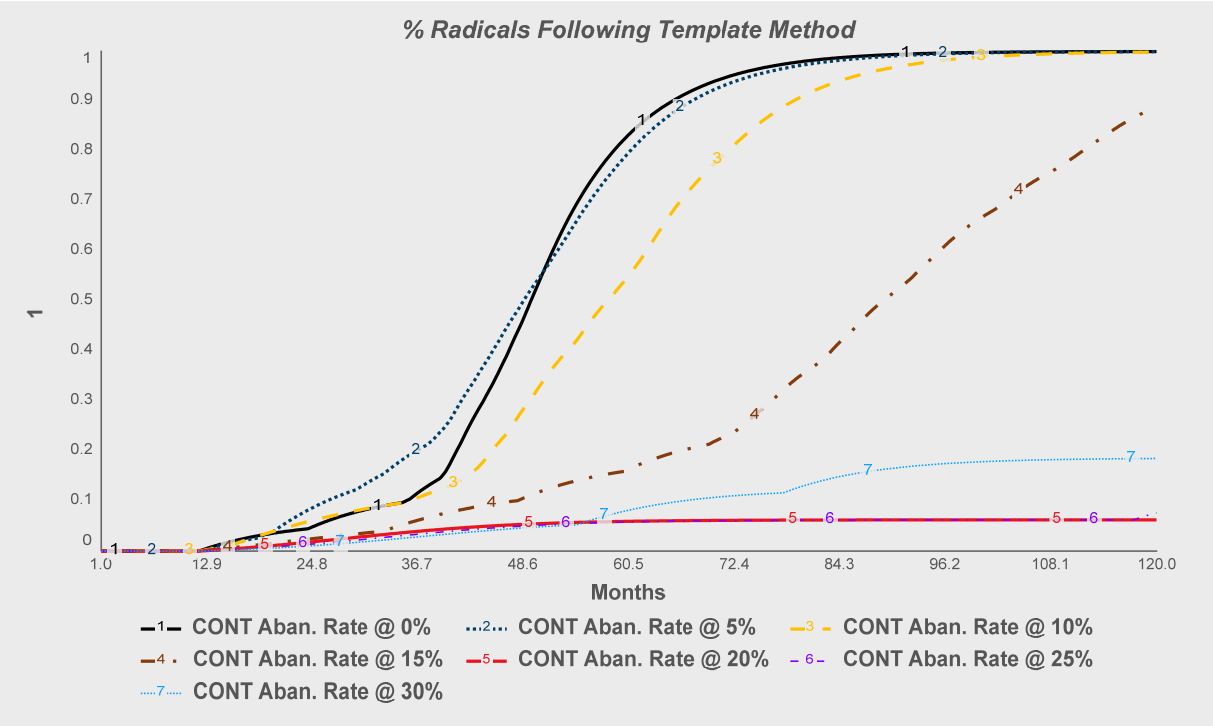
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

Abandonment Rate			

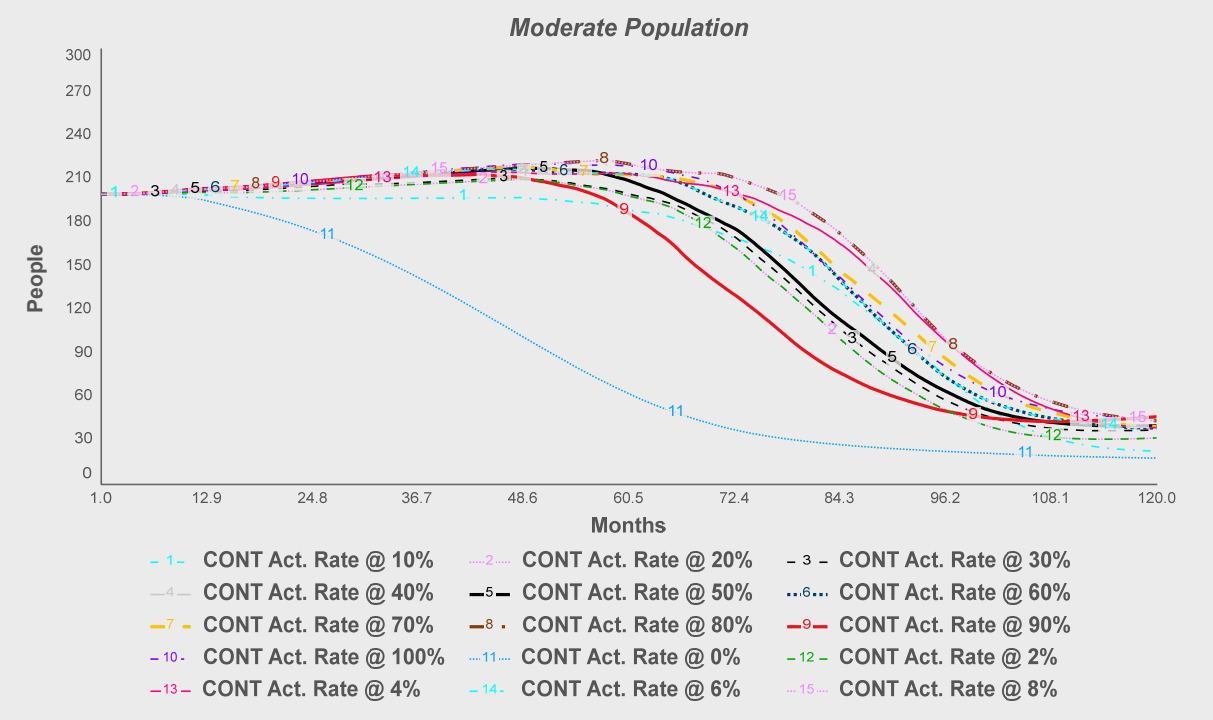
Run	*Total Attempted Incidents*	*Failed Incidents*	*Total Contagion Incidents*
CONT Aban. Rate @ 0%: Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT Aban. Rate @ 5%: Model Testing Structure.ZCB Att Incidents Total	498	259.1	97
CONT Aban. Rate @ 10%: Model Testing Structure.ZCB Att Incidents Total	248	155.9	7
CONT Aban. Rate @ 15%: Model Testing Structure.ZCB Att Incidents Total	146	123.6	0
CONT Aban. Rate @ 20%: Model Testing Structure.ZCB Att Incidents Total	106	104.8	0
CONT Aban. Rate @ 25%: Model Testing Structure.ZCB Att Incidents Total	87	85.7	0
CONT Aban. Rate @ 30%: Model Testing Structure.ZCB Att Incidents Total	76	73.5	0

Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

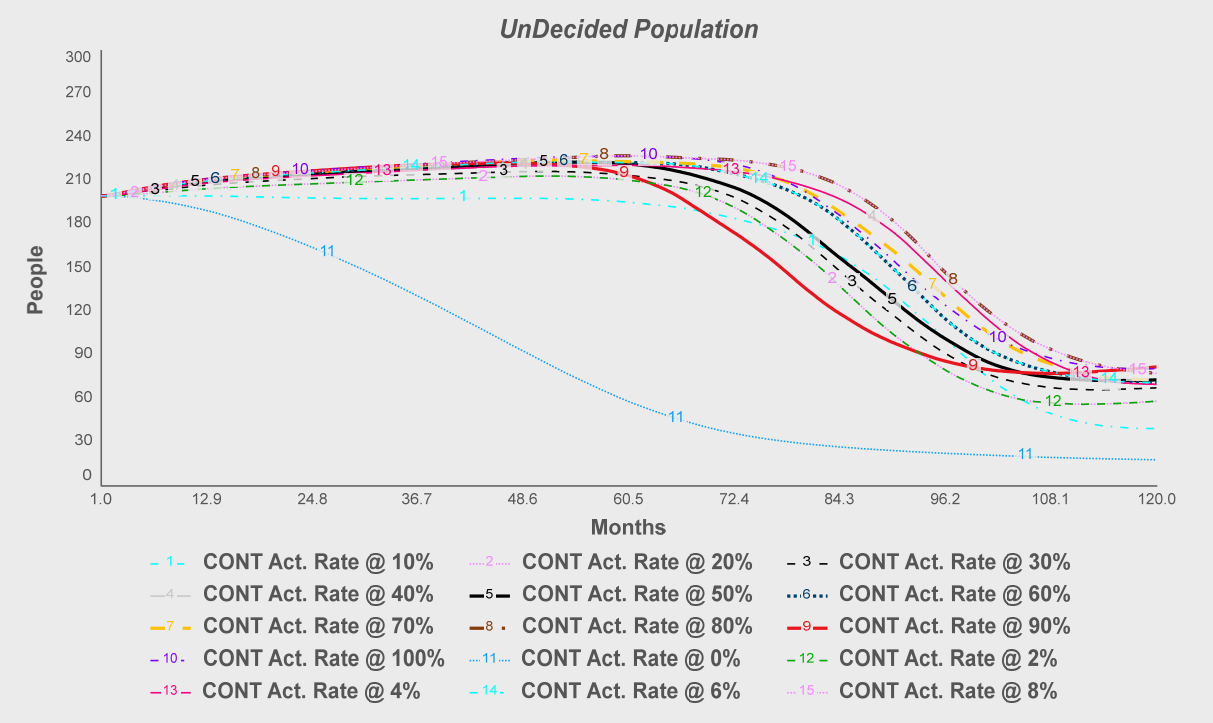
20%+ Abandonment creates a sub-EQ result. 10-20% Abandonment creates a S2G. Even though 10-15% abandonment ends with higher activated, there are significantly fewer casualties.

D-5.3 Proposition #12: Activation Rate 0-100%

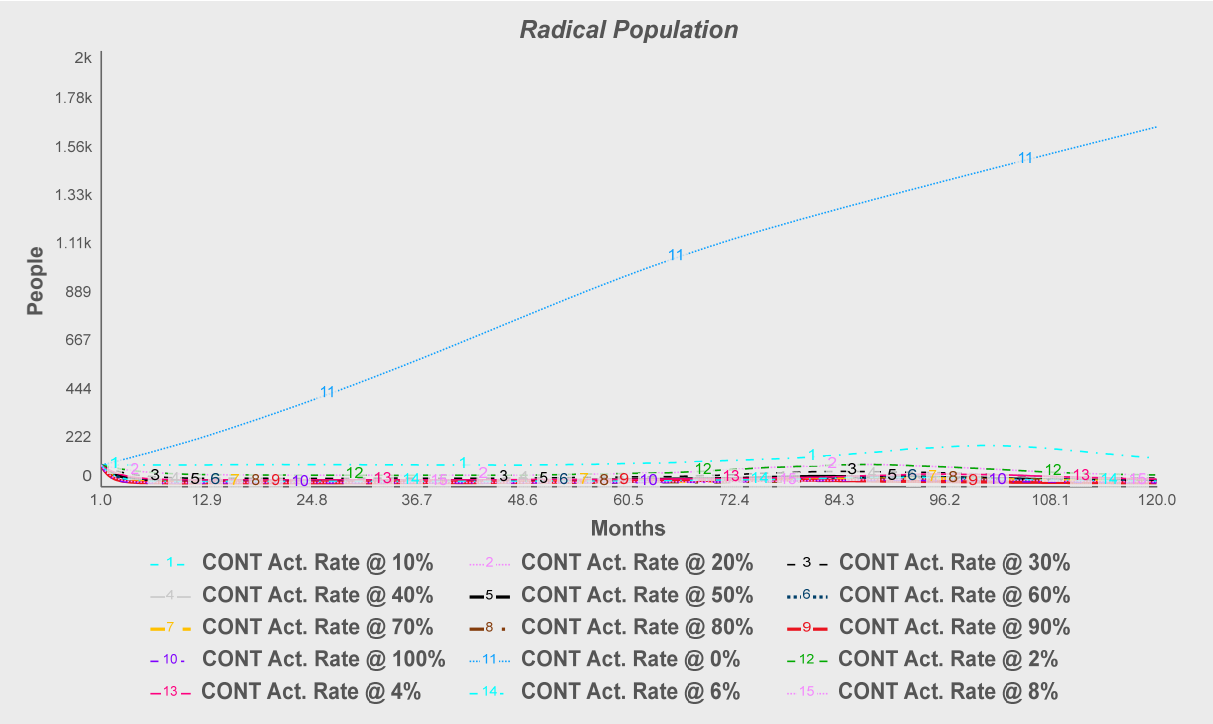
Moderate Population



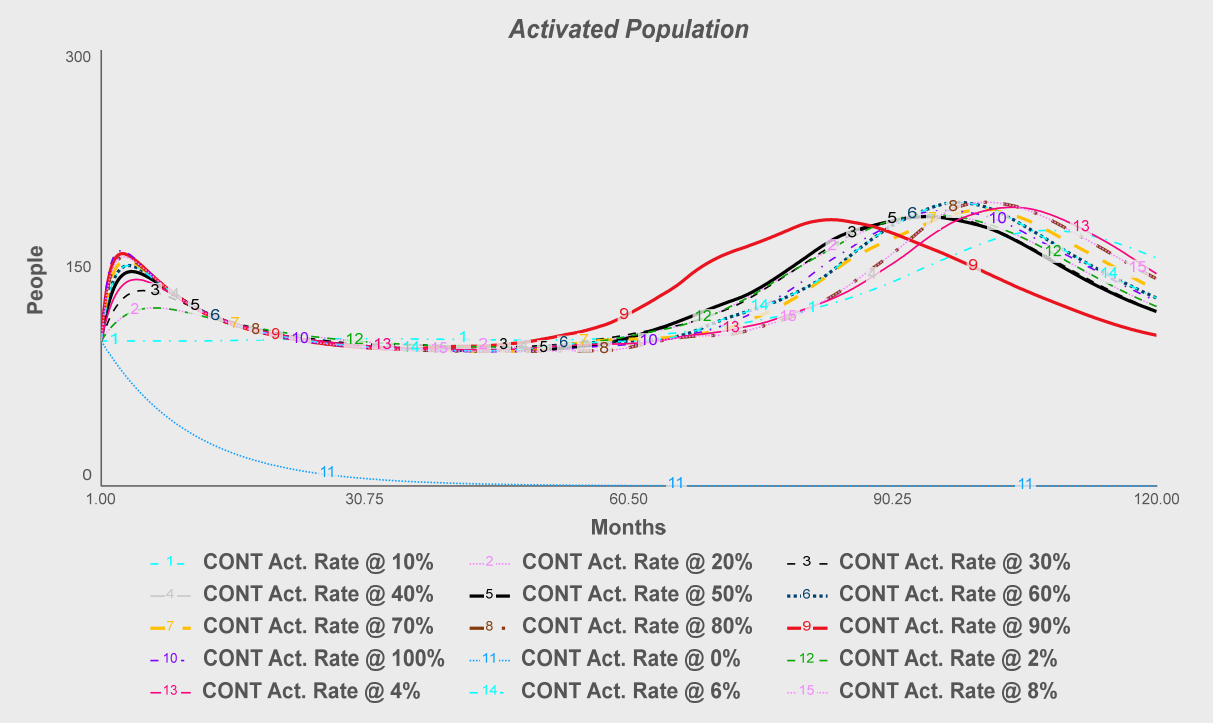
Undecided Population



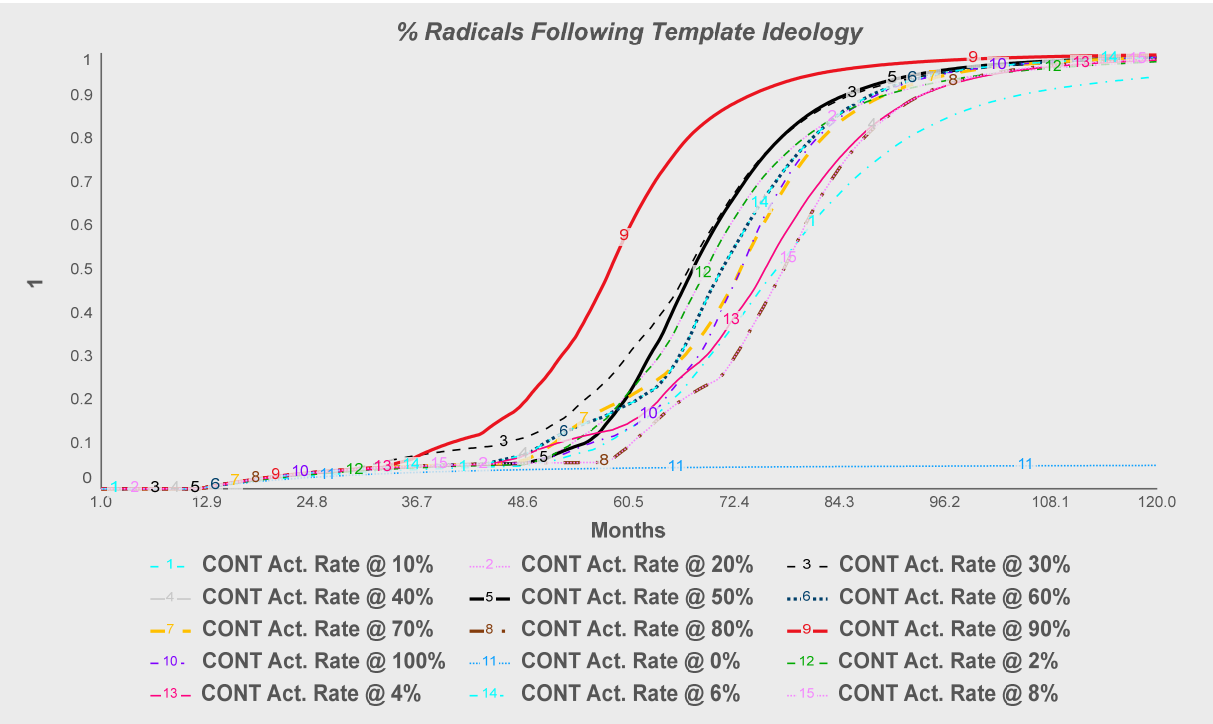
Radical Population



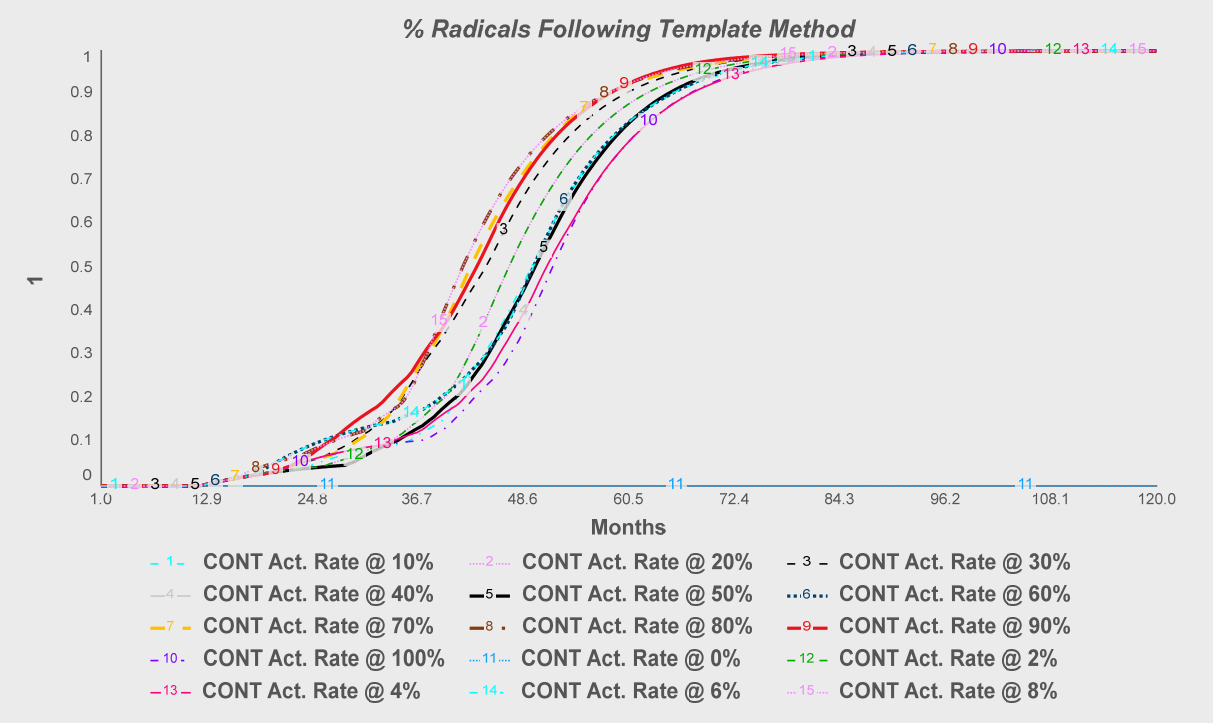
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

Activation Rate			
Run	***Total Attempted Incidents***	***Failed Incidents***	***Total Contagion Incidents***
CONT Act. Rate @ 0%: Model Testing Structure.ZCB Att Incidents Total	49	48.4	0
CONT Act. Rate @ 1%: Model Testing Structure.ZCB Att Incidents Total	369	159.5	28
CONT Act. Rate @ 2%: Model Testing Structure.ZCB Att Incidents Total	517	231.1	75
CONT Act. Rate @ 3%: Model Testing Structure.ZCB Att Incidents Total	597	271.7	131
CONT Act. Rate @ 4%: Model Testing Structure.ZCB Att Incidents Total	620	263.5	123
CONT Act. Rate @ 5%: Model Testing Structure.ZCB Att Incidents Total	628	303.7	105
CONT Act. Rate @ 6%: Model Testing Structure.ZCB Att Incidents Total	707	254.3	264
CONT Act. Rate @ 7%: Model Testing Structure.ZCB Att Incidents Total	650	389.4	122
CONT Act. Rate @ 8%: Model Testing Structure.ZCB Att Incidents Total	676	291.8	172
CONT Act. Rate @ 9%: Model Testing Structure.ZCB Att Incidents Total	679	348.1	158
CONT Act. Rate @ 10%: Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT Act. Rate @ 20%: Model Testing Structure.ZCB Att Incidents Total	760	345.8	307
CONT Act. Rate @ 30%: Model Testing Structure.ZCB Att Incidents Total	761	347.3	297
CONT Act. Rate @ 40%: Model Testing Structure.ZCB Att Incidents Total	749	390.4	254
CONT Act. Rate @ 50%: Model Testing Structure.ZCB Att Incidents Total	763	368.5	297
CONT Act. Rate @ 60%: Model Testing Structure.ZCB Att Incidents Total	761	368.2	294
CONT Act. Rate @ 70%: Model Testing Structure.ZCB Att Incidents Total	758	340.4	283
CONT Act. Rate @ 80%: Model Testing Structure.ZCB Att Incidents Total	751	343.1	253

CONT Act. Rate @ 90%: Model Testing Structure.ZCB Att Incidents Total	769	358.3	328
CONT Act. Rate @ 100%: Model Testing Structure.ZCB Att Incidents Total	758	391.5	265

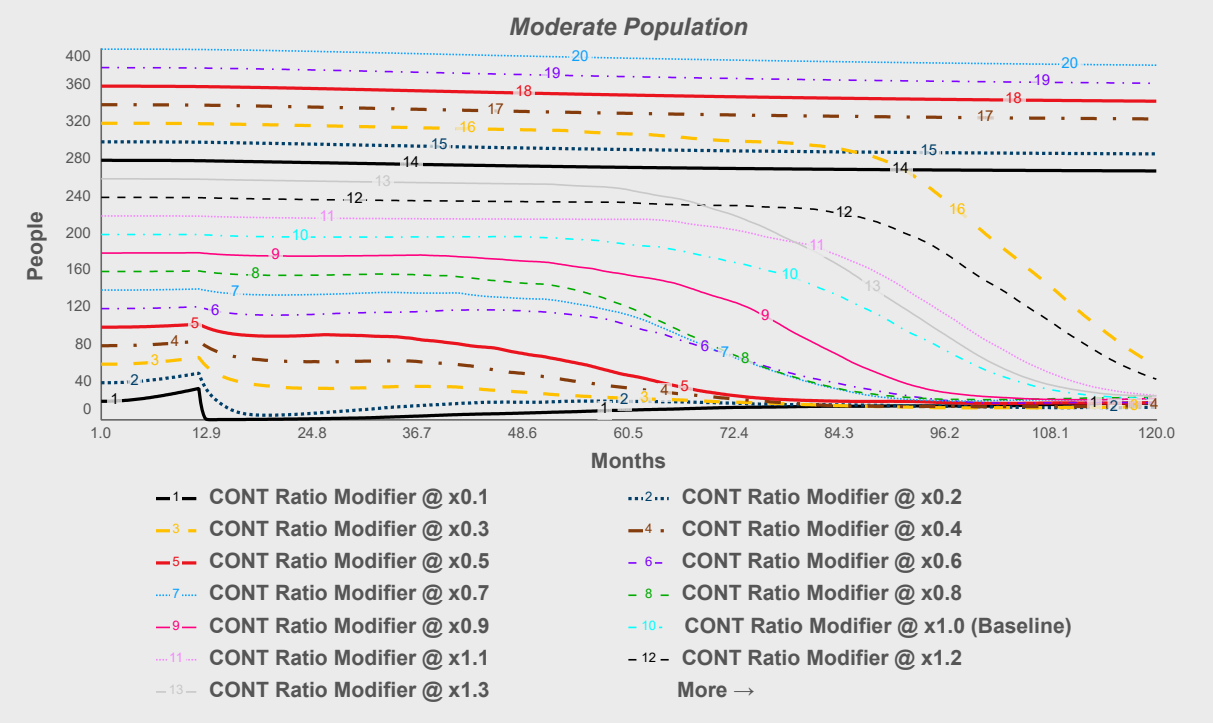
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

Below EQ behavior at 0-1%, F2G at 2-3%, S2G at 4%, CONT at 5-10%. CONT at 10%, 20-100% show initial bumps then CONT. Victim rates increase until 30% Activation, at which they decline slightly, this is because too high and Activation drains the Radicals too fast negatively impacting network effects though this effect is minor.

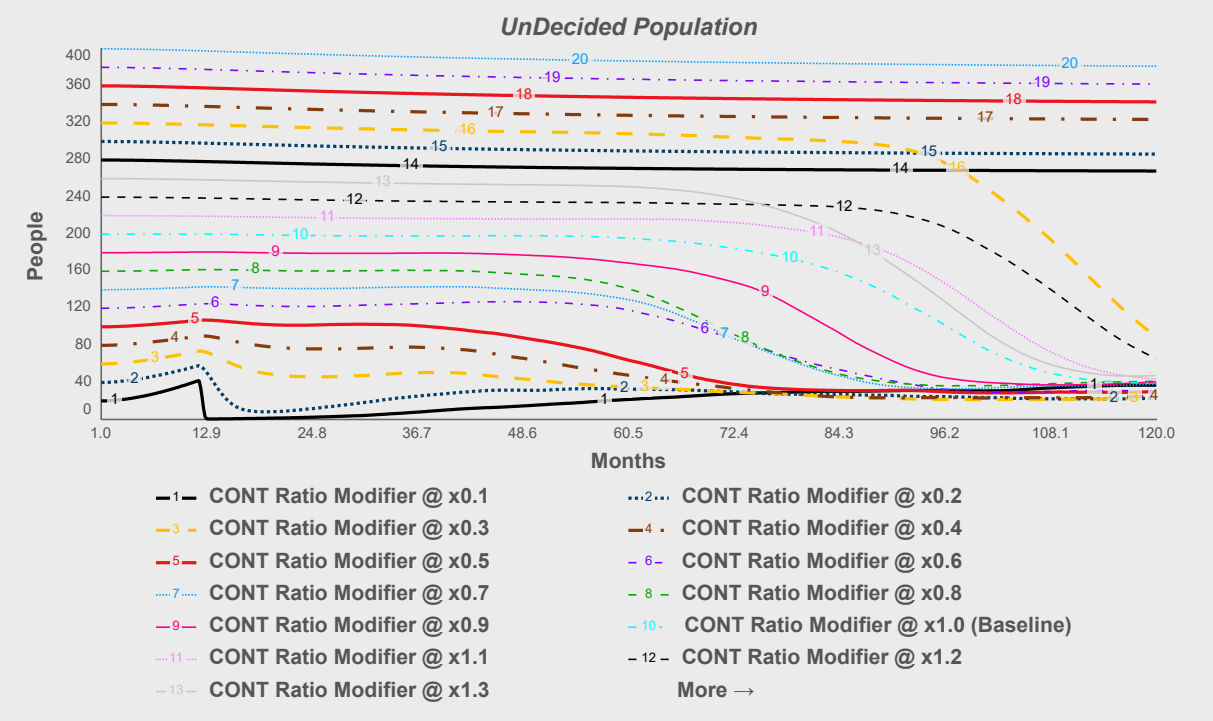
D-7 PROPOSITION ANALYSIS LEVEL 2: AGENTS

D-5.5 Proposition #13: Ratio of non-radicalized to radicalized within the at-risk populations.

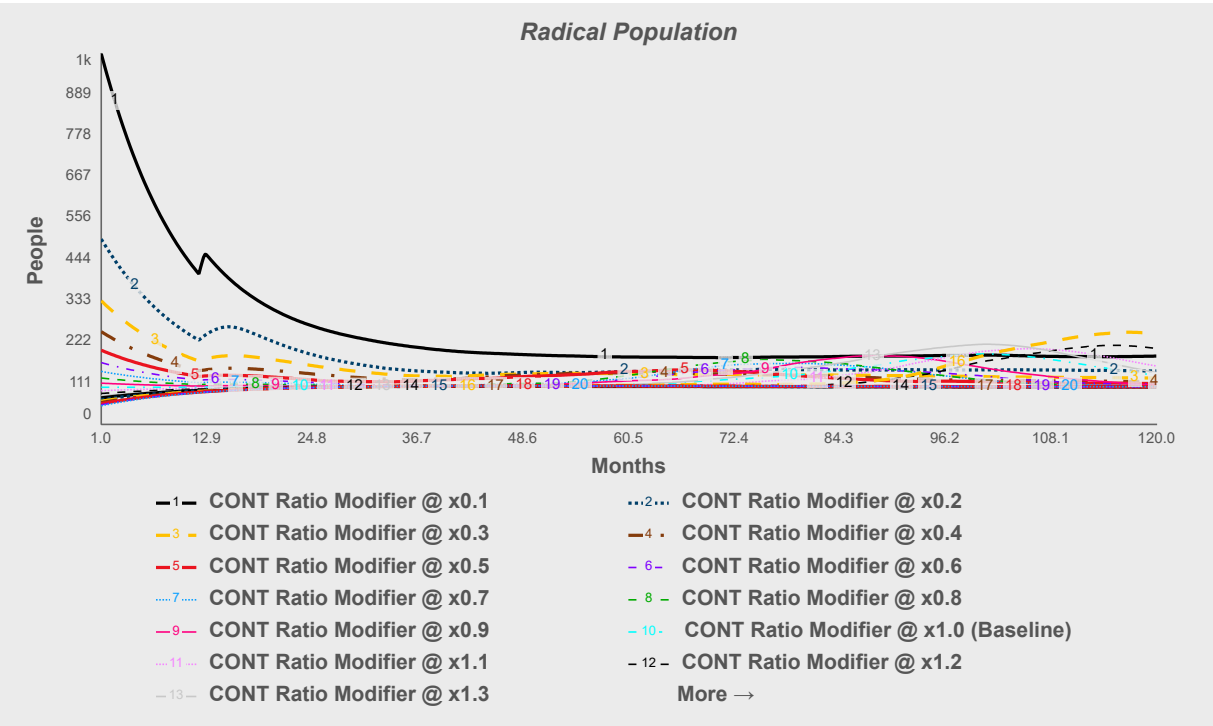
Moderate Population



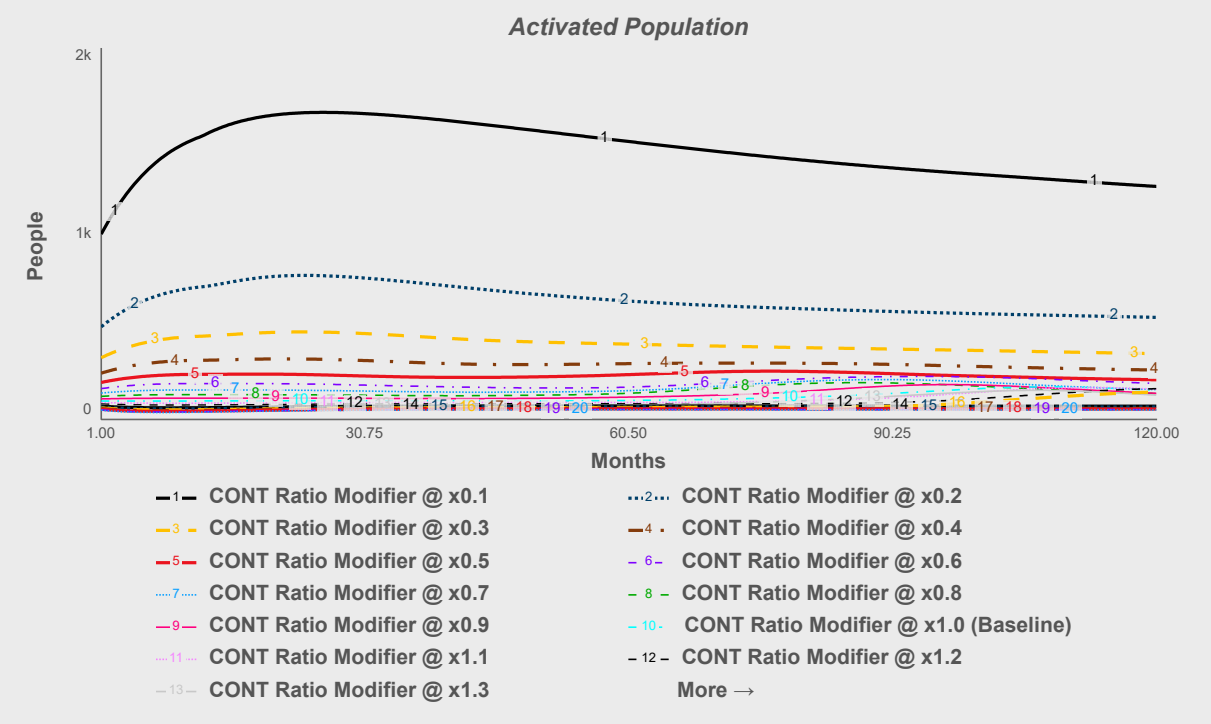
Undecided Population

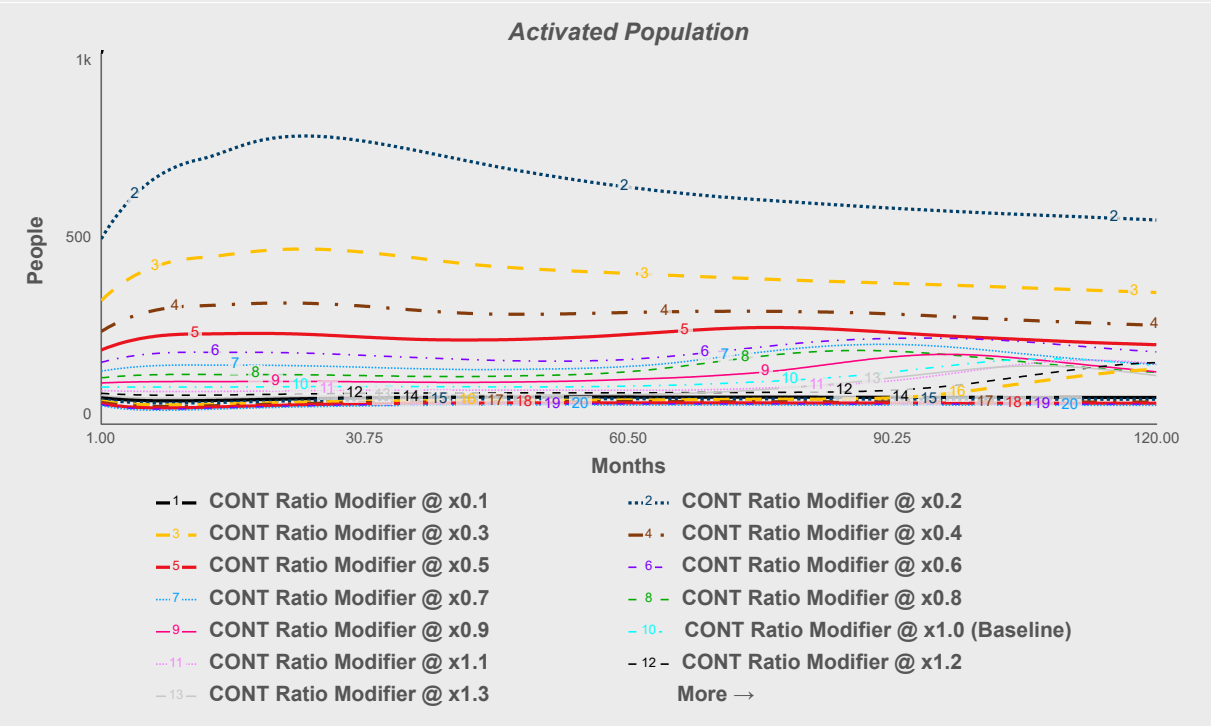


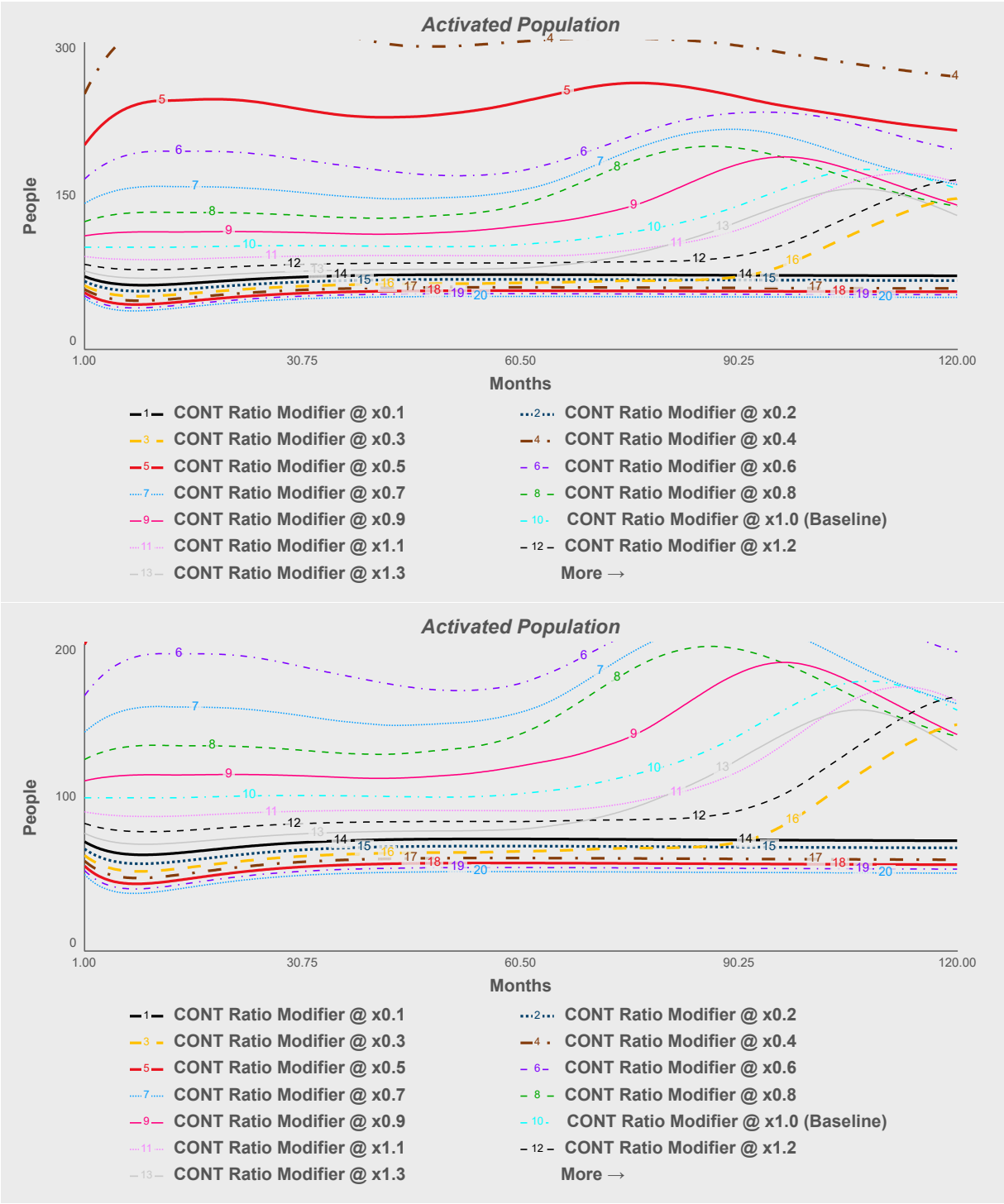
Radical Population



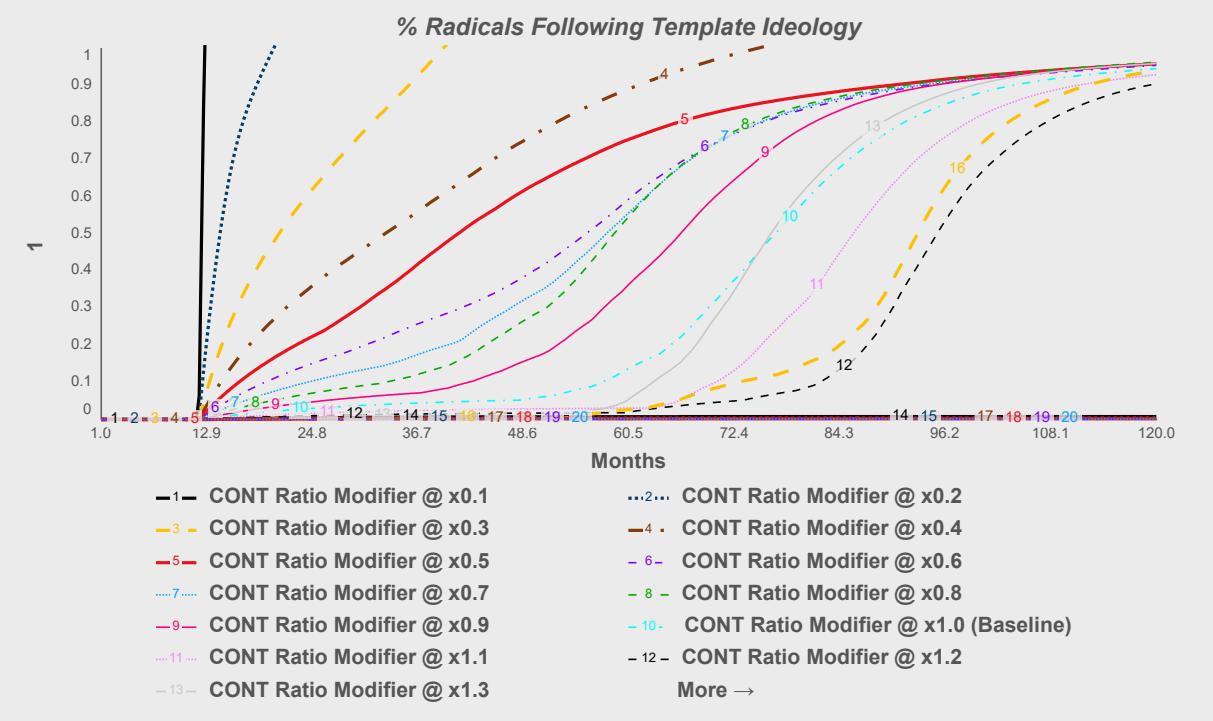
Activated Population



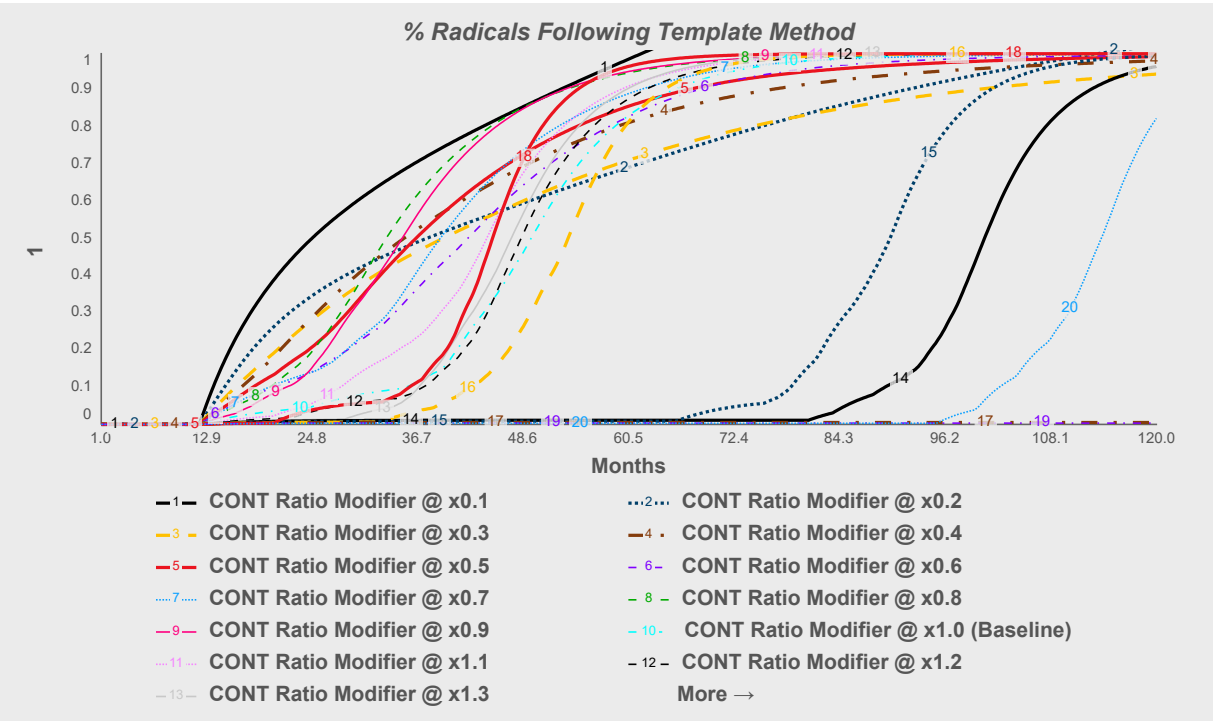



Activated Population
People
300
150
0
1.00
30.75
60.50
90.25
120.00
Months
CONT Ratio Modifier @ x0.1
CONT Ratio Modifier @ x0.2
CONT Ratio Modifier @ x0.3
CONT Ratio Modifier @ x0.4
CONT Ratio Modifier @ x0.5
CONT Ratio Modifier @ x0.6
CONT Ratio Modifier @ x0.7
CONT Ratio Modifier @ x0.8
CONT Ratio Modifier @ x0.9
CONT Ratio Modifier @ x1.0 (Baseline)
CONT Ratio Modifier @ x1.1
CONT Ratio Modifier @ x1.2
CONT Ratio Modifier @ x1.3
More →
Activated Population
People
200
100
0
1.00
30.75
60.50
90.25
120.00
Months
CONT Ratio Modifier @ x0.1
CONT Ratio Modifier @ x0.2
CONT Ratio Modifier @ x0.3
CONT Ratio Modifier @ x0.4
CONT Ratio Modifier @ x0.5
CONT Ratio Modifier @ x0.6
CONT Ratio Modifier @ x0.7
CONT Ratio Modifier @ x0.8
CONT Ratio Modifier @ x0.9
CONT Ratio Modifier @ x1.0 (Baseline)
CONT Ratio Modifier @ x1.1
CONT Ratio Modifier @ x1.2
CONT Ratio Modifier @ x1.3
More →

% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

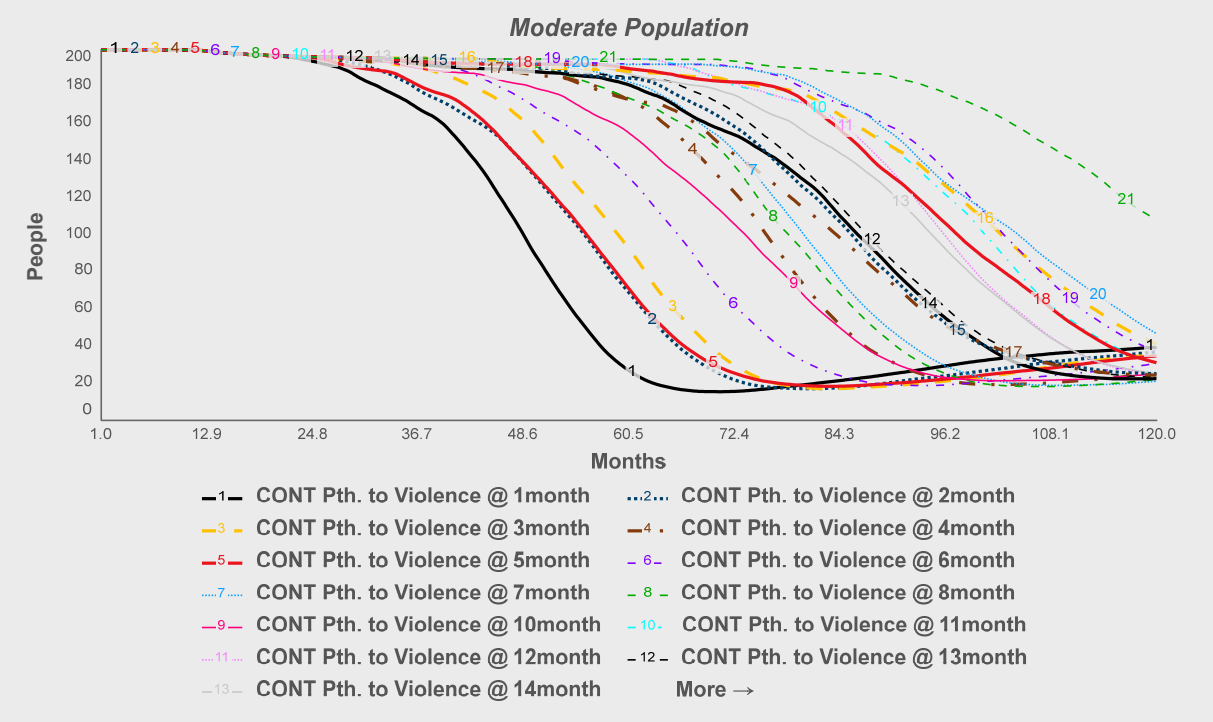
Population Ratio Modification			
Run	***Total Attempted Incidents***	***Failed Incidents***	***Total Contagion Incidents***
CONT Ratio Modifier @ x0.1: Model Testing Structure.ZCB Att Incidents Total	86.6	33.95	52.4
CONT Ratio Modifier @ x0.2: Model Testing Structure.ZCB Att Incidents Total	153.8	81.64	71.4
CONT Ratio Modifier @ x0.3: Model Testing Structure.ZCB Att Incidents Total	218.7	116.52	99.3
CONT Ratio Modifier @ x0.4: Model Testing Structure.ZCB Att Incidents Total	285.2	133.44	130
CONT Ratio Modifier @ x0.5: Model Testing Structure.ZCB Att Incidents Total	354	159.1	147.5
CONT Ratio Modifier @ x0.6: Model Testing Structure.ZCB Att Incidents Total	422.4	210.9	155.4
CONT Ratio Modifier @ x0.7: Model Testing Structure.ZCB Att Incidents Total	500.5	231.98	191.8
CONT Ratio Modifier @ x0.8: Model Testing Structure.ZCB Att Incidents Total	580.8	231.6	238.4
CONT Ratio Modifier @ x0.9: Model Testing Structure.ZCB Att Incidents Total	657	266.31	250.2
CONT Ratio Modifier @ x1.0 (Baseline): Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT Ratio Modifier @ x1.1: Model Testing Structure.ZCB Att Incidents Total	781	343.53	231
CONT Ratio Modifier @ x1.2: Model Testing Structure.ZCB Att Incidents Total	813.6	390	190.8
CONT Ratio Modifier @ x1.3: Model Testing Structure.ZCB Att Incidents Total	986.7	433.03	364
CONT Ratio Modifier @ x1.4: Model Testing Structure.ZCB Att Incidents Total	827.4	702.66	0
CONT Ratio Modifier @ x1.5: Model Testing Structure.ZCB Att Incidents Total	885	686.25	0
CONT Ratio Modifier @ x1.6: Model Testing Structure.ZCB Att Incidents Total	1131.2	540.32	316.8
CONT Ratio Modifier @ x1.7: Model Testing Structure.ZCB Att Incidents Total	1001.3	992.12	0
CONT Ratio Modifier @ x1.8: Model Testing Structure.ZCB Att Incidents Total	1058.4	503.28	0
CONT Ratio Modifier @ x1.9: Model Testing Structure.ZCB Att Incidents Total	1115.3	1105.8	0

CONT Ratio Modifier @ x2.0: Model Testing Structure.ZCB Att Incidents Total	1172	1101.8	0

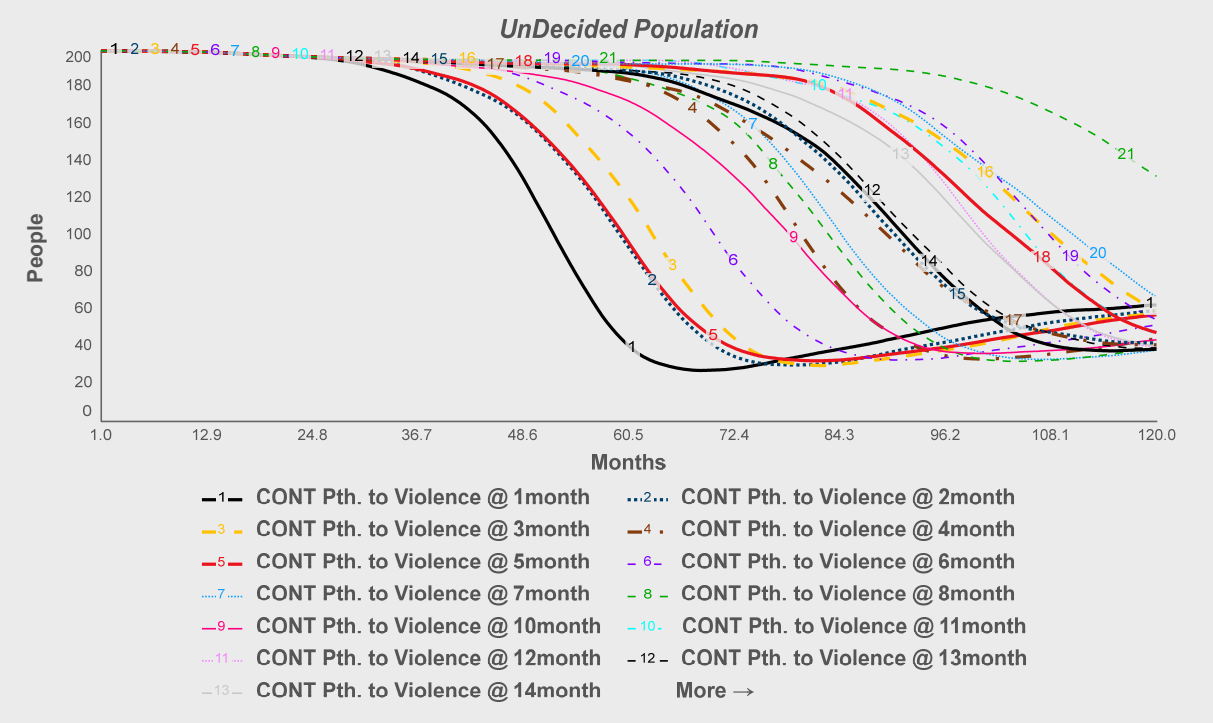
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D 5.6 Proposition #14: Time to Complete Pathway to Violence

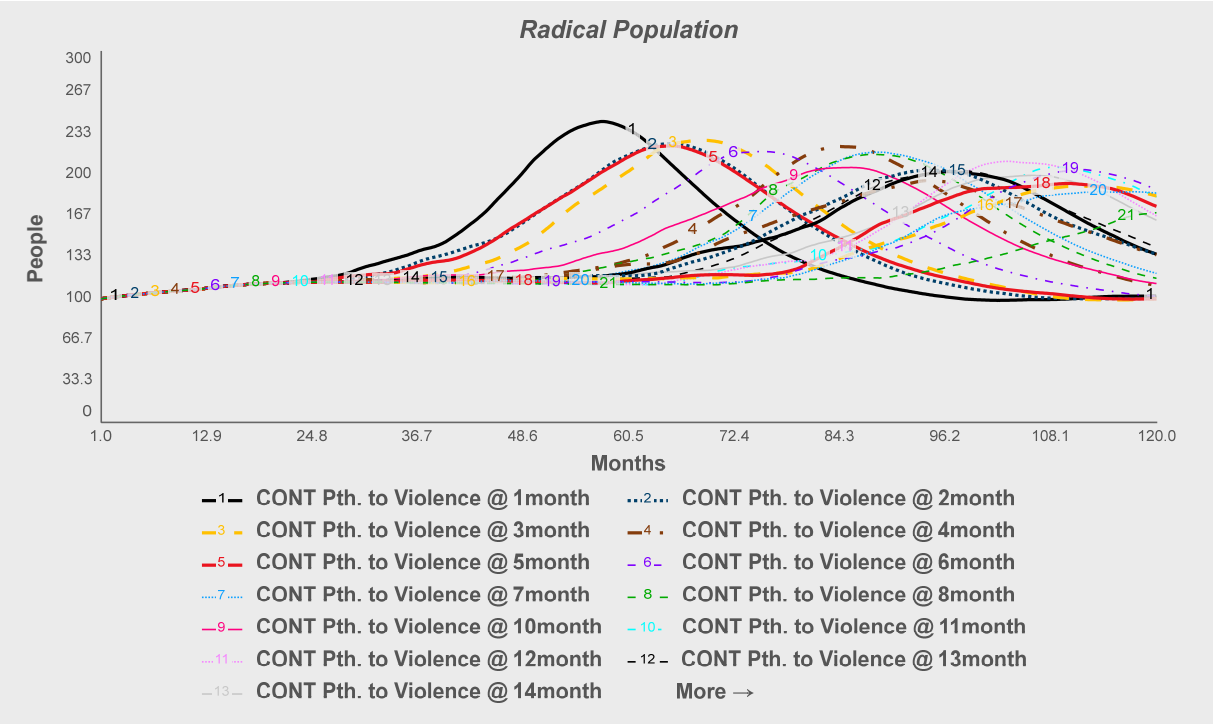
Moderate Population



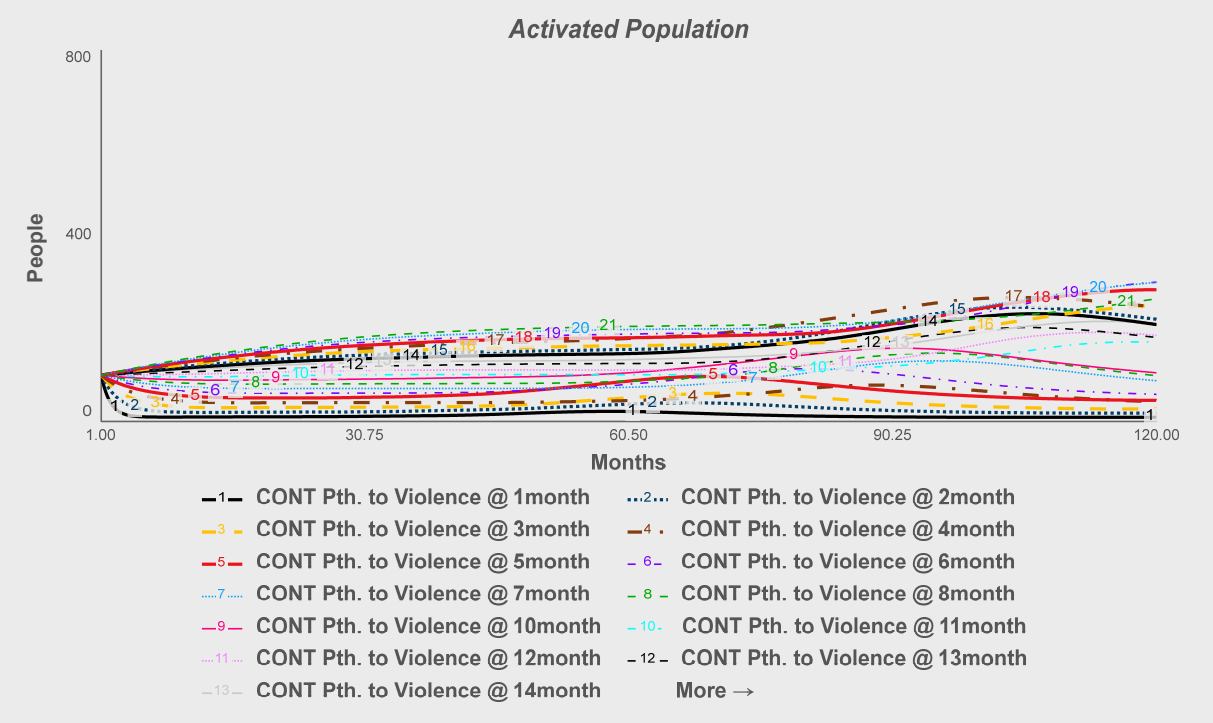
Undecided Population



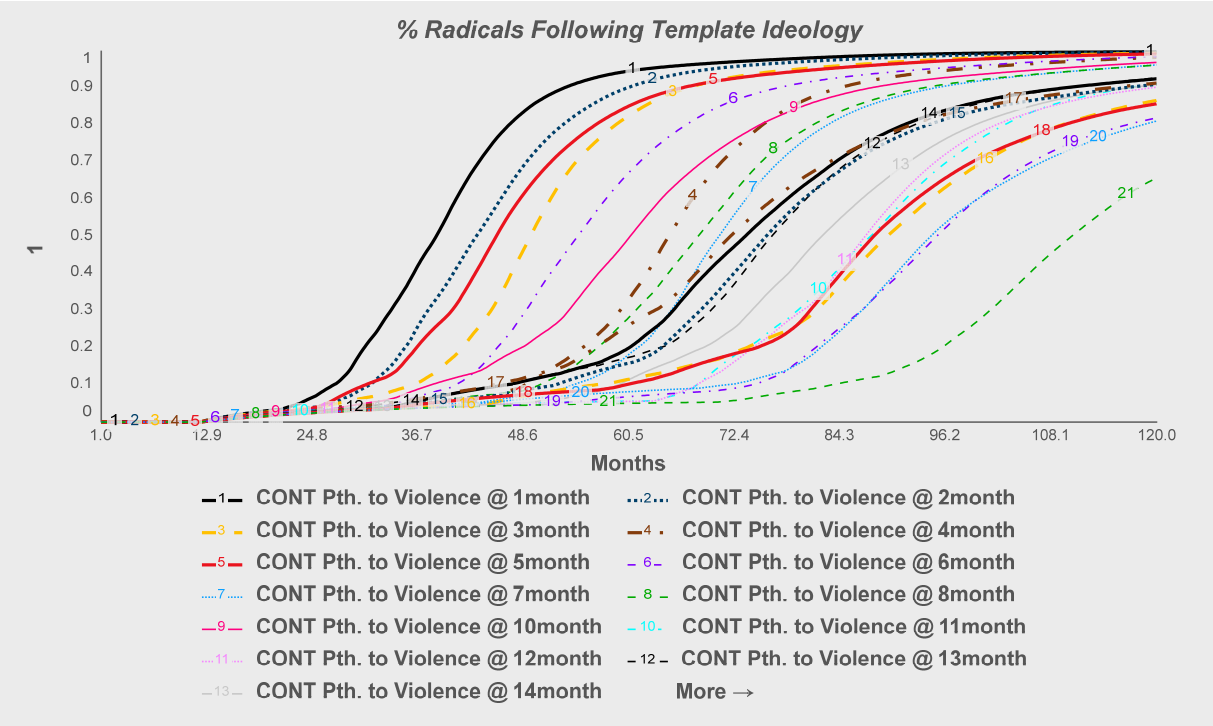
Radical Population



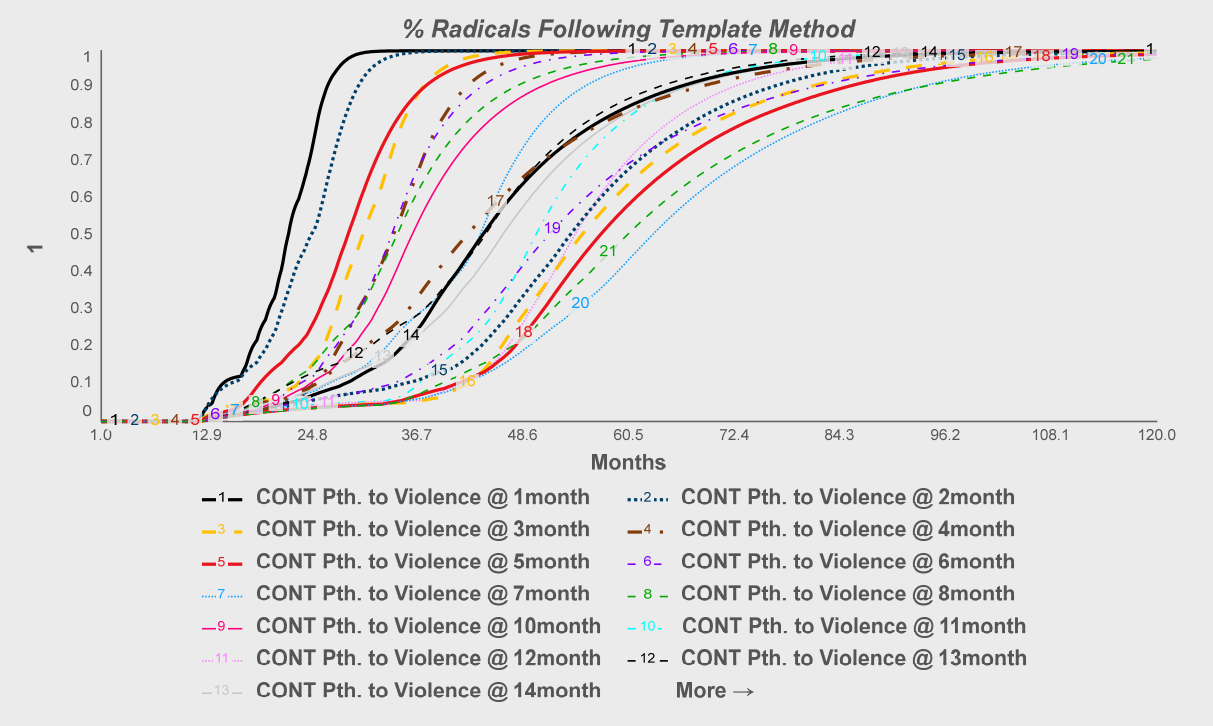
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

Pathway to Violence Delay Time			
Run	***Total Attempted Incidents***	***Failed Incidents***	***Total Contagion Incidents***
CONT Pth. to Violence @ 1month: Model Testing Structure.ZCB Att Incidents Total	787	275	421
CONT Pth. to Violence @ 2month: Model Testing Structure.ZCB Att Incidents Total	787	288.9	392
CONT Pth. to Violence @ 3month: Model Testing Structure.ZCB Att Incidents Total	784	308	381
CONT Pth. to Violence @ 4month: Model Testing Structure.ZCB Att Incidents Total	783	315.6	310
CONT Pth. to Violence @ 5month: Model Testing Structure.ZCB Att Incidents Total	776	290.4	396
CONT Pth. to Violence @ 6month: Model Testing Structure.ZCB Att Incidents Total	773	307.5	349
CONT Pth. to Violence @ 7month: Model Testing Structure.ZCB Att Incidents Total	760	307.9	299
CONT Pth. to Violence @ 8month: Model Testing Structure.ZCB Att Incidents Total	756	270	314
CONT Pth. to Violence @ 10month: Model Testing Structure.ZCB Att Incidents Total	751	299.6	316

CONT Pth. to Violence @ 11month: Model Testing Structure.ZCB Att Incidents Total	679	348.1	158
CONT Pth. to Violence @ 12month: Model Testing Structure.ZCB Att Incidents Total	685	351.5	183
CONT Pth. to Violence @ 13month: Model Testing Structure.ZCB Att Incidents Total	701	313	228
CONT Pth. to Violence @ 14month: Model Testing Structure.ZCB Att Incidents Total	674	307.3	193
CONT Pth. to Violence @ 15month: Model Testing Structure.ZCB Att Incidents Total	691	280.5	244
CONT Pth. to Violence @ 16month: Model Testing Structure.ZCB Att Incidents Total	682	332.3	229
CONT Pth. to Violence @ 17month: Model Testing Structure.ZCB Att Incidents Total	627	336.8	135
CONT Pth. to Violence @ 18month: Model Testing Structure.ZCB Att Incidents Total	671	296.5	241
CONT Pth. to Violence @ 21month: Model Testing Structure.ZCB Att Incidents Total	625	318.7	162
CONT Pth. to Violence @ 22month: Model Testing Structure.ZCB Att Incidents Total	604	298.2	138
CONT Pth. to Violence @ 23month: Model Testing Structure.ZCB Att Incidents Total	595	328.6	123
CONT Pth. to Violence @ 24month: Model Testing Structure.ZCB Att Incidents Total	557	325.7	48

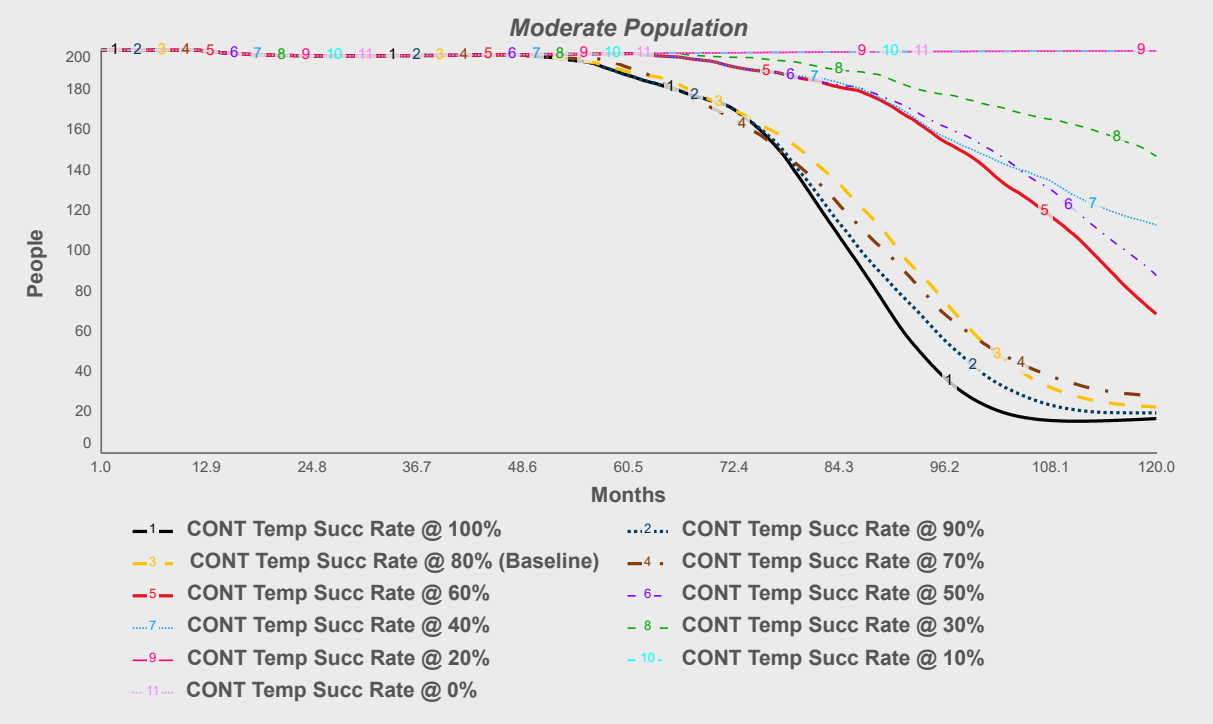
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-8 PROPOSITION ANALYSIS LEVEL 1: INCIDENTS

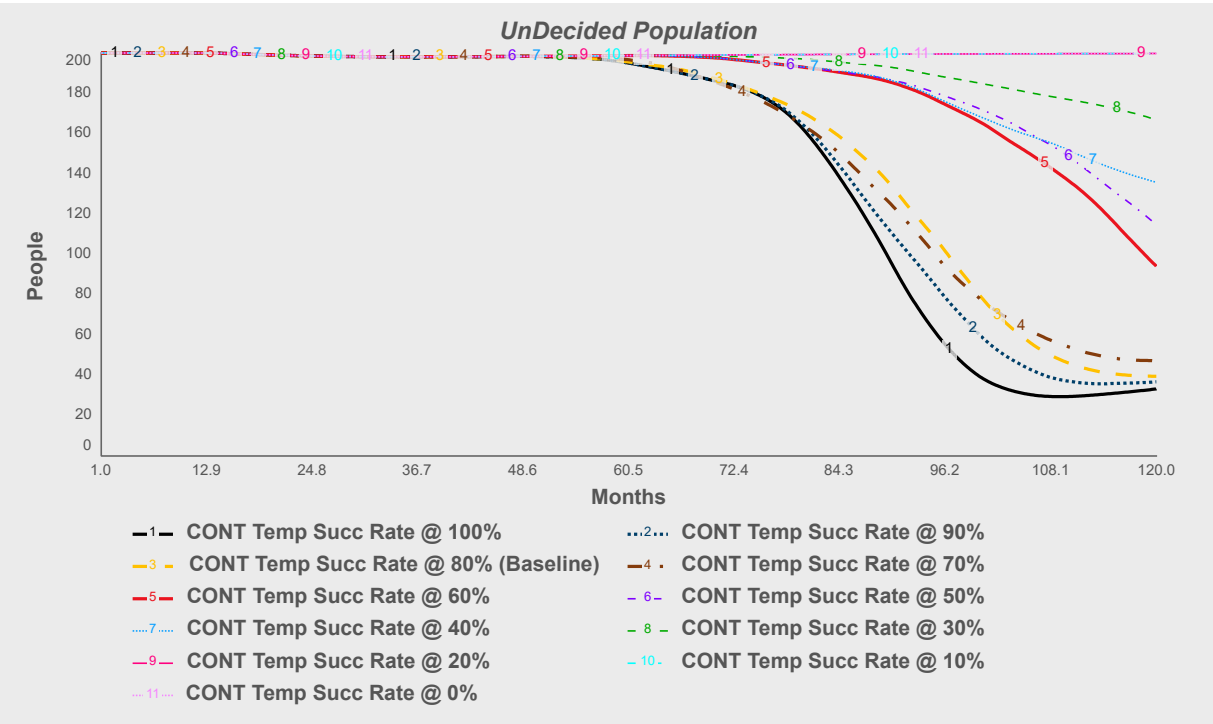
SHEET1

D-8.1 Proposition #15: Template Method OTD Success Rate

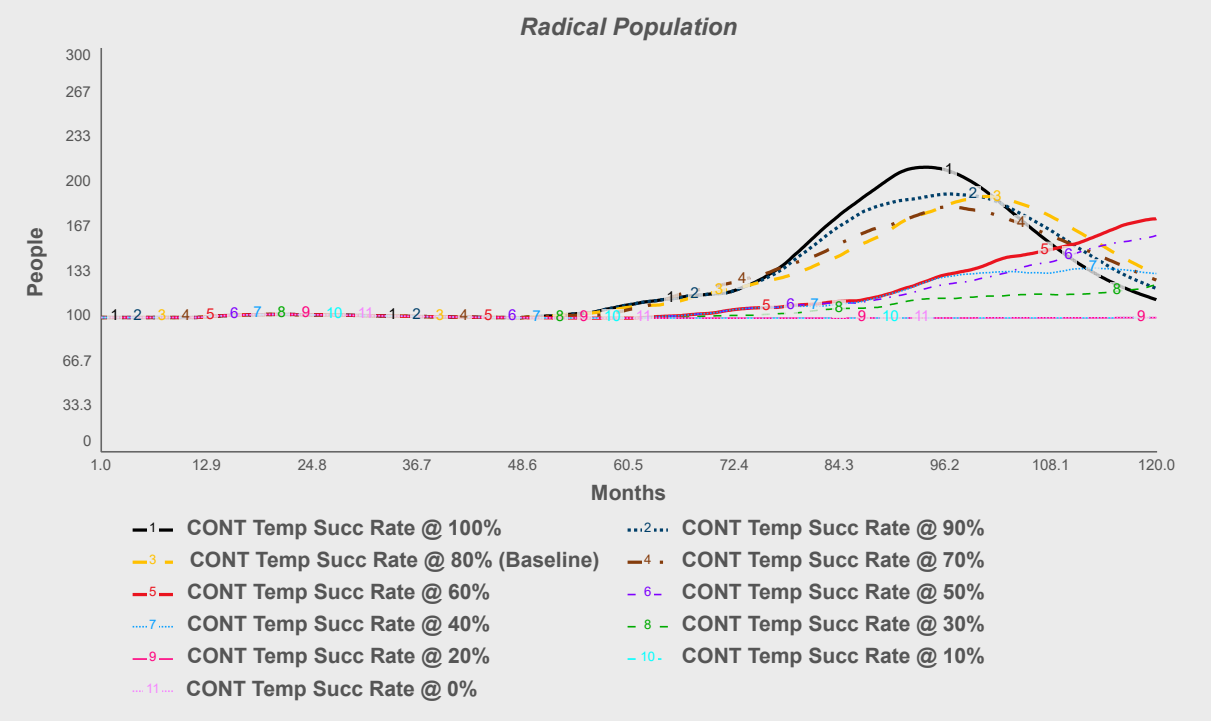
Moderate Population



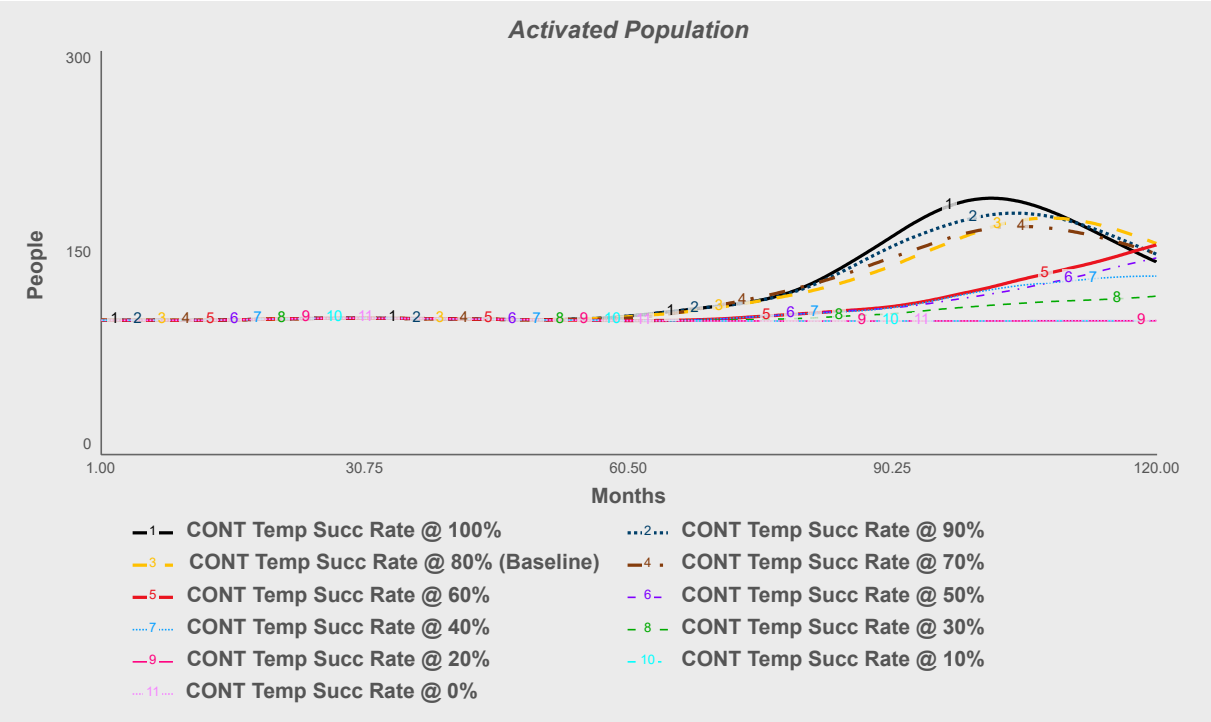
Undecided Population



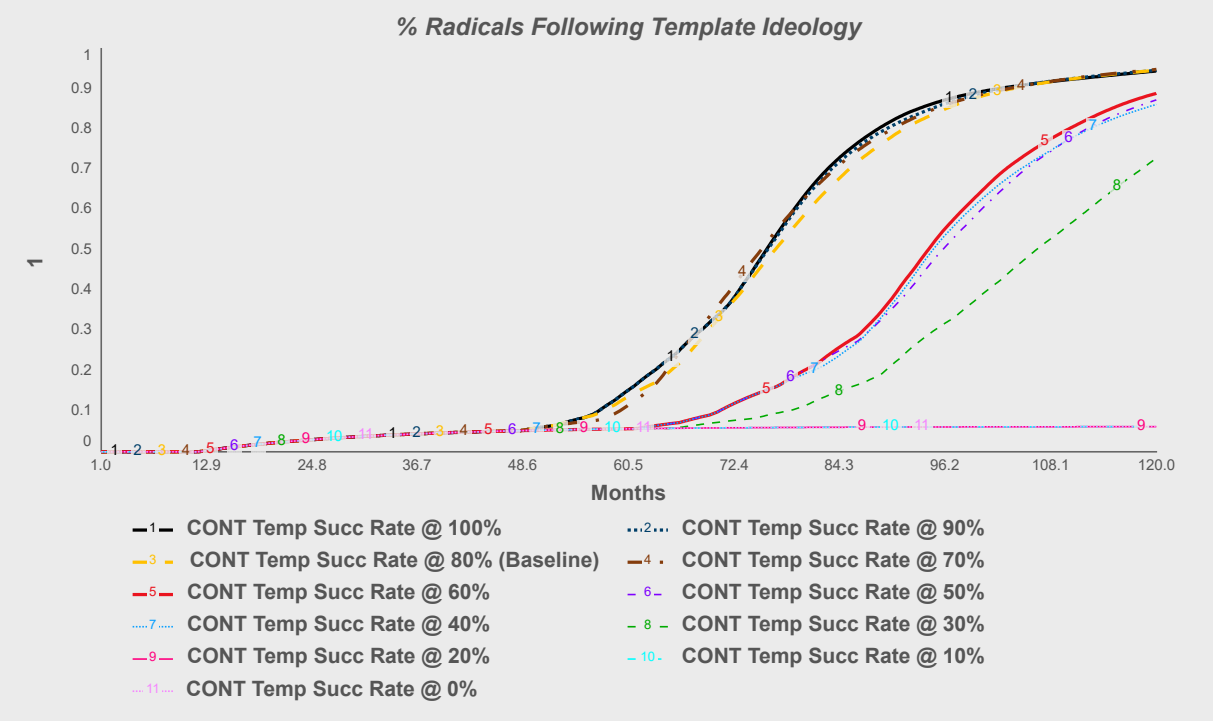
Radical Population



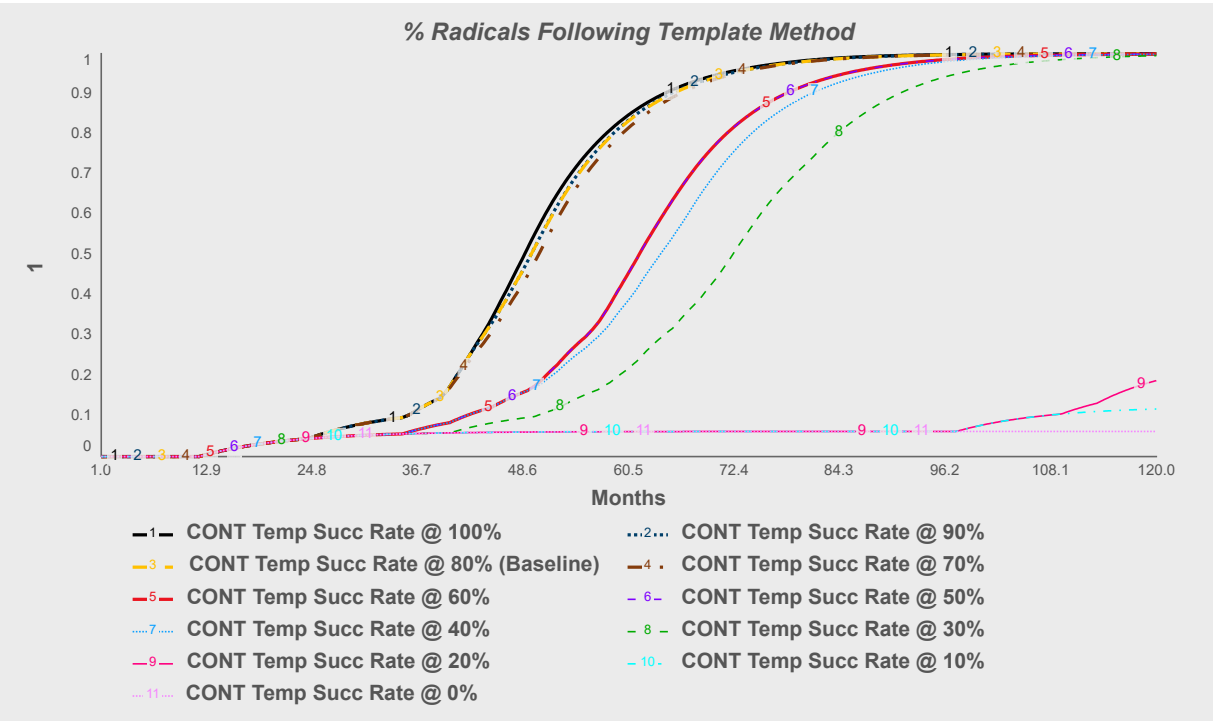
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

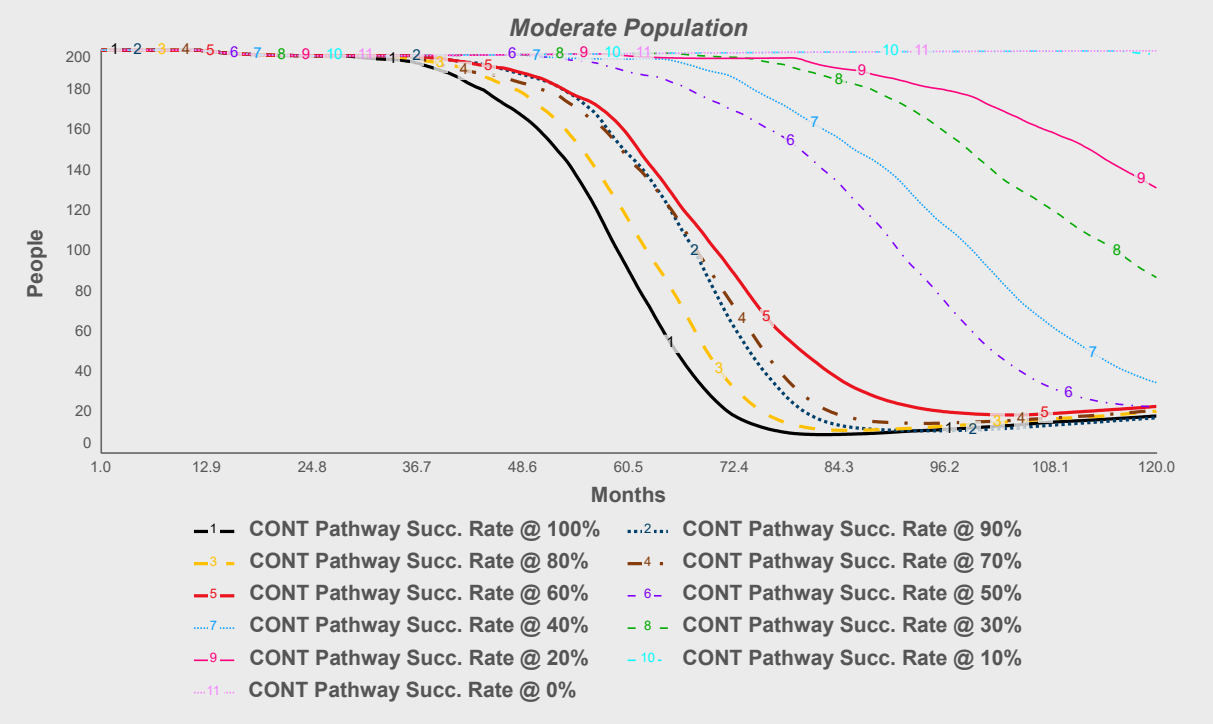
Proposition OTD Success Rate			

Run	*Total Attempted Incidents*	*Failed Incidents*	*Total Contagion Incidents*
CONT Temp Succ Rate @ 100%: Model Testing Structure.ZCB Att Incidents Total	741	241.4	336
CONT Temp Succ Rate @ 90%: Model Testing Structure.ZCB Att Incidents Total	731	292.4	276
CONT Temp Succ Rate @ 80% (Baseline): Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT Temp Succ Rate @ 70%: Model Testing Structure.ZCB Att Incidents Total	718	386.3	212
CONT Temp Succ Rate @ 60%: Model Testing Structure.ZCB Att Incidents Total	648	433.5	95
CONT Temp Succ Rate @ 50%: Model Testing Structure.ZCB Att Incidents Total	639	464.6	76
CONT Temp Succ Rate @ 40%: Model Testing Structure.ZCB Att Incidents Total	637	503.2	50
CONT Temp Succ Rate @ 30%: Model Testing Structure.ZCB Att Incidents Total	616	533.2	29
CONT Temp Succ Rate @ 20%: Model Testing Structure.ZCB Att Incidents Total	595	587.2	0
CONT Temp Succ Rate @ 10%: Model Testing Structure.ZCB Att Incidents Total	595	589.1	0
CONT Temp Succ Rate @ 0%: Model Testing Structure.ZCB Att Incidents Total	595	589.9	0

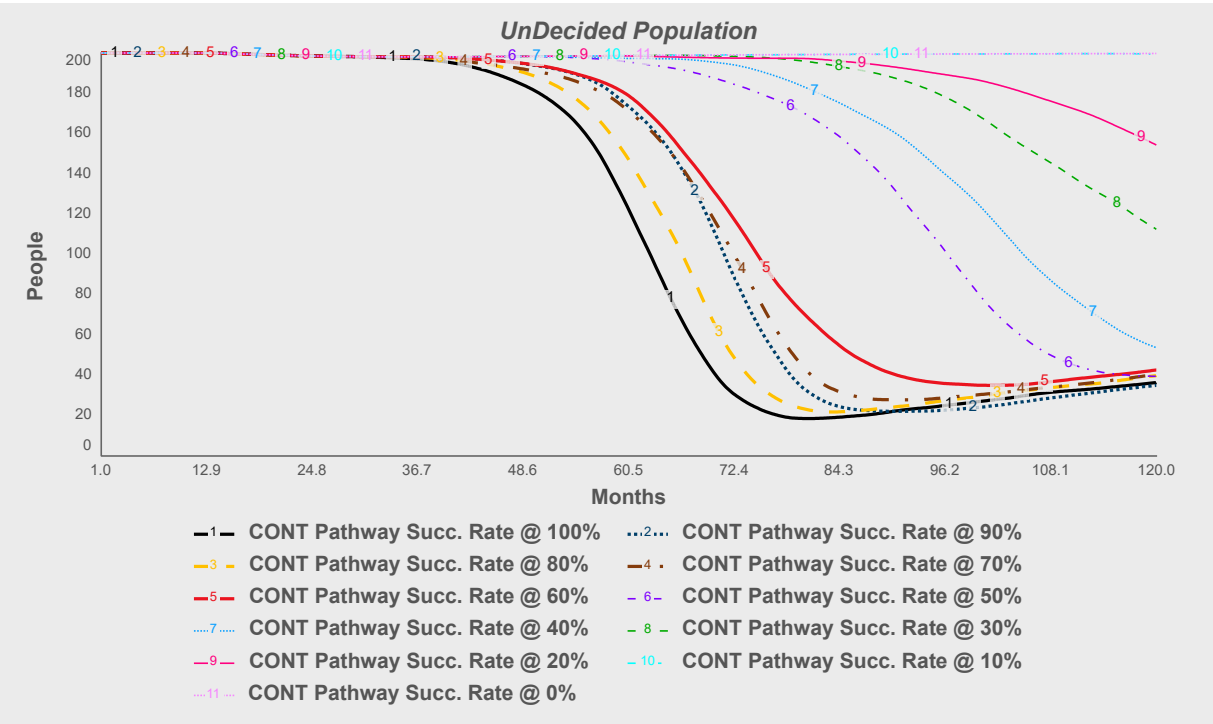
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-8.2 Proposition # 16: Template Method Pathway to Violence Success Rate

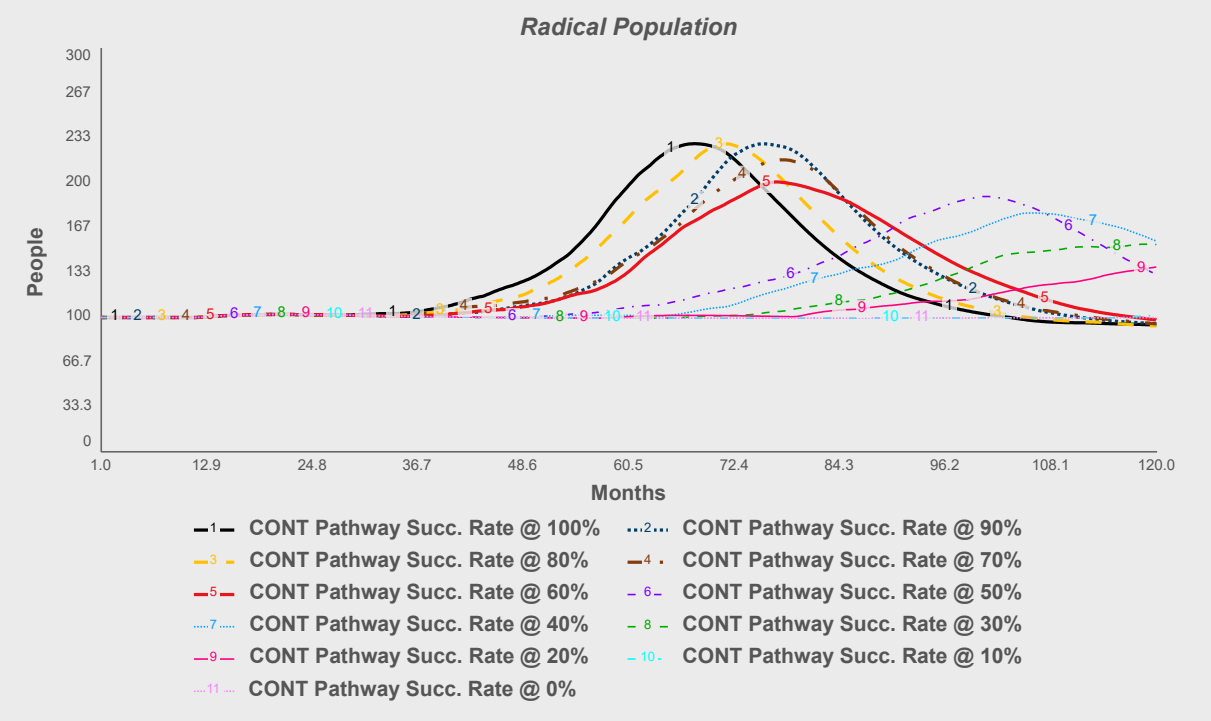
Moderate Population



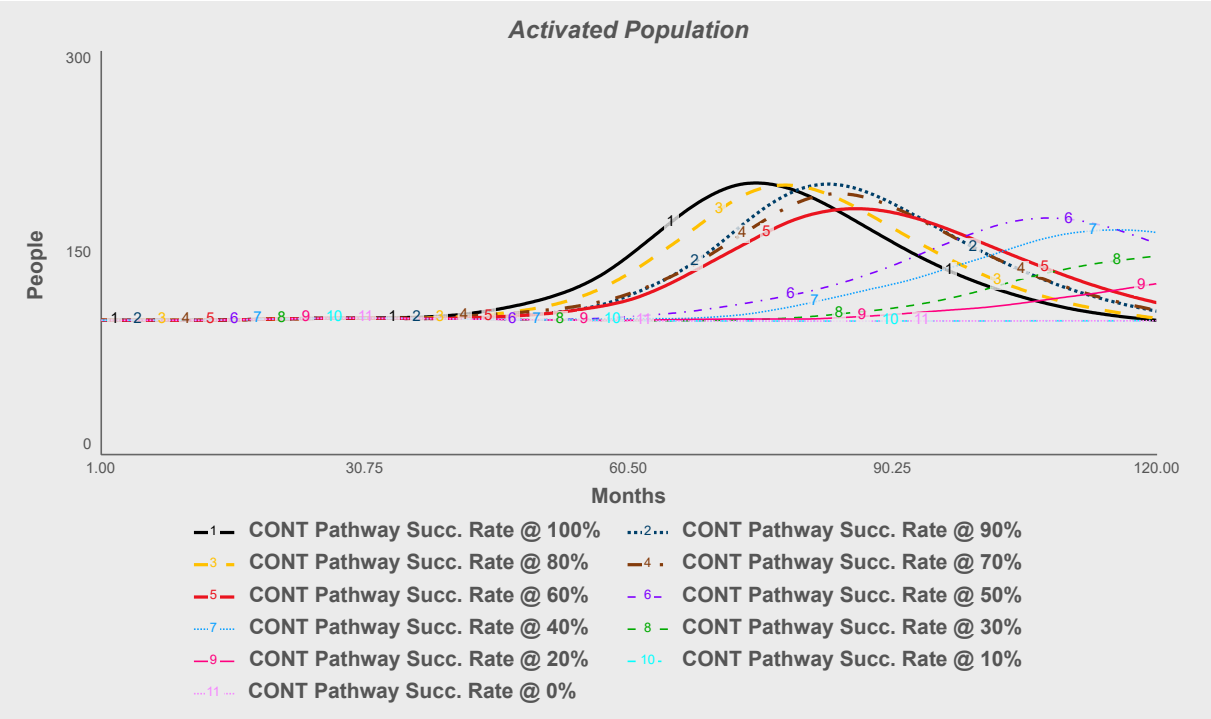
Undecided Population



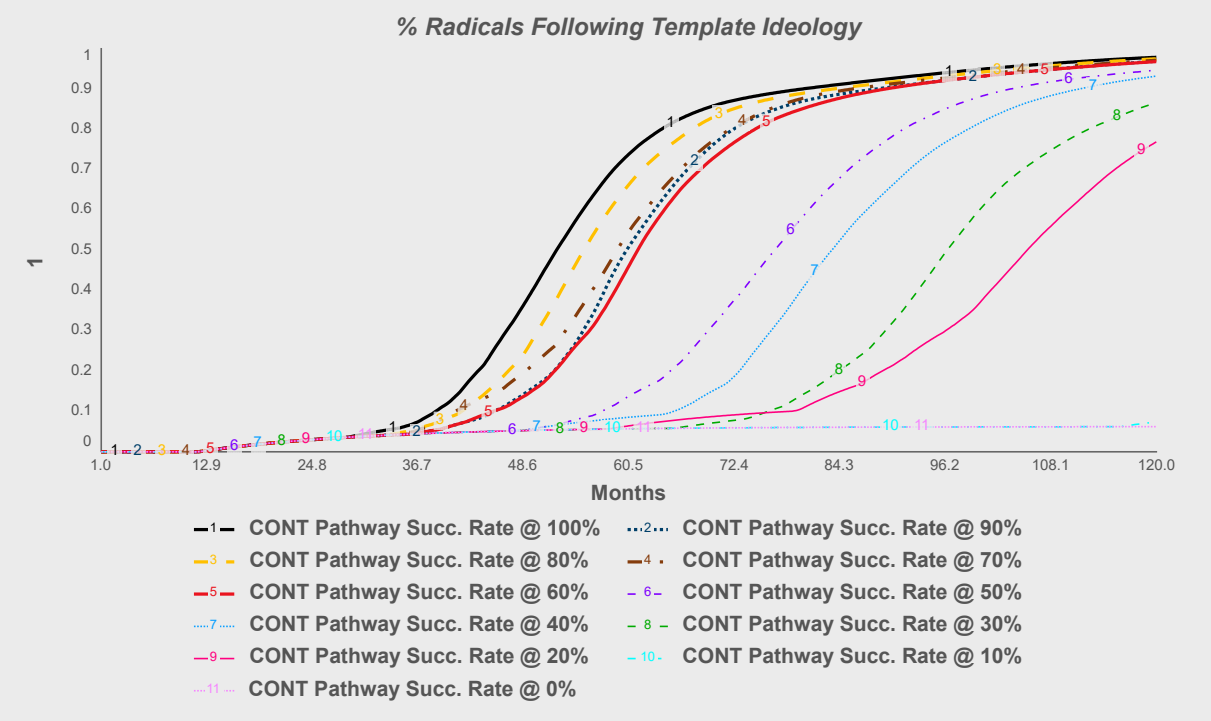
Radical Population



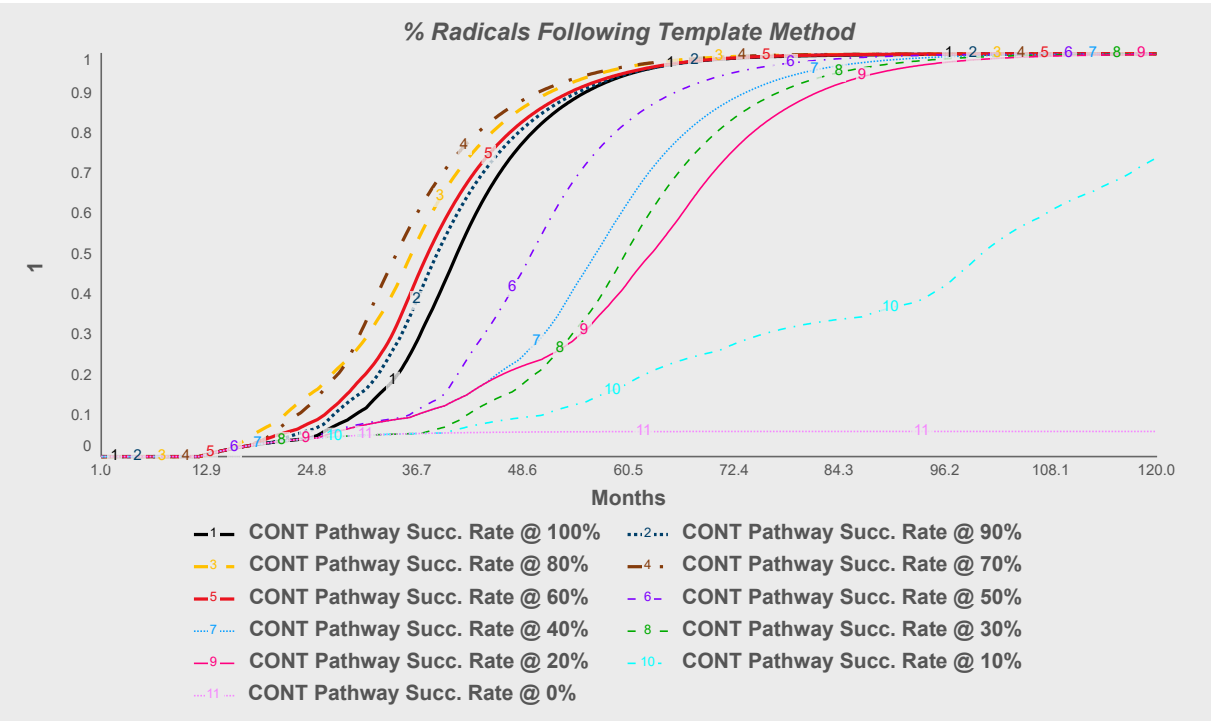
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

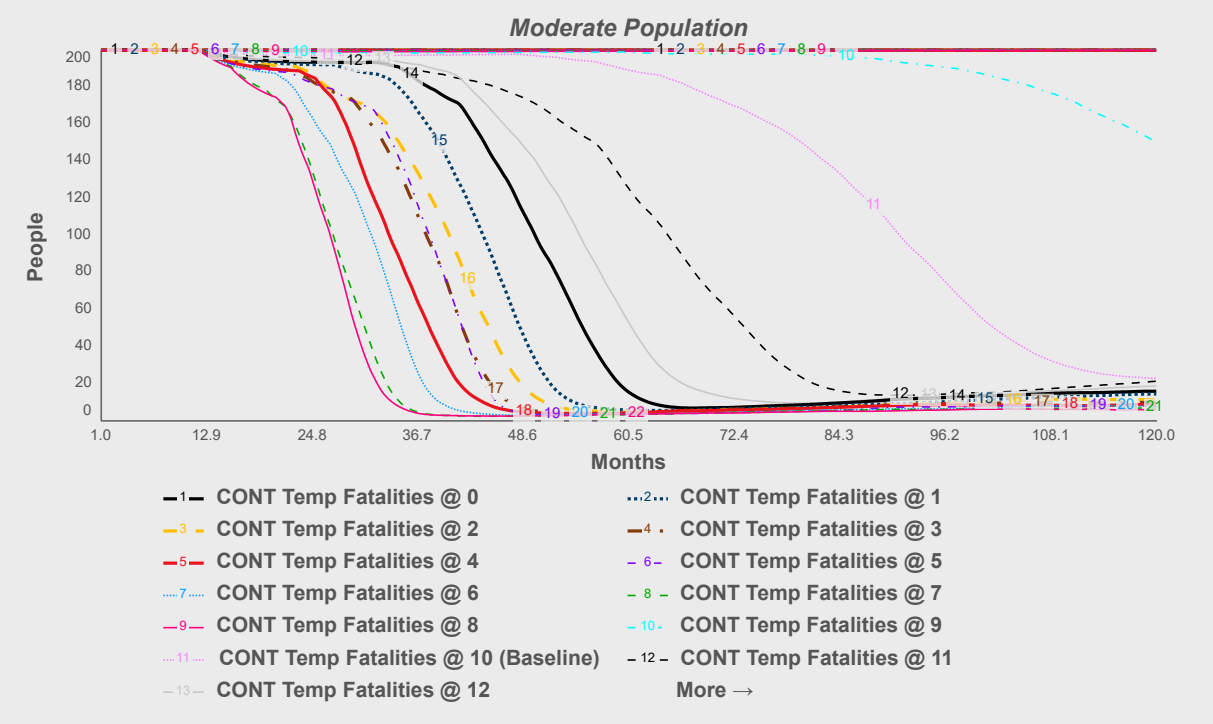
Proposition Pathway to Violence Success Rate			

Run	*Total Attempted Incidents*	*Failed Incidents*	*Total Contagion Incidents*
CONT Pathway Succ. Rate @ 100%: Model Testing Structure.ZCB Att Incidents Total	1540	665.1	695
CONT Pathway Succ. Rate @ 90%: Model Testing Structure.ZCB Att Incidents Total	1381	569.2	585
CONT Pathway Succ. Rate @ 80%: Model Testing Structure.ZCB Att Incidents Total	1227	480.6	576
CONT Pathway Succ. Rate @ 70%: Model Testing Structure.ZCB Att Incidents Total	1067	411	472
CONT Pathway Succ. Rate @ 60%: Model Testing Structure.ZCB Att Incidents Total	907	377.4	383
CONT Pathway Succ. Rate @ 50%: Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT Pathway Succ. Rate @ 40%: Model Testing Structure.ZCB Att Incidents Total	551	281	161
CONT Pathway Succ. Rate @ 30%: Model Testing Structure.ZCB Att Incidents Total	386	225.9	72
CONT Pathway Succ. Rate @ 20%: Model Testing Structure.ZCB Att Incidents Total	247	145.6	37
CONT Pathway Succ. Rate @ 10%: Model Testing Structure.ZCB Att Incidents Total	119	101.9	1
CONT Pathway Succ. Rate @ 0%: Model Testing Structure.ZCB Att Incidents Total	0	0	0

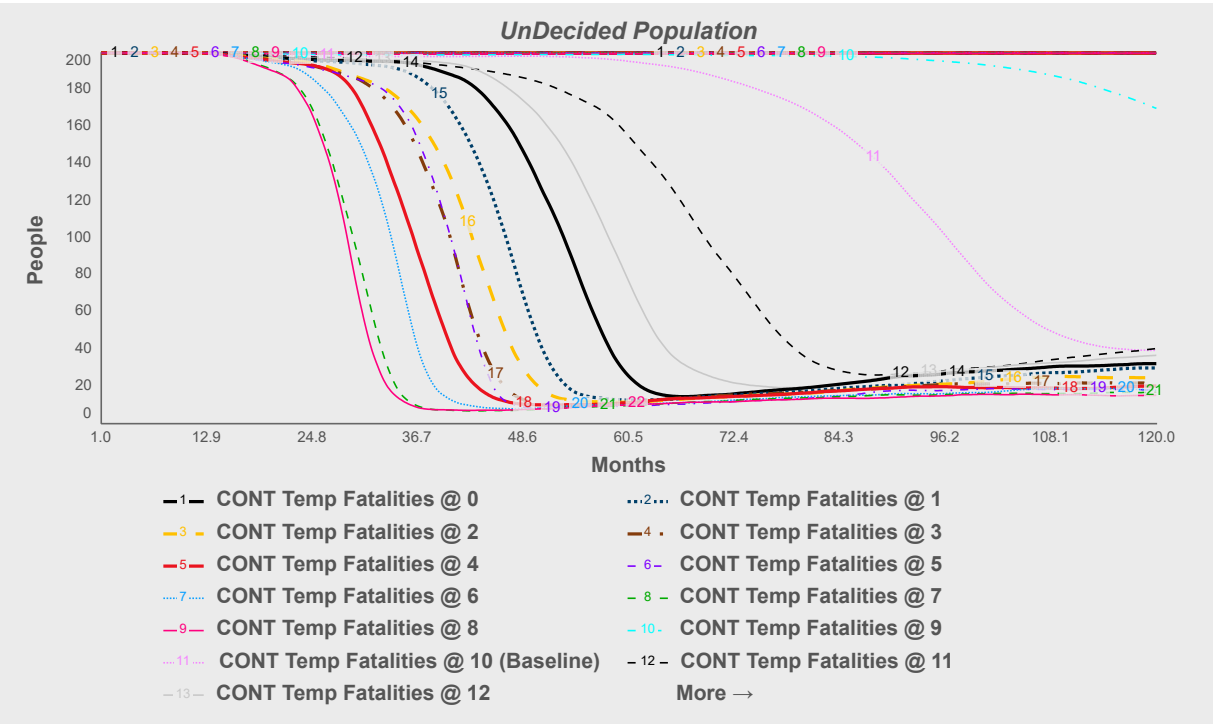
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-8.3 Proposition #17: Template Casualty Rates 0-21 Fatalities

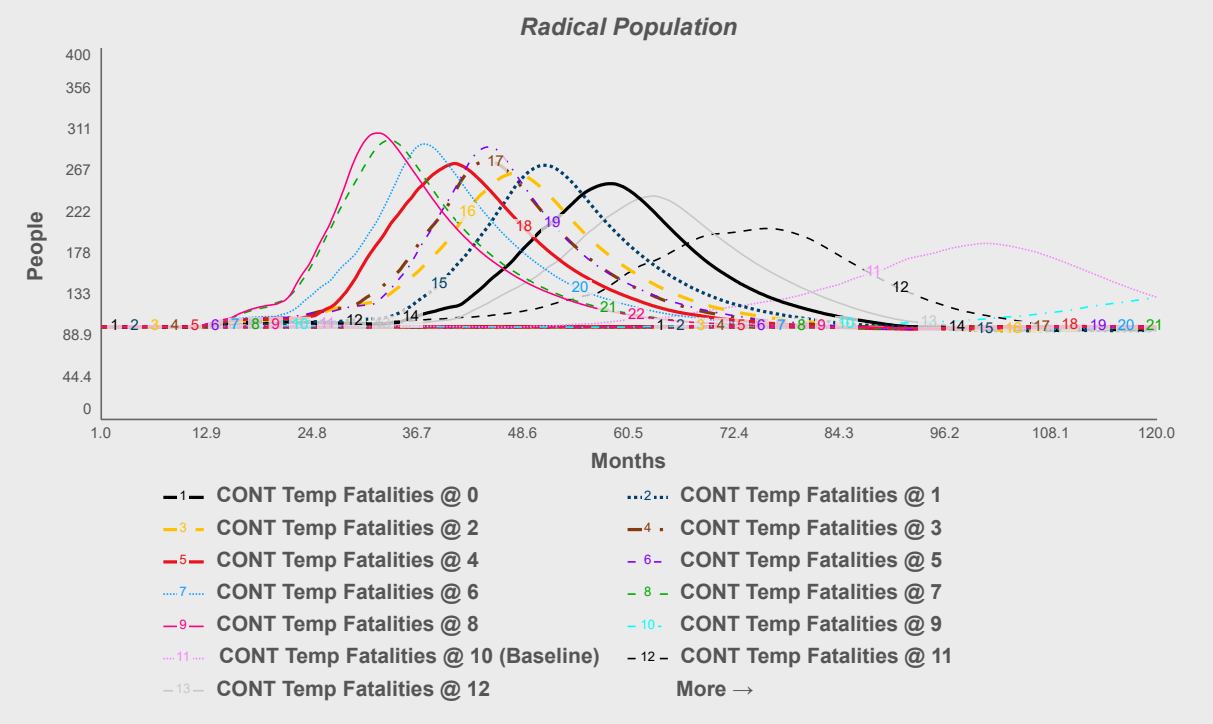
Moderate Population



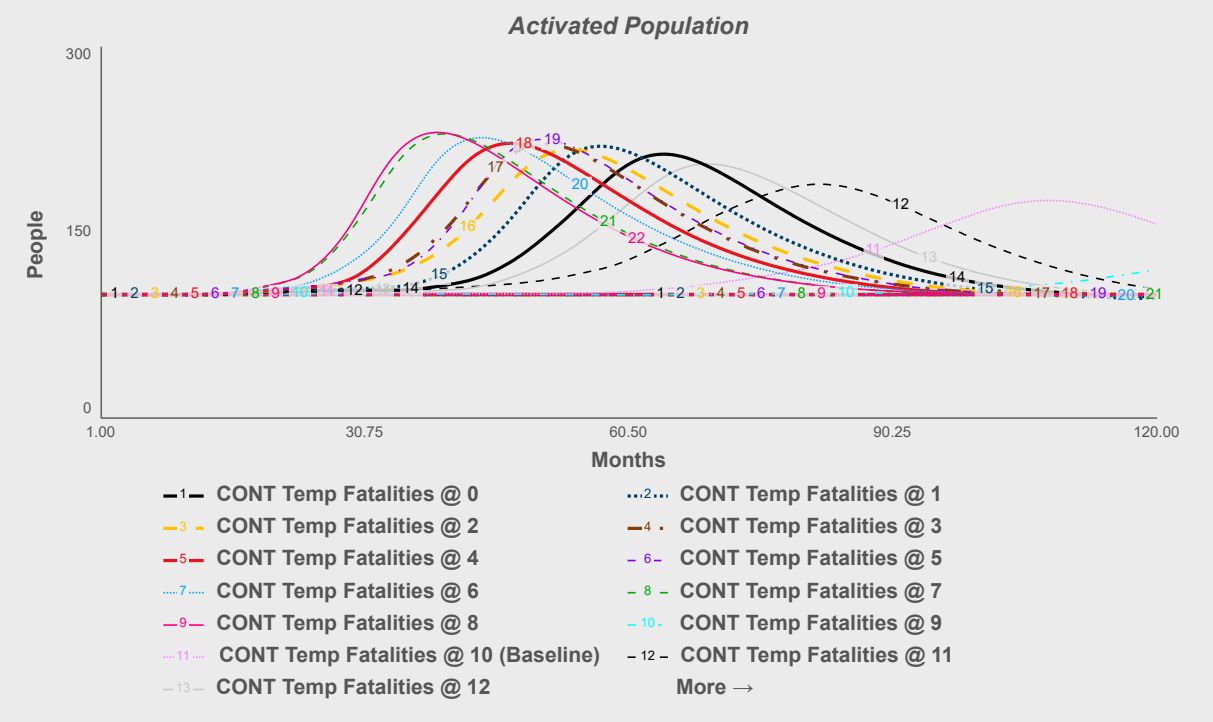
Undecided Population



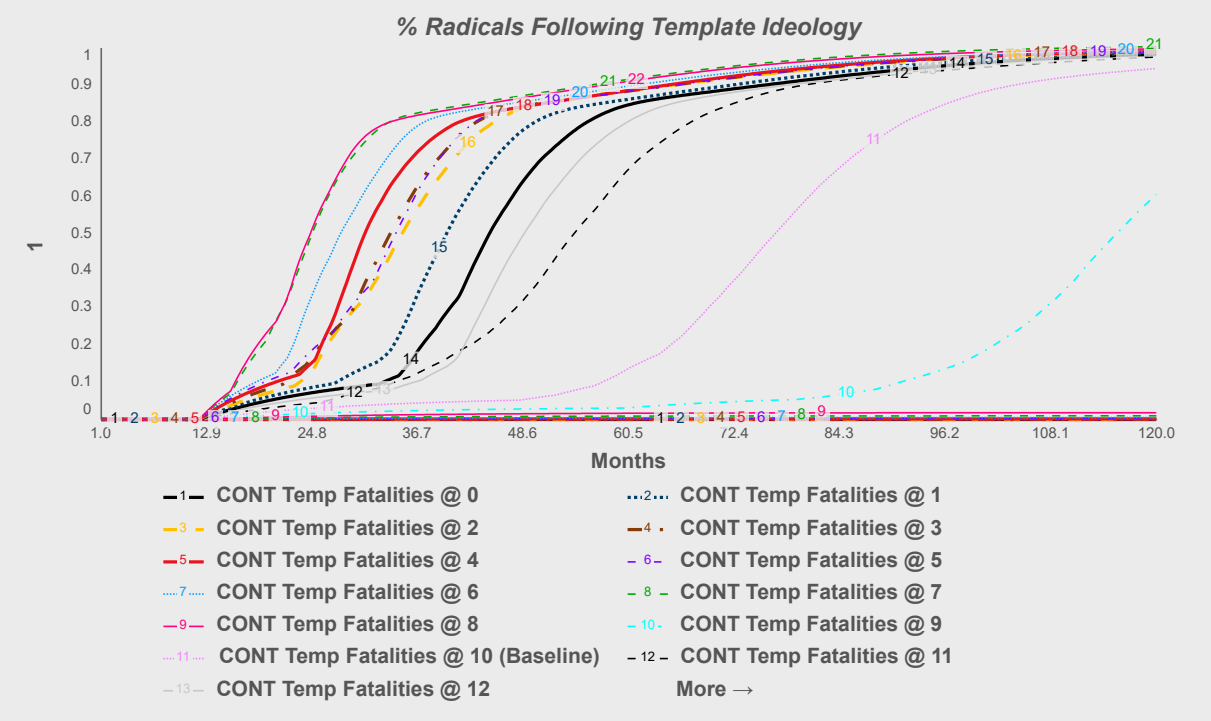
Radical Population



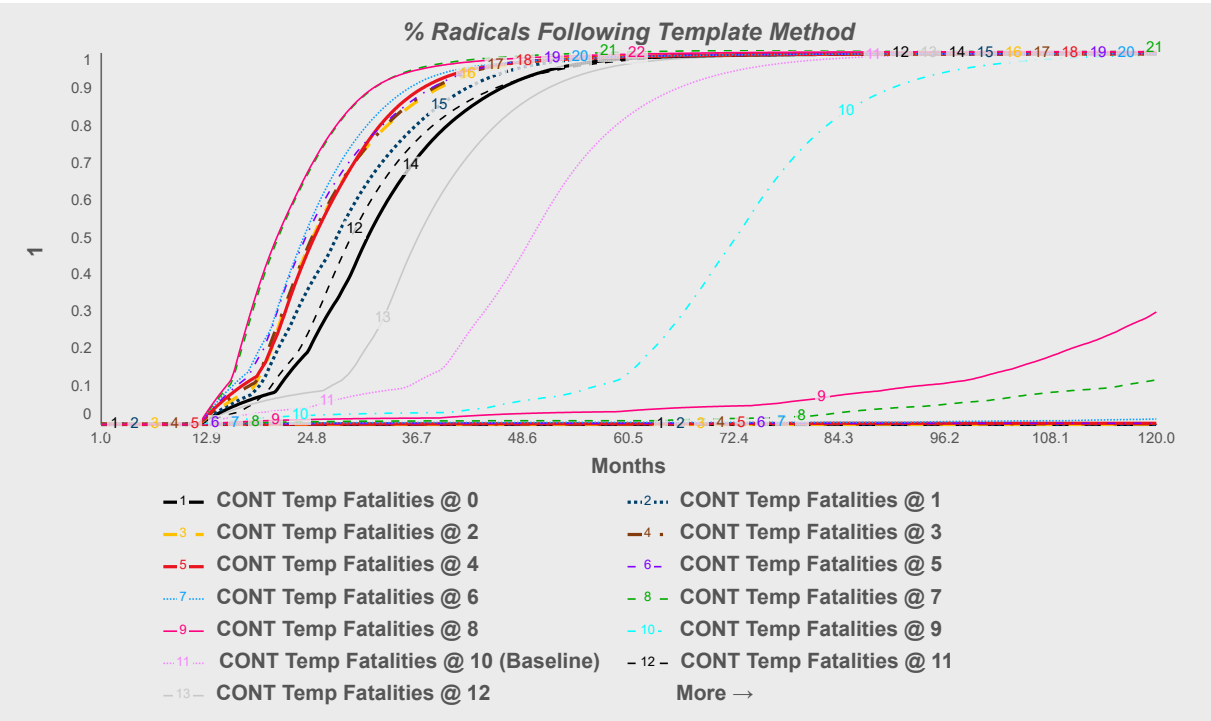
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

Template Average Fatalities			

Run	*Total Attempted Incidents*	*Failed Incidents*	*Total Contagion Incidents*
CONT Temp Fatalities @ 0: Model Testing Structure.ZCB Att Incidents Total	594	589.2	0
CONT Temp Fatalities @ 1: Model Testing Structure.ZCB Att Incidents Total	594	589.2	0
CONT Temp Fatalities @ 2: Model Testing Structure.ZCB Att Incidents Total	594	589.2	0
CONT Temp Fatalities @ 3: Model Testing Structure.ZCB Att Incidents Total	594	588.2	0
CONT Temp Fatalities @ 4: Model Testing Structure.ZCB Att Incidents Total	594	588.2	0
CONT Temp Fatalities @ 5: Model Testing Structure.ZCB Att Incidents Total	594	589.2	0
CONT Temp Fatalities @ 6: Model Testing Structure.ZCB Att Incidents Total	594	584.4	0
CONT Temp Fatalities @ 7: Model Testing Structure.ZCB Att Incidents Total	595	574.2	0
CONT Temp Fatalities @ 8: Model Testing Structure.ZCB Att Incidents Total	595	566.3	0
CONT Temp Fatalities @ 9: Model Testing Structure.ZCB Att Incidents Total	608	398.3	48
CONT Temp Fatalities @ 10 (Baseline): Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT Temp Fatalities @ 11: Model Testing Structure.ZCB Att Incidents Total	764	280.7	347
CONT Temp Fatalities @ 12: Model Testing Structure.ZCB Att Incidents Total	770	303.8	377
CONT Temp Fatalities @ 13: Model Testing Structure.ZCB Att Incidents Total	772	289	392
CONT Temp Fatalities @ 14: Model Testing Structure.ZCB Att Incidents Total	775	271.1	429
CONT Temp Fatalities @ 15: Model Testing Structure.ZCB Att Incidents Total	777	248.5	439
CONT Temp Fatalities @ 16: Model Testing Structure.ZCB Att Incidents Total	779	270.7	432
CONT Temp Fatalities @ 17: Model Testing Structure.ZCB Att Incidents Total	781	279.1	432
CONT Temp Fatalities @ 18: Model Testing Structure.ZCB Att Incidents Total	781	263	434
CONT Temp Fatalities @ 19: Model Testing Structure.ZCB Att Incidents Total	782	271.1	444

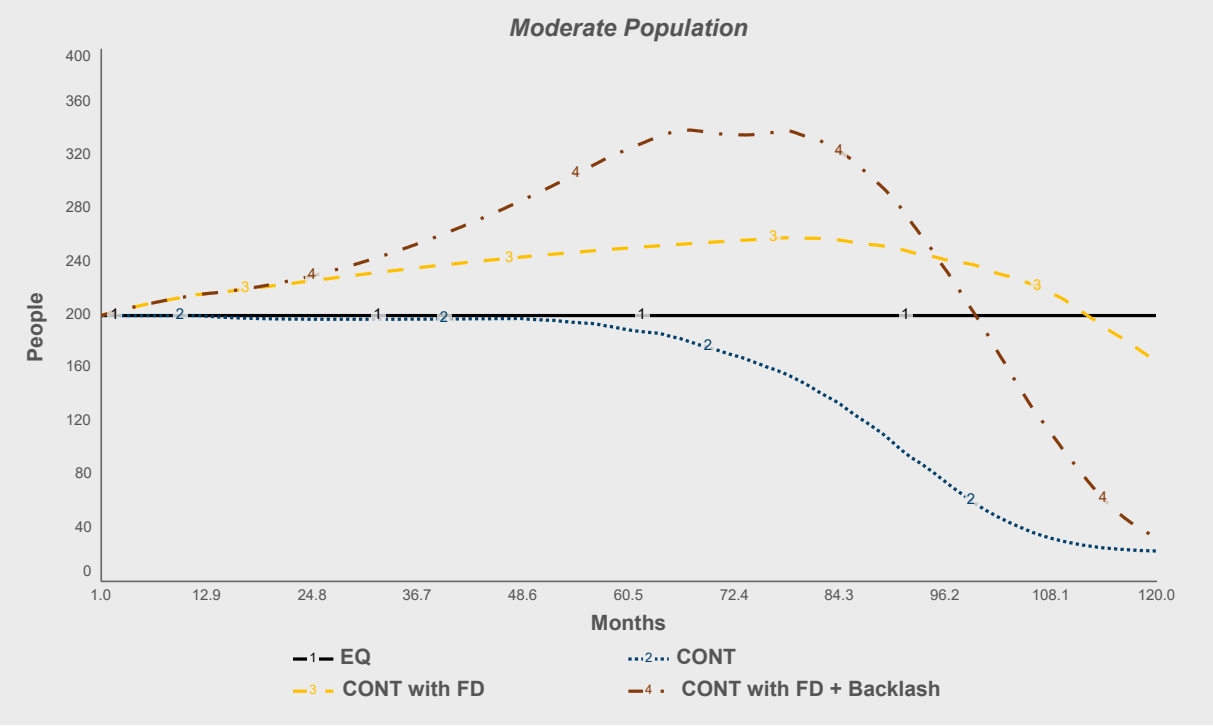
CONT Temp Fatalities @ 20: Model Testing Structure.ZCB Att Incidents Total	783	249	477
CONT Temp Fatalities @ 21: Model Testing Structure.ZCB Att Incidents Total	784	247.2	464

Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

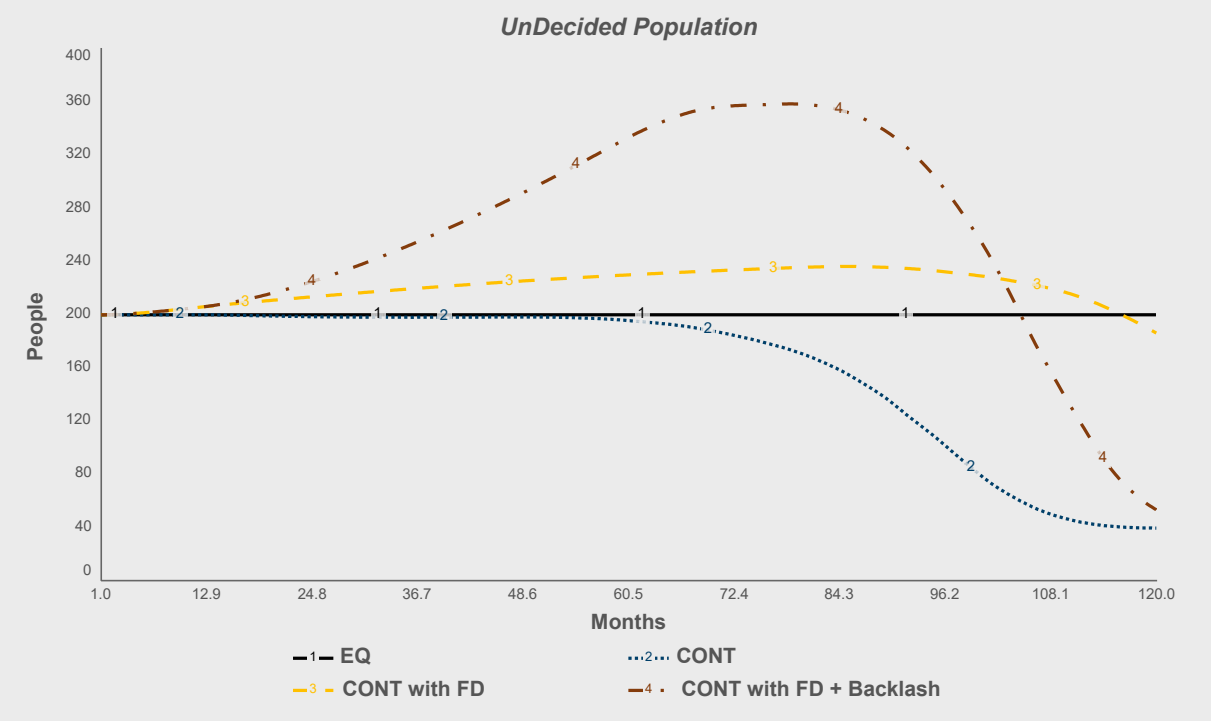
D-9 POLICY ANALYSIS

D-9.1 Policy Test Focused Deterrence (FD) and FD with Backlash

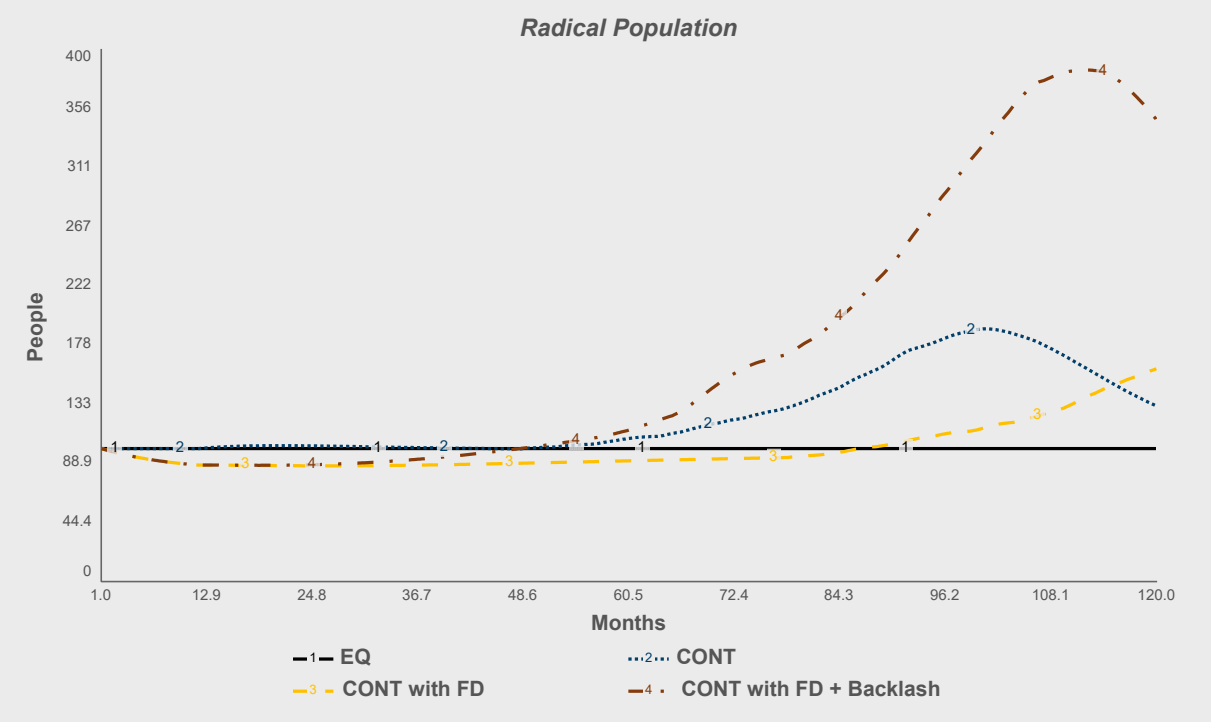
Moderate Population



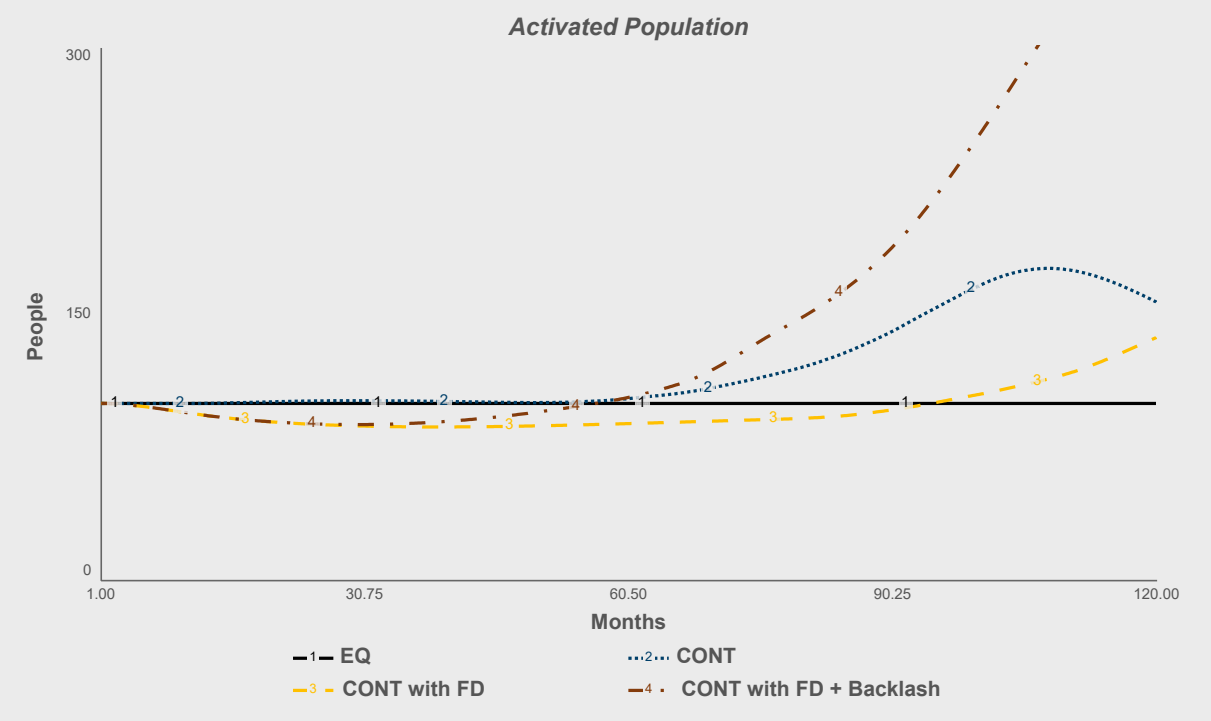
Undecided Population



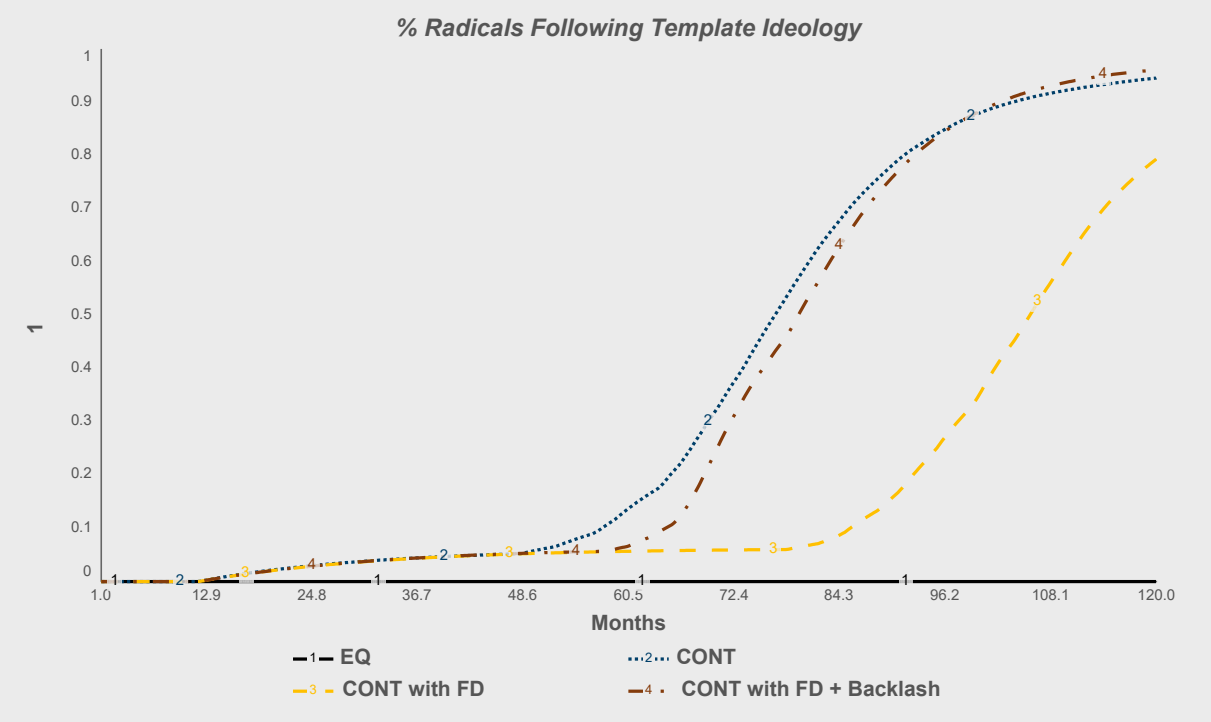
Radical Population



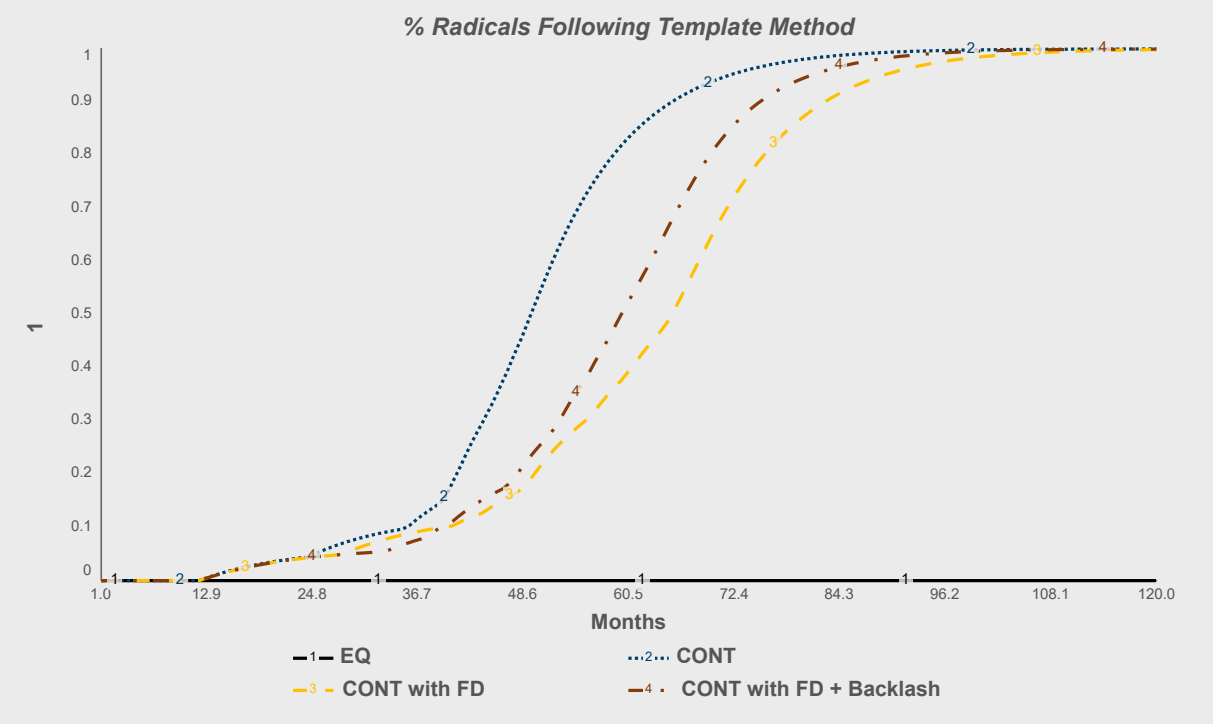
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

Run	*Total Attempted Incidents*	*Failed Incidents*	*Total Contagion Incidents*
EQ: Model Testing Structure.ZCB Att Incidents Total	118	117.2	0
CONT : Model Testing Structure.ZCB Att Incidents Total	719	342.4	234
CONT with FD: Model Testing Structure.ZCB Att Incidents Total	456	307	52
CONT with FD + Backlash: Model Testing Structure.ZCB Att Incidents Total	723	397.4	238

Statistics

FD POLICY RUNS

Descriptive Statistics for Focused Deterrence Policy Analysis. ATT = Attempts, Fails = Failures, TCONT = Terror Contagion Incidents.

Table 10: Descriptive Statistics for Focused Deterrence Policy Analysis.

Variable	Mean	Minimum	Maximum

(CONT)Att	726.44	620.00	756.00
(CONT)Fails	318.25	264.60	405.90
(CONT)TCont	259.82	57.00	372.00
(CONT)ICont	259.82	57.00	372.00
(CONT)Vic	2598.2	570.0	3720.0
(CONTFD)Att	468.50	434.00	559.00
(CONTFD)Fails	305.74	257.90	400.80
(CONTFD)TCont	65.34	3.00	211.00
(CONTFD)ICont	65.34	3.00	211.00
(CONTFD)Vic	653.5	30.0	2110.0
(CONTFDB)Att	654.48	542.00	786.00
(CONTFDB)Fails	380.83	313.10	467.40
(CONTFDB)TCont	157.55	7.00	318.00
(CONTFDB)ICont	157.55	7.00	318.00
(CONTFDB)Vic	1575.5	70.0	3180.0

FD POLICY RUNS

One-Way ANOVA for effect of Focused Deterrence Policies on Terror Contagion Incidents.

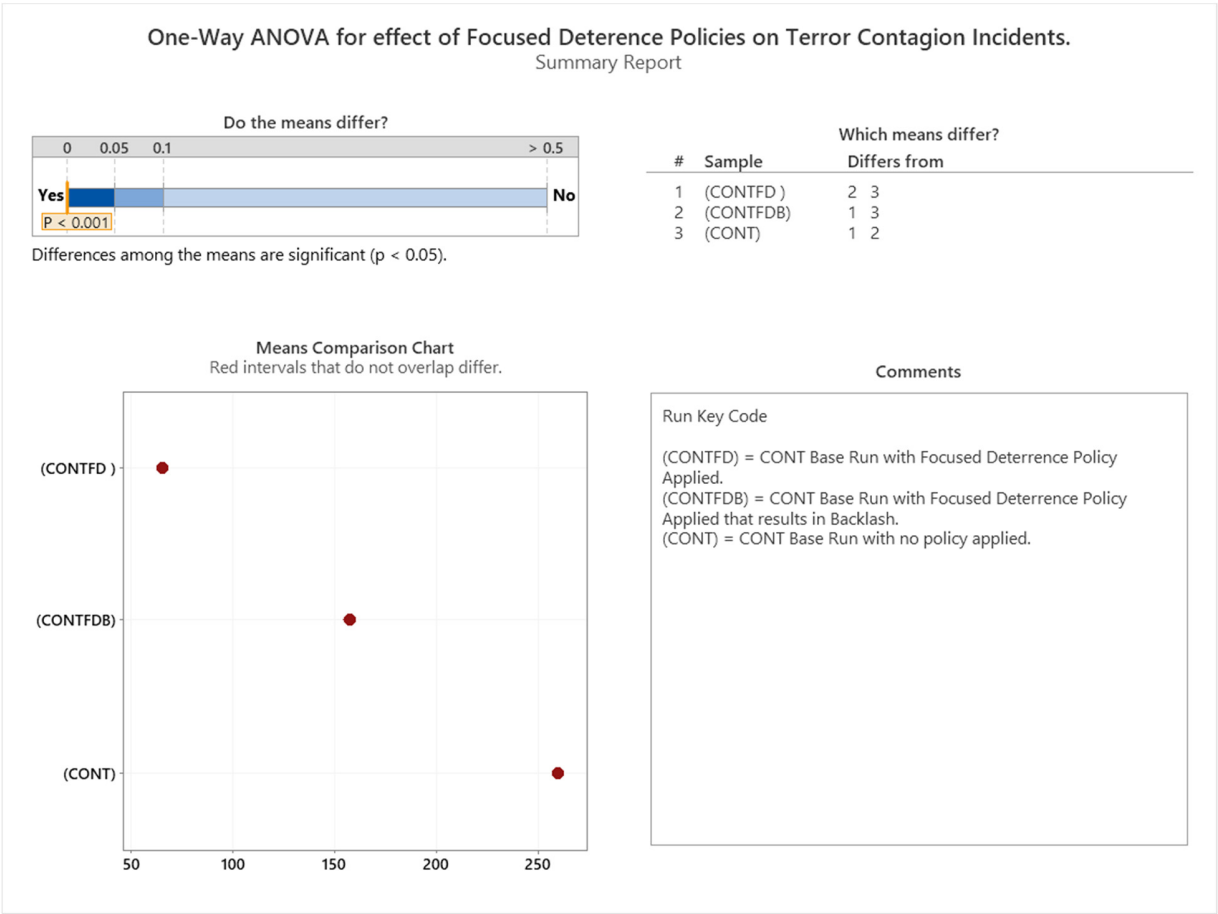


Figure 47: One Way ANOVA for Focused Deterrence Policies Summary Report.

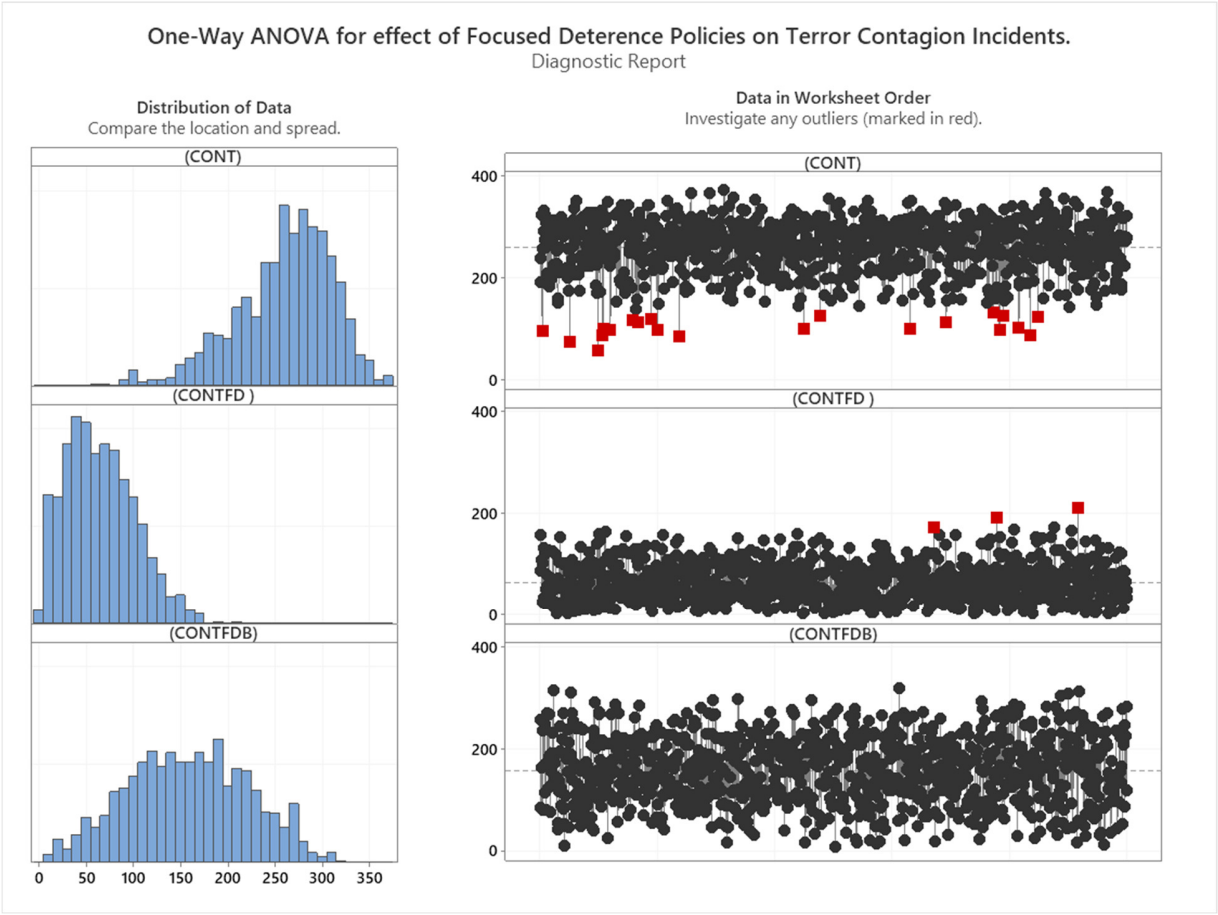
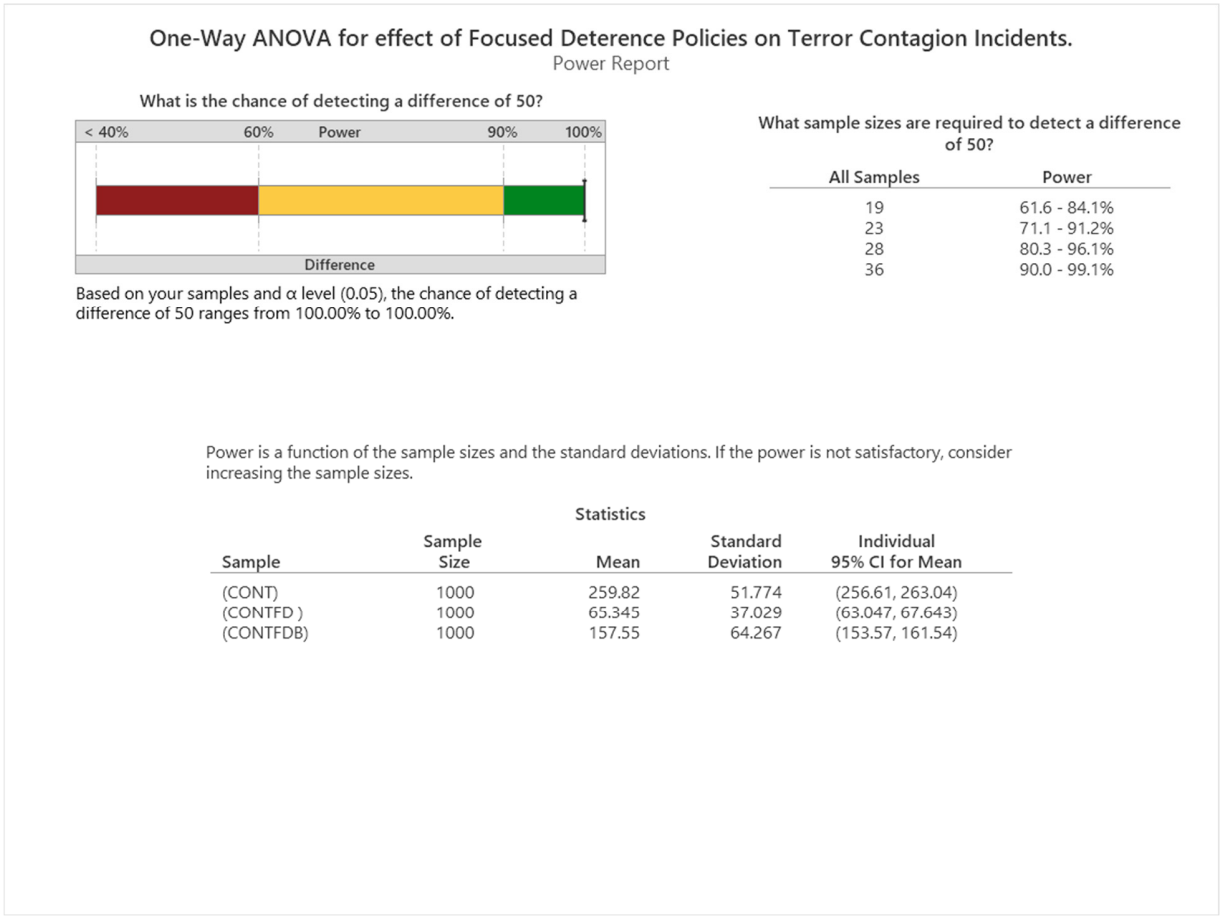


Figure 48: One Way ANOVA for Focused Deterrence Policies Diagnostic Report.



One-Way ANOVA for effect of Focused Deterence Policies on Terror Contagion Incidents.

Power Report

What is the chance of detecting a difference of 50?

< 40% | 60% | Power | 90% | 100%

Difference

Based on your samples and α level (0.05), the chance of detecting a difference of 50 ranges from 100.00% to 100.00%.

What sample sizes are required to detect a difference of 50?

All Samples	Power
19	61.6 - 84.1%
23	71.1 - 91.2%
28	80.3 - 96.1%
36	90.0 - 99.1%

Power is a function of the sample sizes and the standard deviations. If the power is not satisfactory, consider increasing the sample sizes.

Statistics

Sample	Sample Size	Mean	Standard Deviation	Individual 95% CI for Mean
(CONT)	1000	259.82	51.774	(256.61, 263.04)
(CONTFD)	1000	65.345	37.029	(63.047, 67.643)
(CONTFDB)	1000	157.55	64.267	(153.57, 161.54)

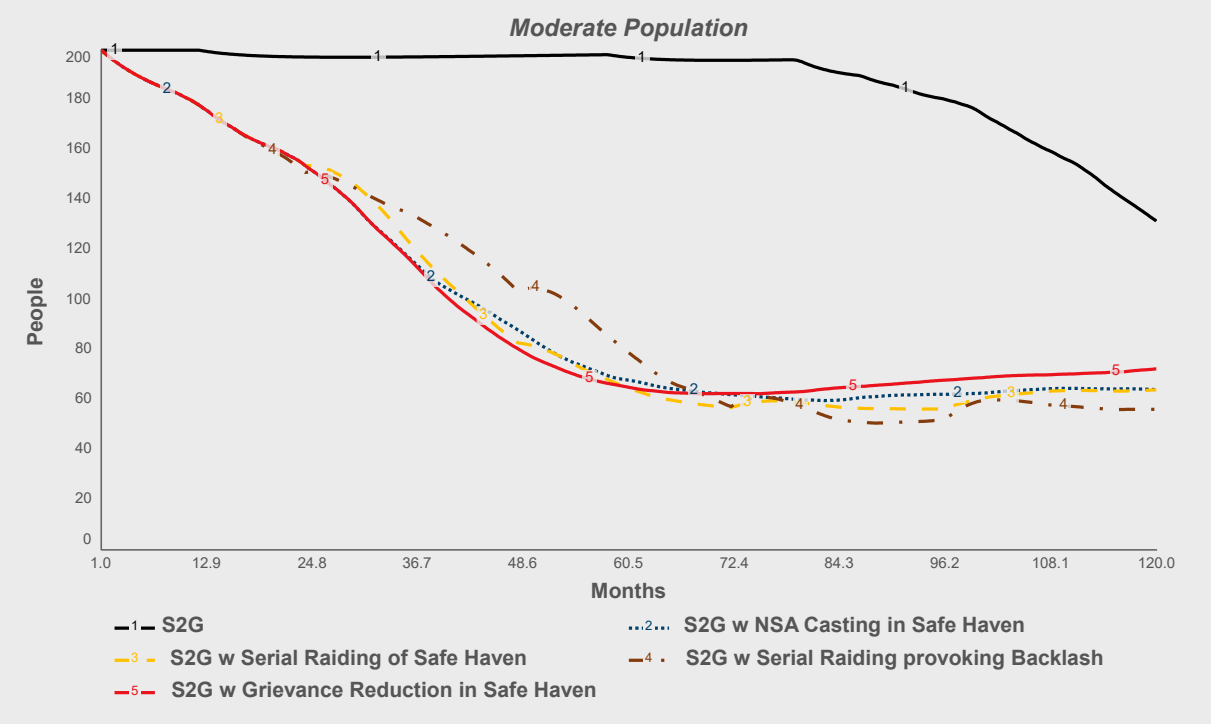
Figure 49: One Way ANOVA for Focused Deterrence Policies Power Report.

Figure 50: One Way ANOVA for Focused Deterrence Policies Report Card.

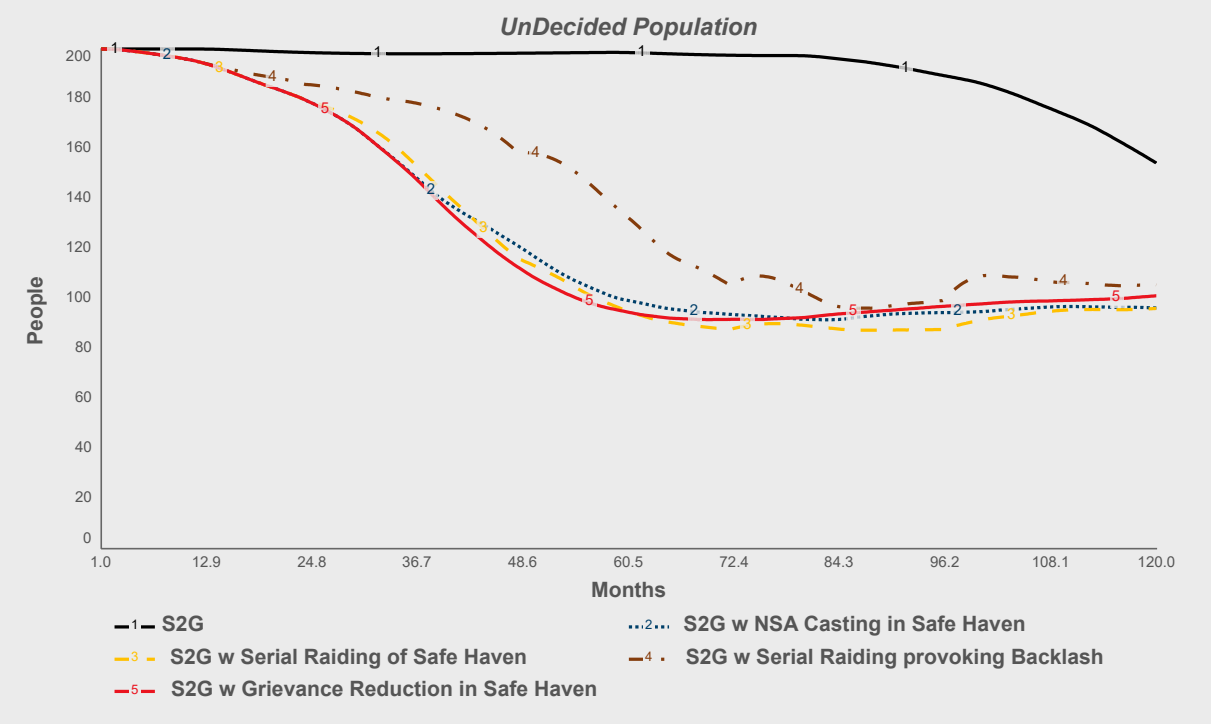
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-9.2 Safe Haven Runs for Policy Analysis

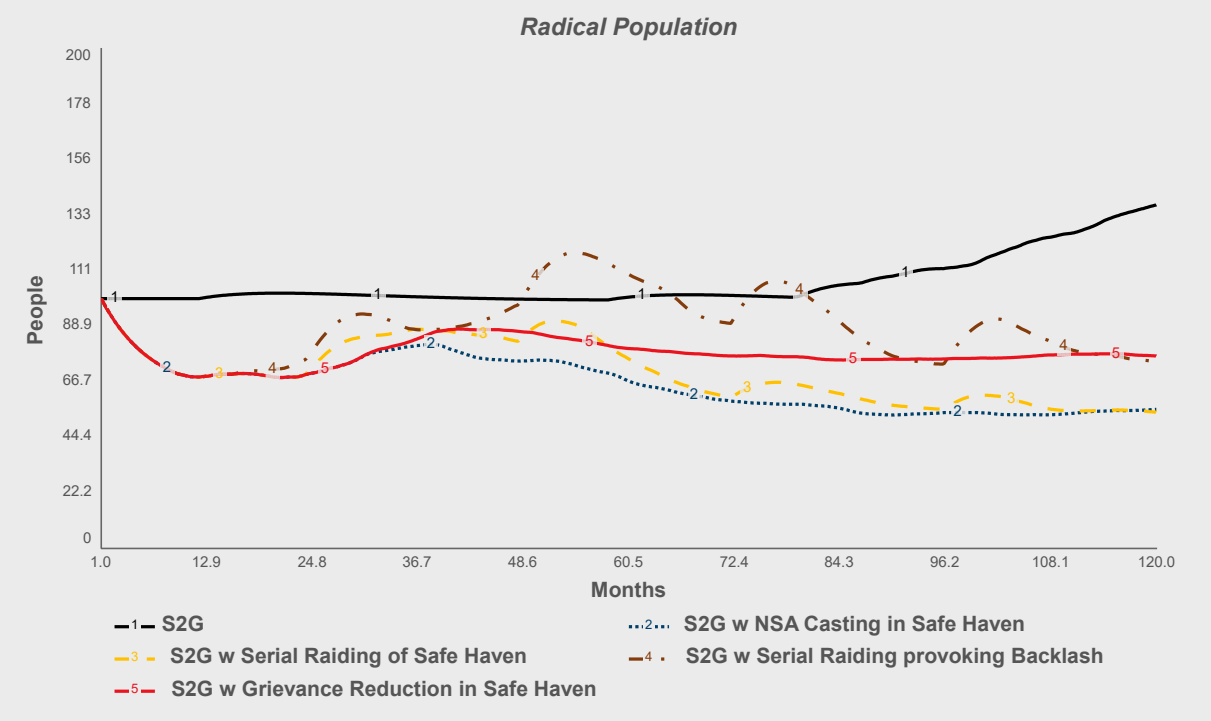
Moderate Population



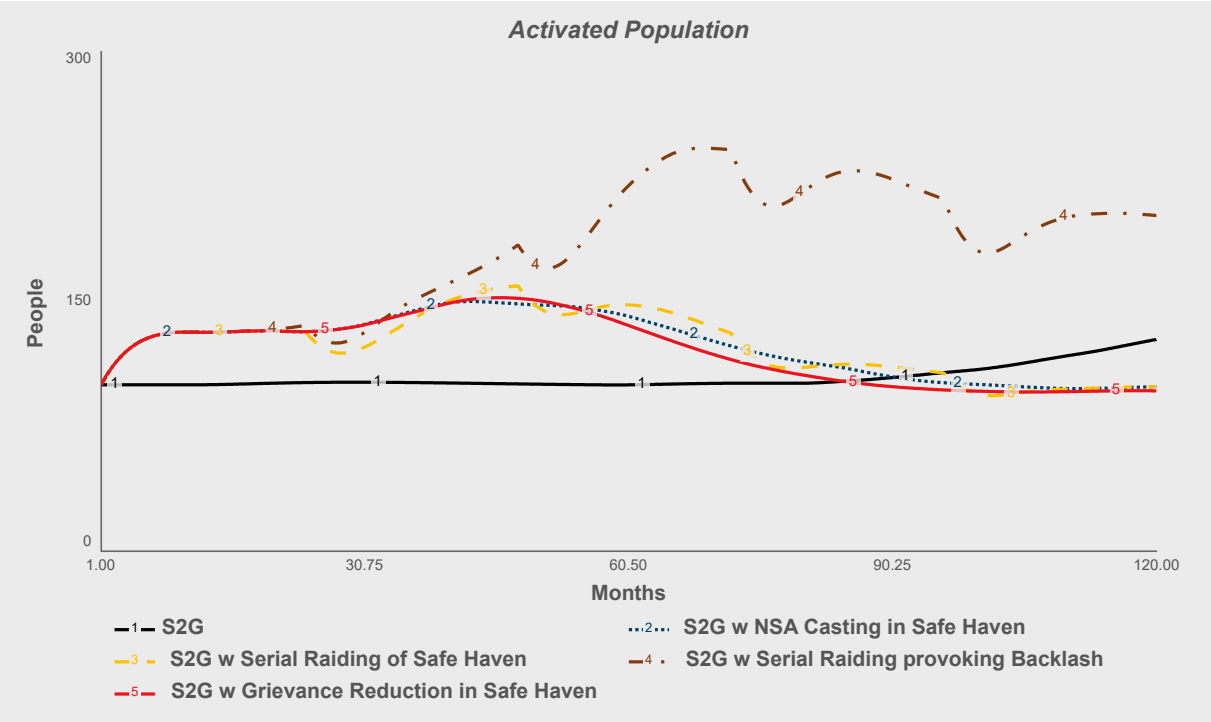
Undecided Population



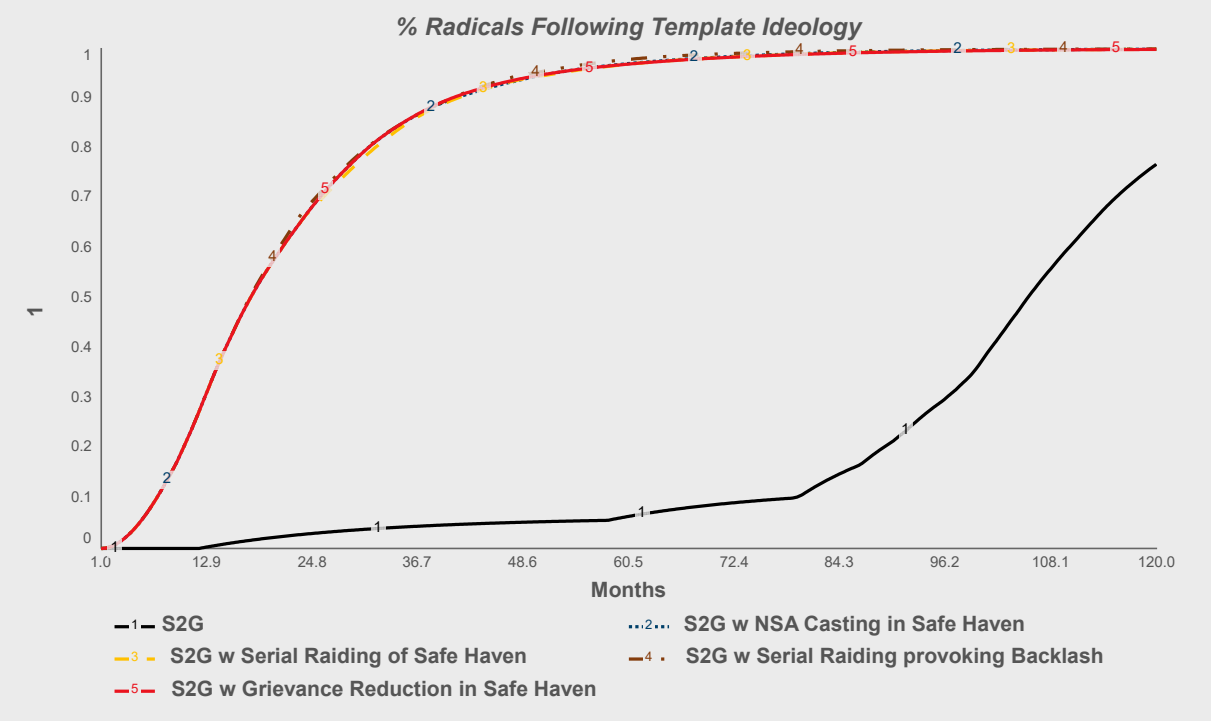
Radical Population



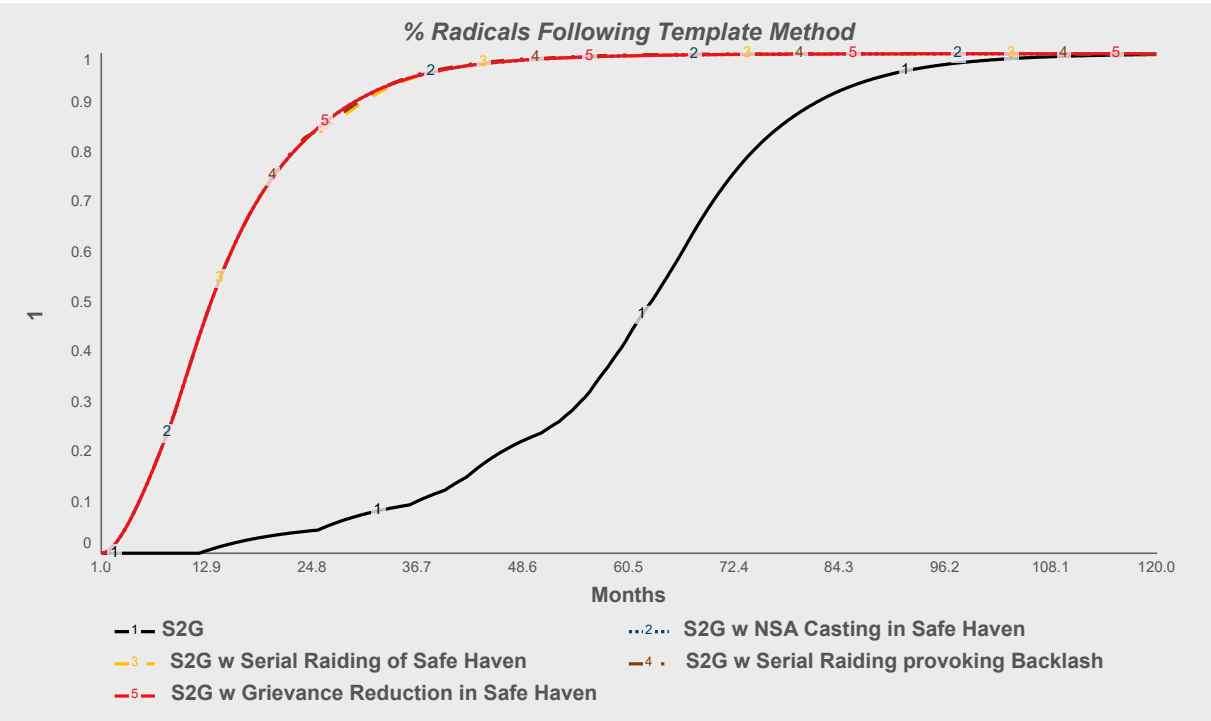
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Statistics

SH POLICY RUNS

Descriptive Statistics for Safe Haven Intervention Policy Analysis. ATT = Attempts, Fails = Failures, and TCONT = Terror Contagion Incidents

Table 11: Descriptive Statistics for Safe Haven Policy Analysis.

Variable	Mean	Minimum	Maximum
(S2G)Att	245.43	238.00	271.00
(S2G)Fails	146.29	100.80	235.60
(S2G)TCont	27.731	0.000	105.000
(S2GSH)Att	295.38	293.00	297.00
(S2GSH)Fails	88.130	63.600	110.600
(S2GSH)TCont	184.82	157.00	210.00
(S2GSH wR)Att	294.29	291.00	296.00
(S2GSH wR)Fails	87.855	62.700	112.600
(S2GSH wR)TCont	183.85	153.00	204.00
(S2GSH wR+B)Att	431.46	428.00	434.00
(S2GSH wR+B)Fails	115.39	86.60	140.60
(S2GSH wR+B)TCont	293.69	265.00	325.00
(S2GSH+GR)Att	287.11	283.00	290.00
(S2GSH+GR)Fails	86.215	62.600	107.200
(S2GSH+GR)TCont	178.26	157.00	201.00

SH POLICY RUNS

One-Way ANOVA for effect of Safe Haven Intervention Policies on Terror Contagion Incidents.

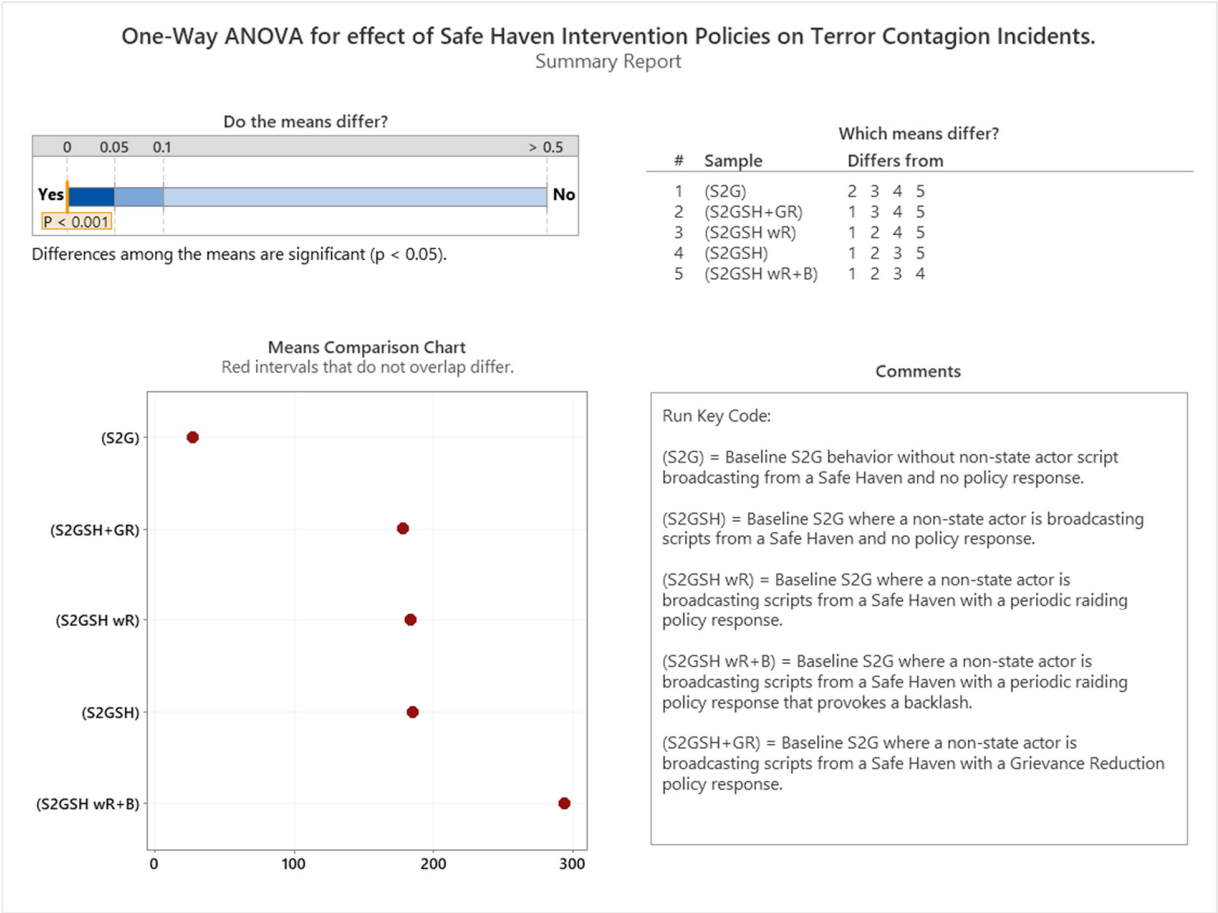


Figure 51: One Way ANOVA for Safe Haven Intervention Policies Summary Report.

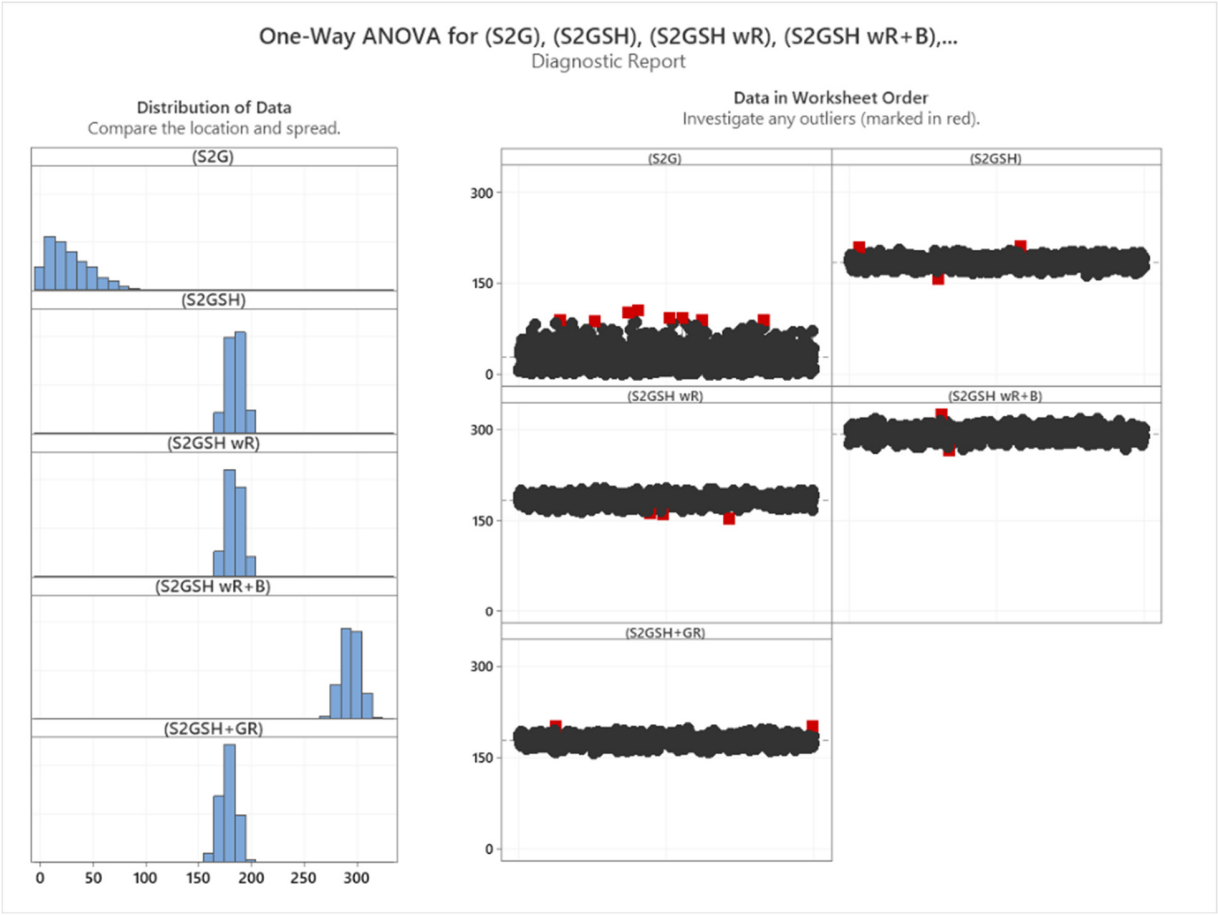
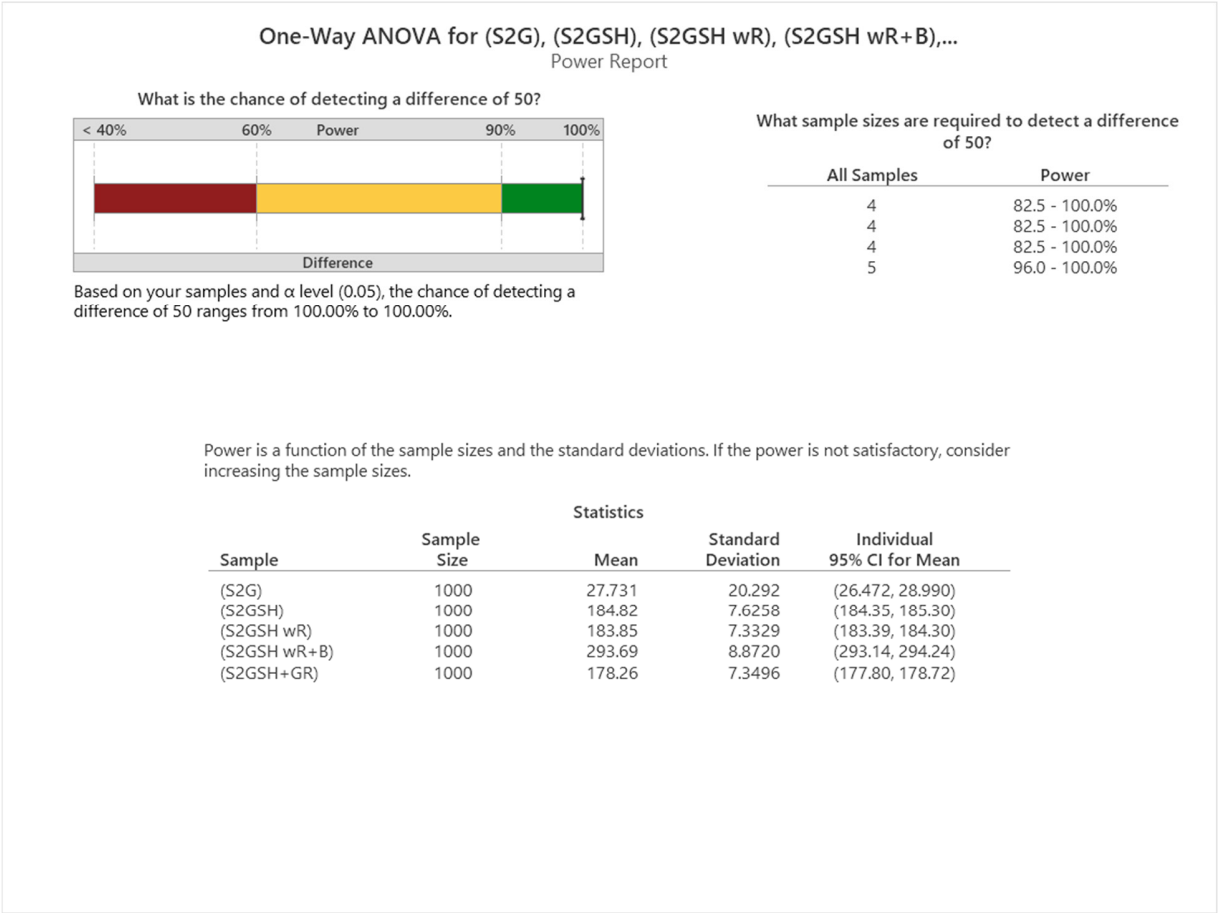


Figure 52: One Way ANOVA for Safe Haven Intervention Policies Diagnostic Report



One-Way ANOVA for (S2G), (S2GSH), (S2GSH wR), (S2GSH wR+B),...
Power Report

What is the chance of detecting a difference of 50?

< 40% | 60% | Power | 90% | 100%

Difference

Based on your samples and α level (0.05), the chance of detecting a difference of 50 ranges from 100.00% to 100.00%.

What sample sizes are required to detect a difference of 50?

All Samples	Power
4	82.5 - 100.0%
4	82.5 - 100.0%
4	82.5 - 100.0%
5	96.0 - 100.0%

Power is a function of the sample sizes and the standard deviations. If the power is not satisfactory, consider increasing the sample sizes.

Statistics

Sample	Sample Size	Mean	Standard Deviation	Individual 95% CI for Mean
(S2G)	1000	27.731	20.292	(26.472, 28.990)
(S2GSH)	1000	184.82	7.6258	(184.35, 185.30)
(S2GSH wR)	1000	183.85	7.3329	(183.39, 184.30)
(S2GSH wR+B)	1000	293.69	8.8720	(293.14, 294.24)
(S2GSH+GR)	1000	178.26	7.3496	(177.80, 178.72)

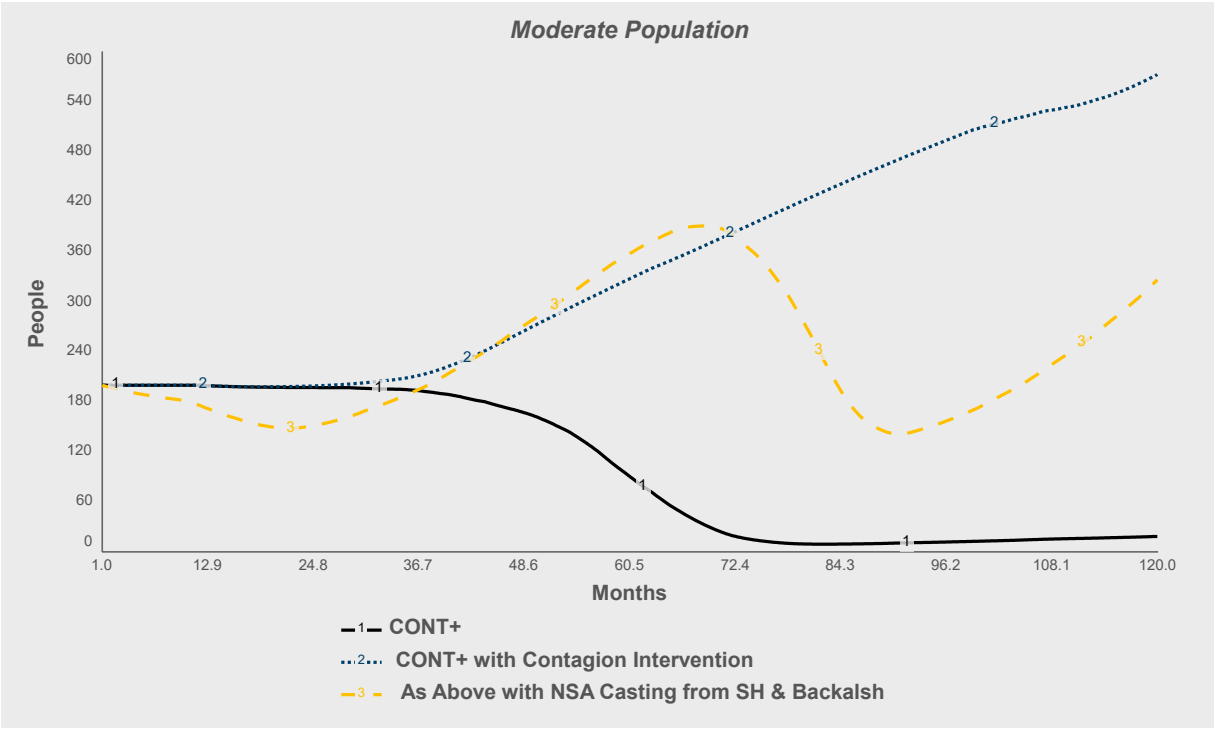
Figure 53: One Way ANOVA for Safe Haven Intervention Policies Power Report.

Figure 54: One Way ANOVA for Safe Haven Intervention Policies Report Card.

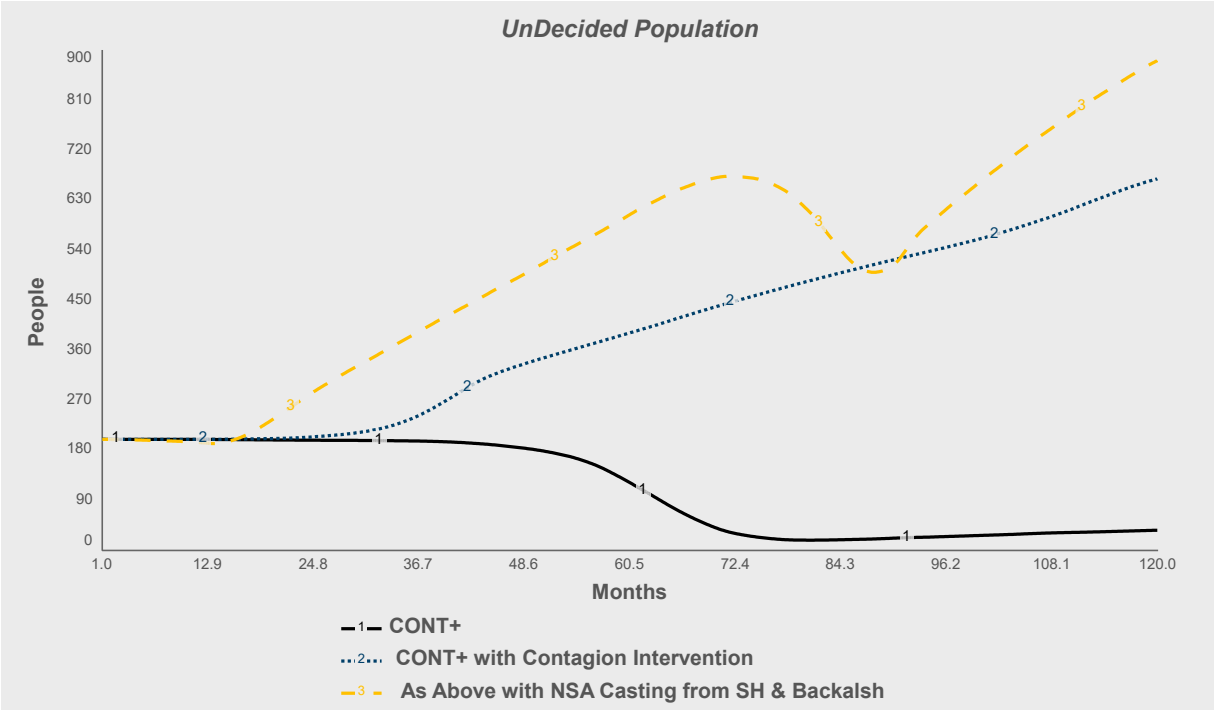
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

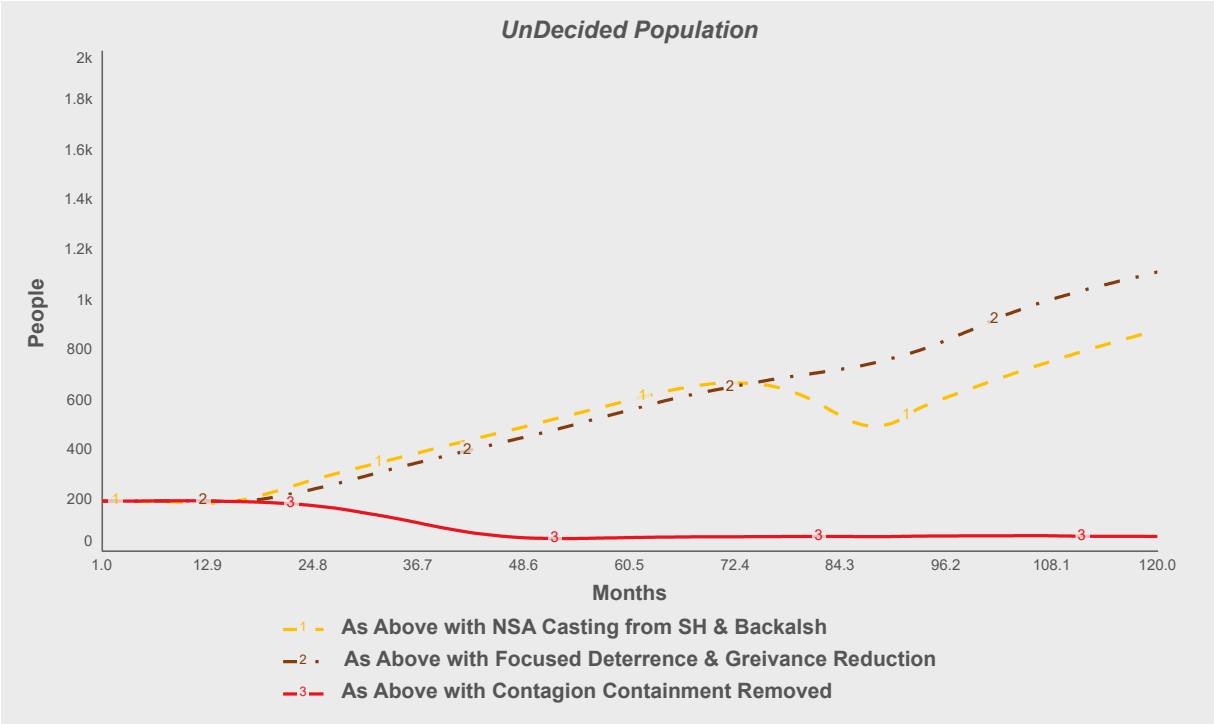
D-9.3 Contagion Containment Policy Tests

Moderate Population

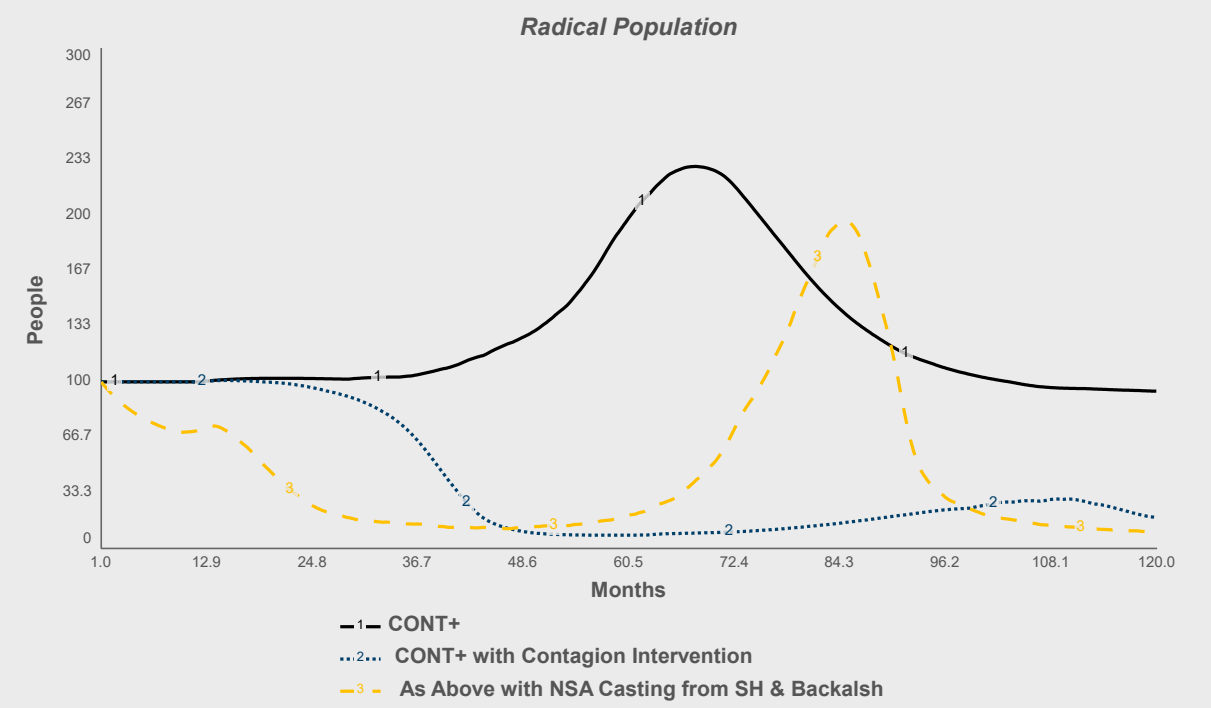


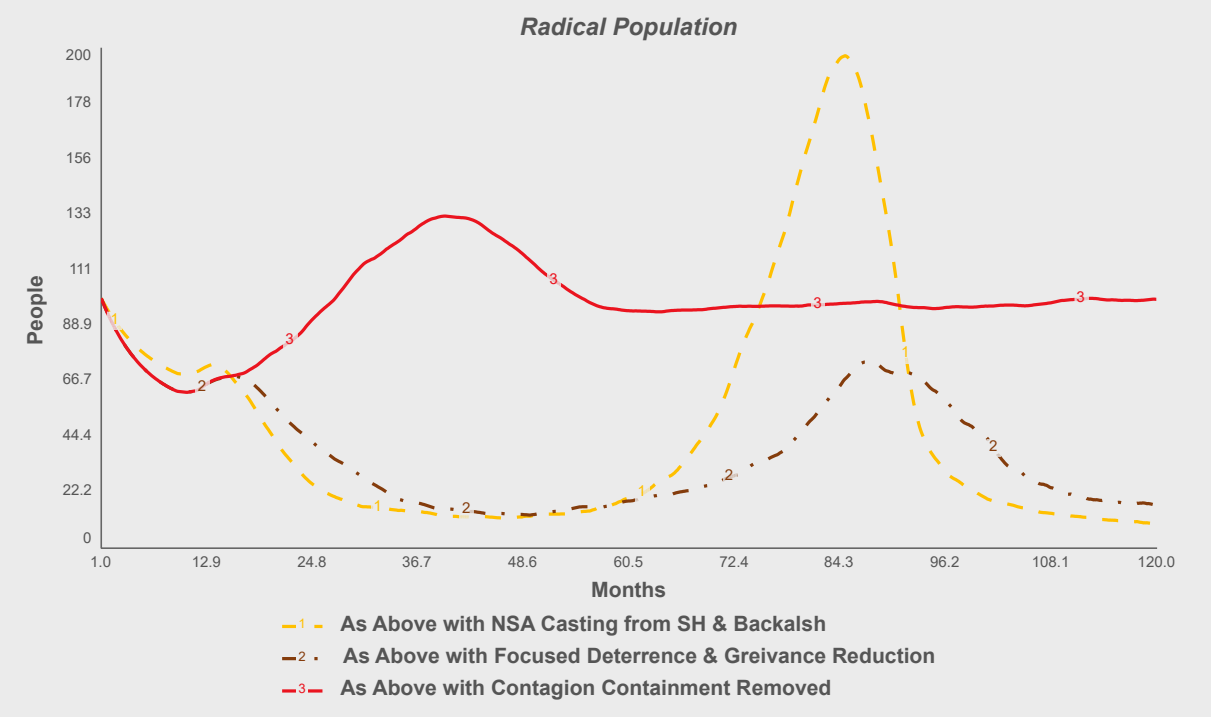
Undecided Population



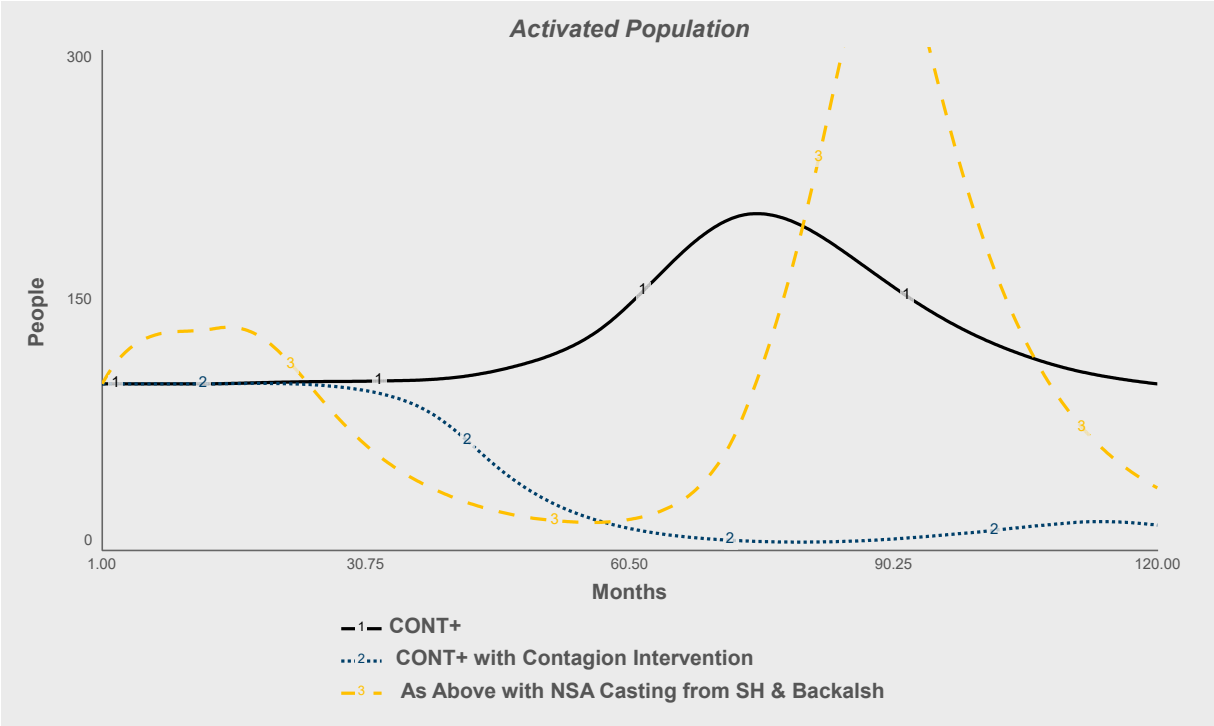


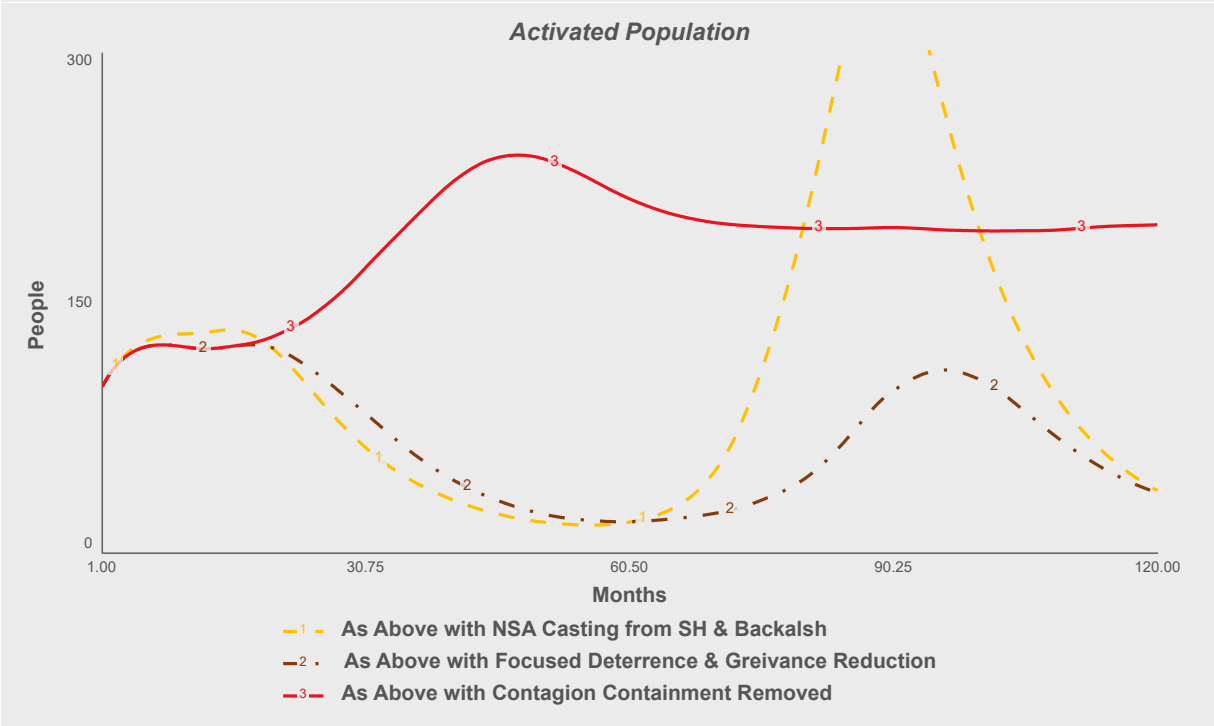
Radical Population



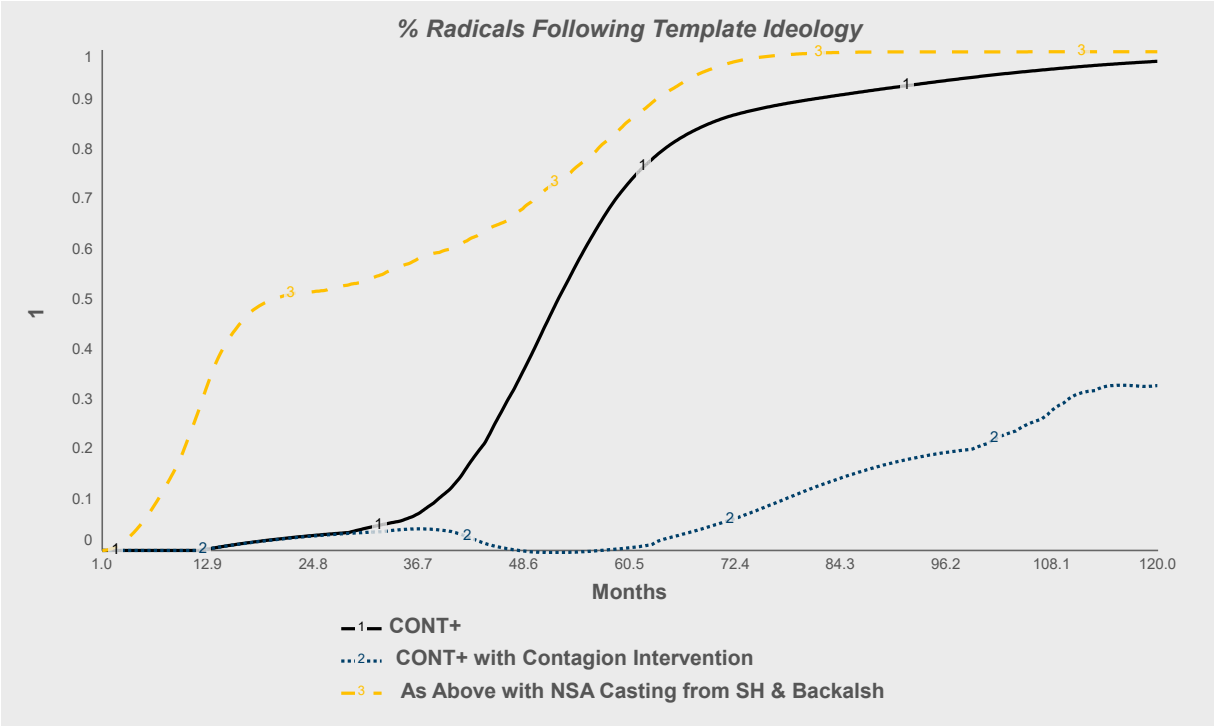


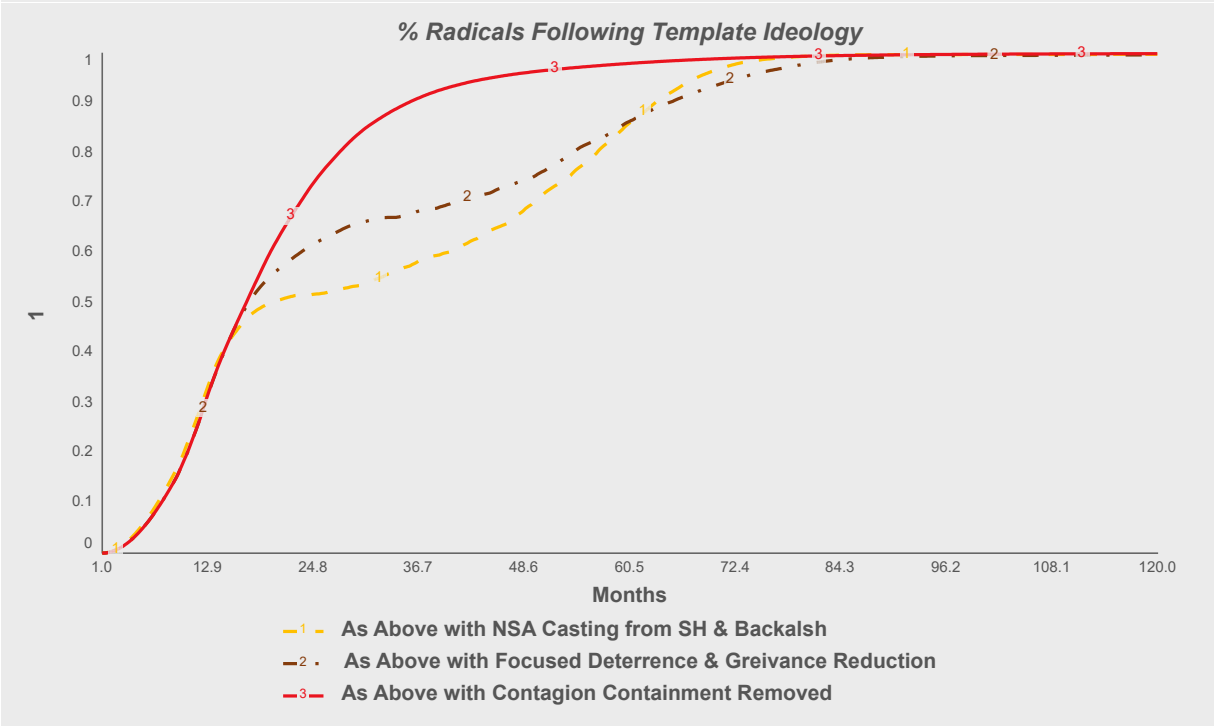
Activated Population



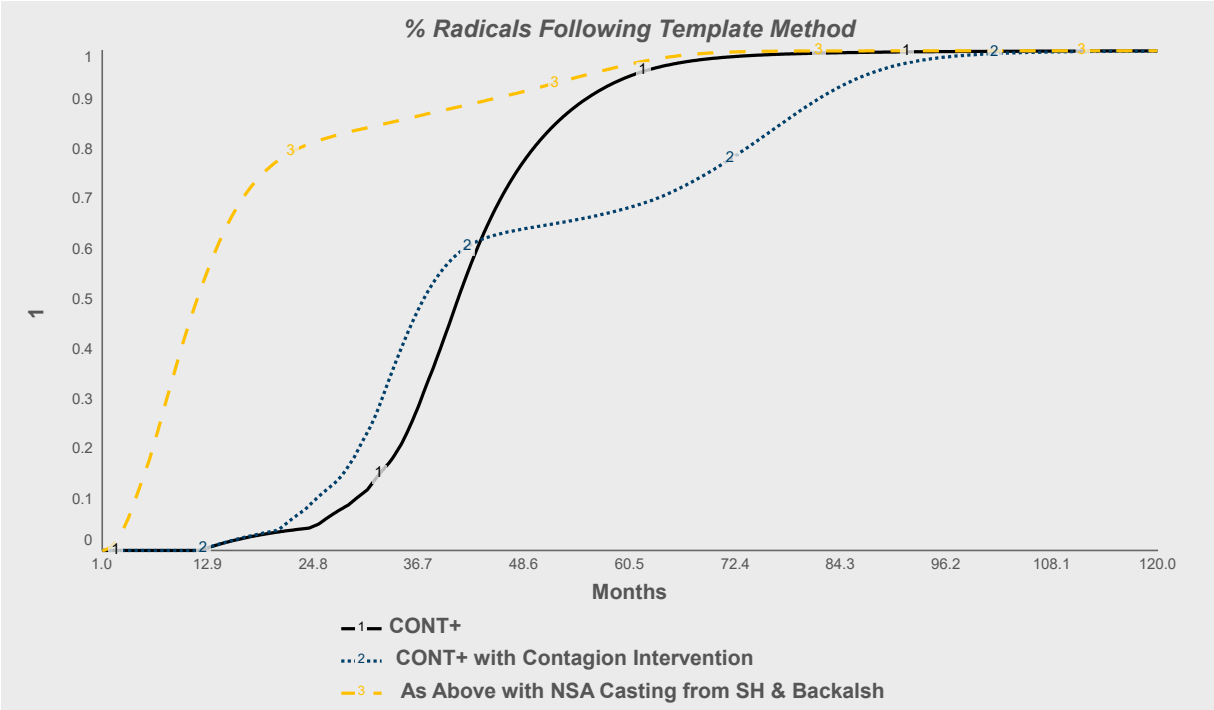


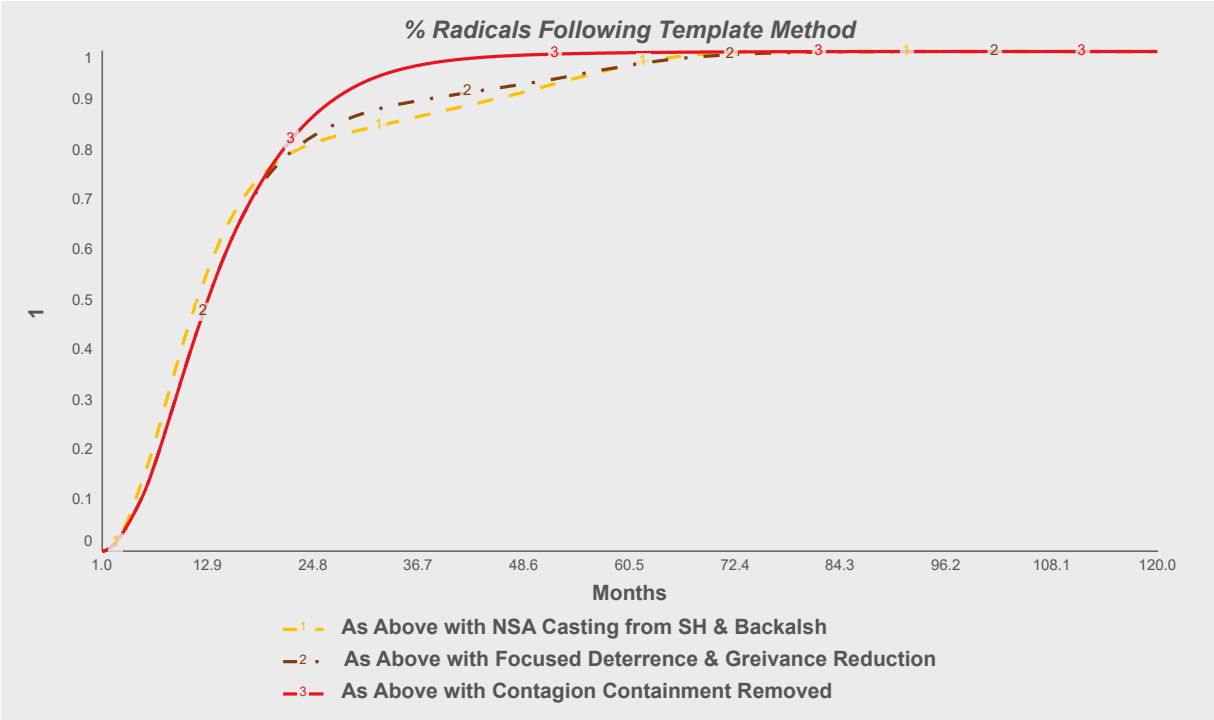
% Radicals Following Template Ideology

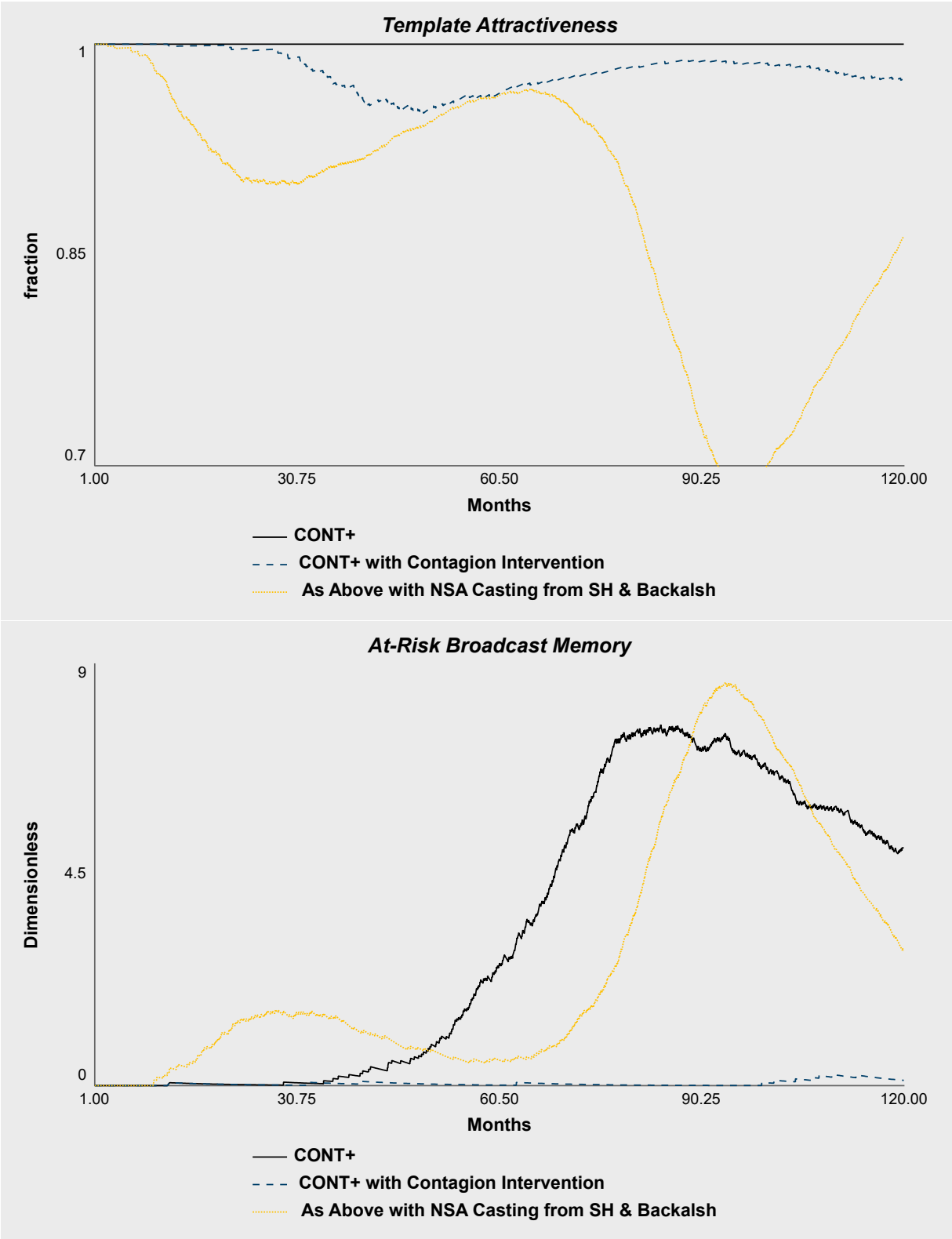




% Radicals Following Template Method







Statistics
CONTAGION CONTAINMENT RUNS

Descriptive Statistics for Terror Contagion Containment Policy Analysis. Att = Attempts, Fails = Failures, and TCONT = Terror Contagion Incidents.

Table 12: Descriptive Statistics for Terror Contagion Containment Policies.

Variable	Mean	Minimum	Maximum
(CONT+)Att	1540.2	1491.0	1544.0
(CONT+)Fails	591.62	511.00	770.70
(CONT+)TCont	704.81	469.00	806.00
(CONT+ WInt)Att	499.50	424.00	624.00
(CONT+ WInt)Fails	370.60	290.60	513.40
(CONT+Wint)Tcont	13.190	0.000	57.000
(CONT+ SH&RT)Att	1205.8	989.0	1439.0
(CONT+ SH&RT)Fails	376.36	324.00	442.90
(CONT+ SH&RT)TCont	717.81	529.00	899.00
(CONT+ Wint & FD/GR)Att	619.84	549.00	744.00
(CONT+ Wint & FD/GR)Fails	328.53	275.70	397.80
(CONT+ Wint & FD/GR)TCont	229.17	178.00	302.00
(CONT+ False)Att	1771.9	1765.0	1779.0
(CONT+ False)Fails	789.74	729.60	860.60
(CONT+ False)TCont	917.81	845.00	991.00

CONTAGION CONTAINMENT RUNS

One-Way ANOVA for effect of Terror Contagion Containment Policies on Terror Contagion Incidents.

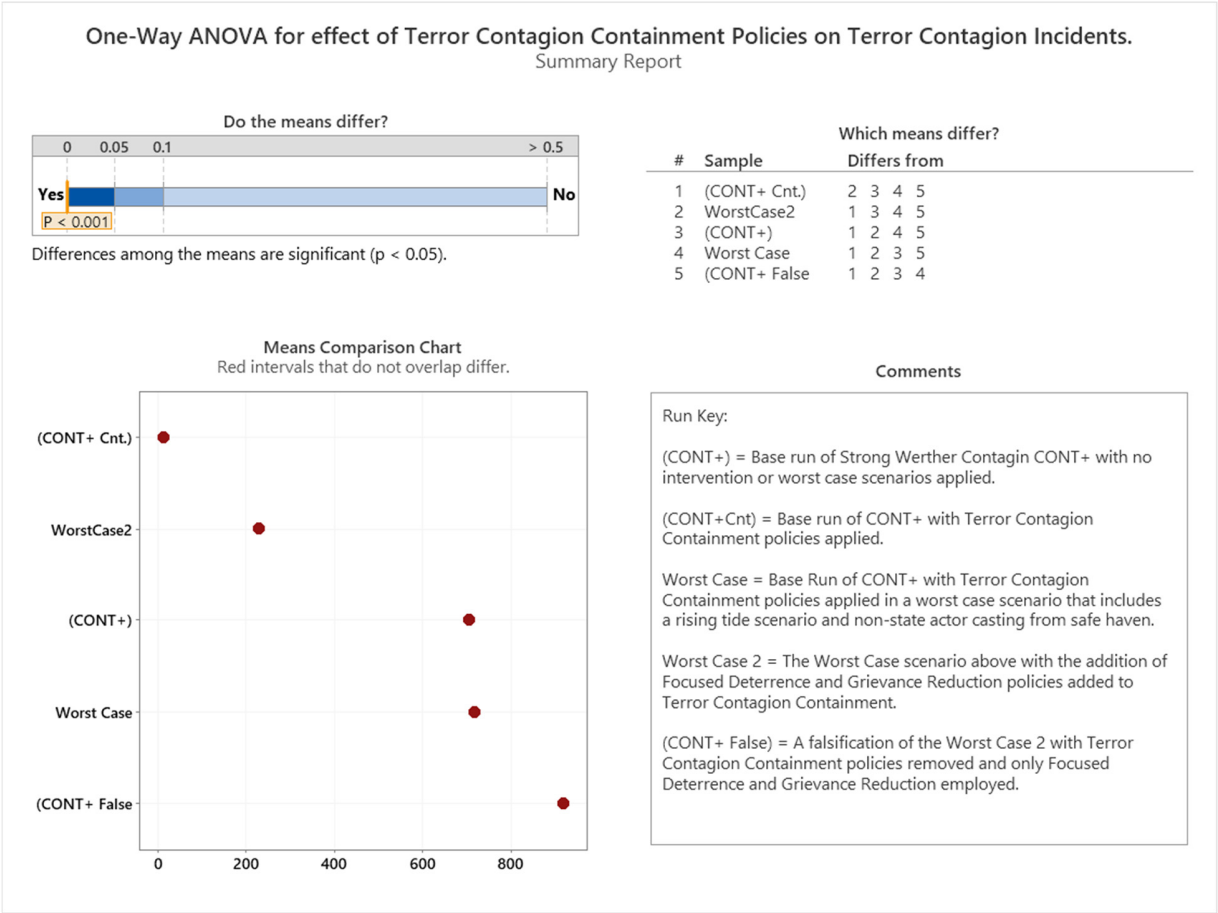


Figure 55: One Way ANOVA on Terror Contagion Containment Policies Summary Report.

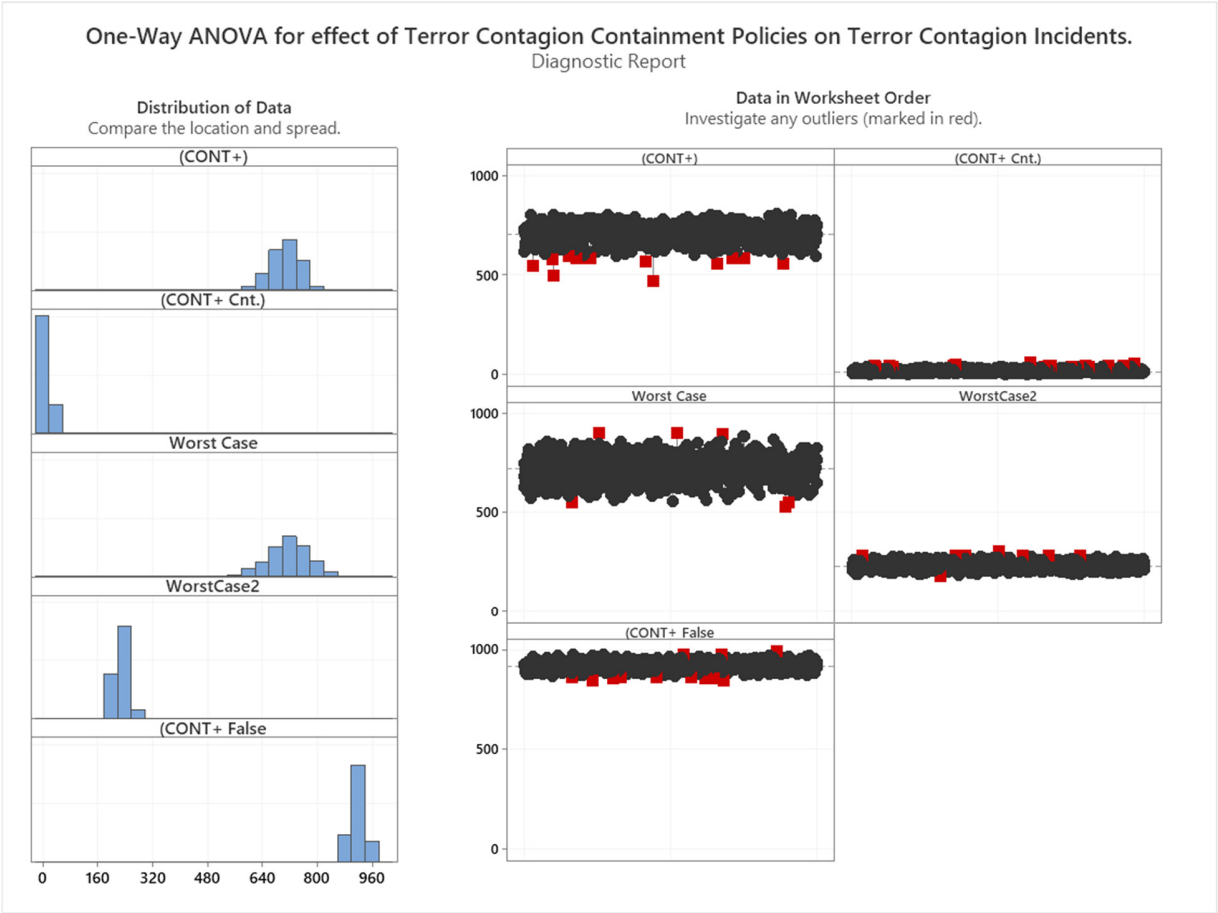


Figure 56: One Way ANOVA on Terror Contagion Containment Policies Diagnostic Report.

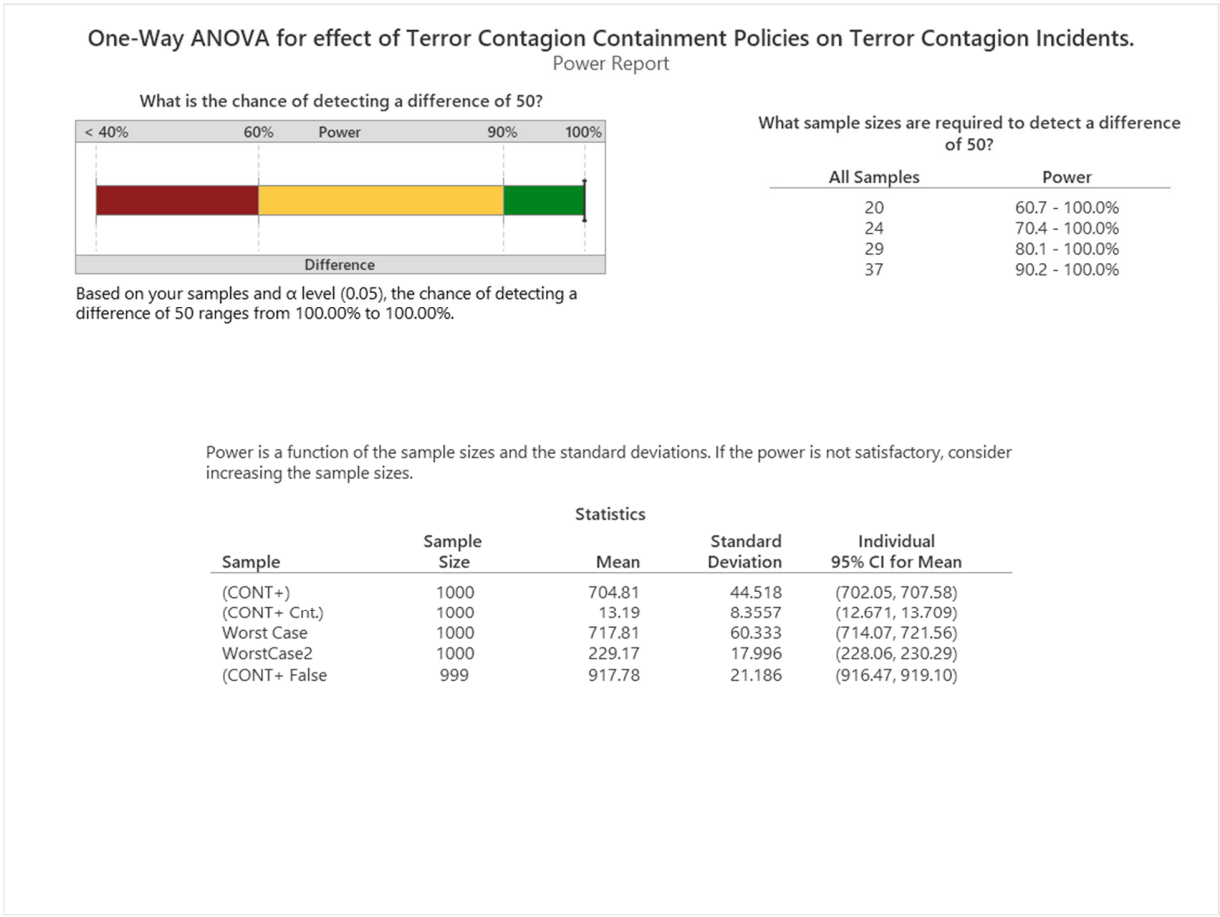


Figure 57: One Way ANOVA on Terror Contagion Containment Policies Power Report.

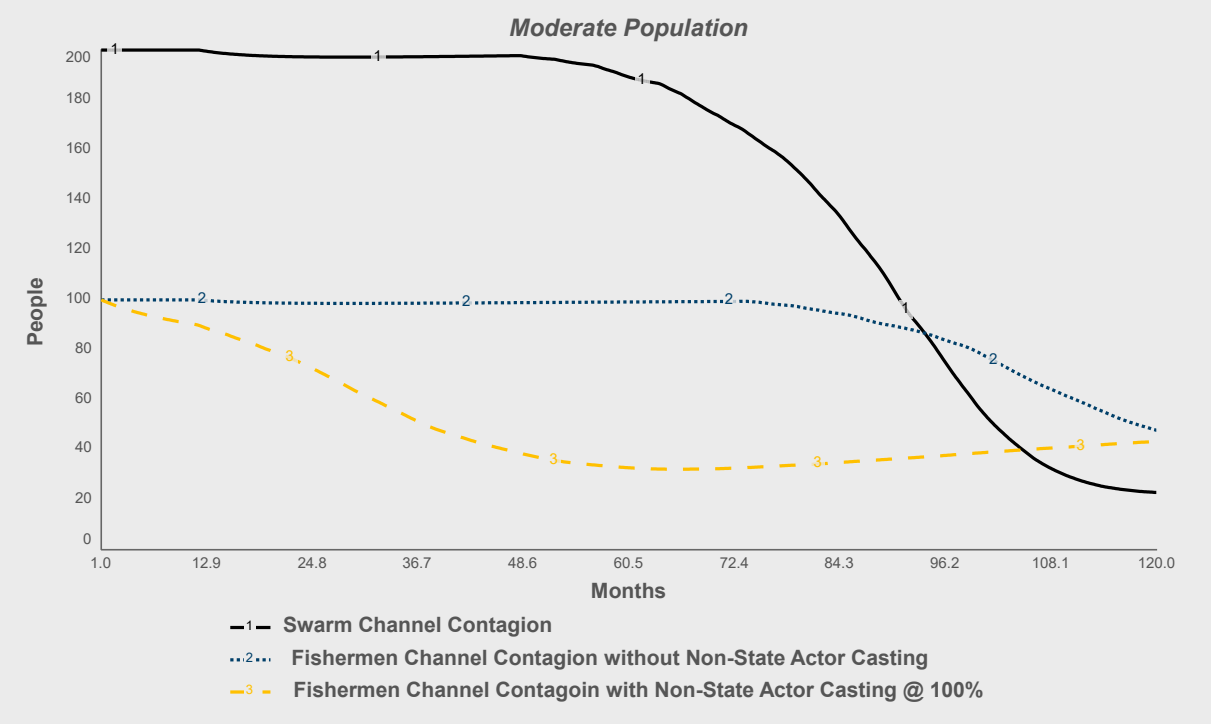
Figure 58: One Way ANOVA on Terror Contagion Containment Policies Report Card.

Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

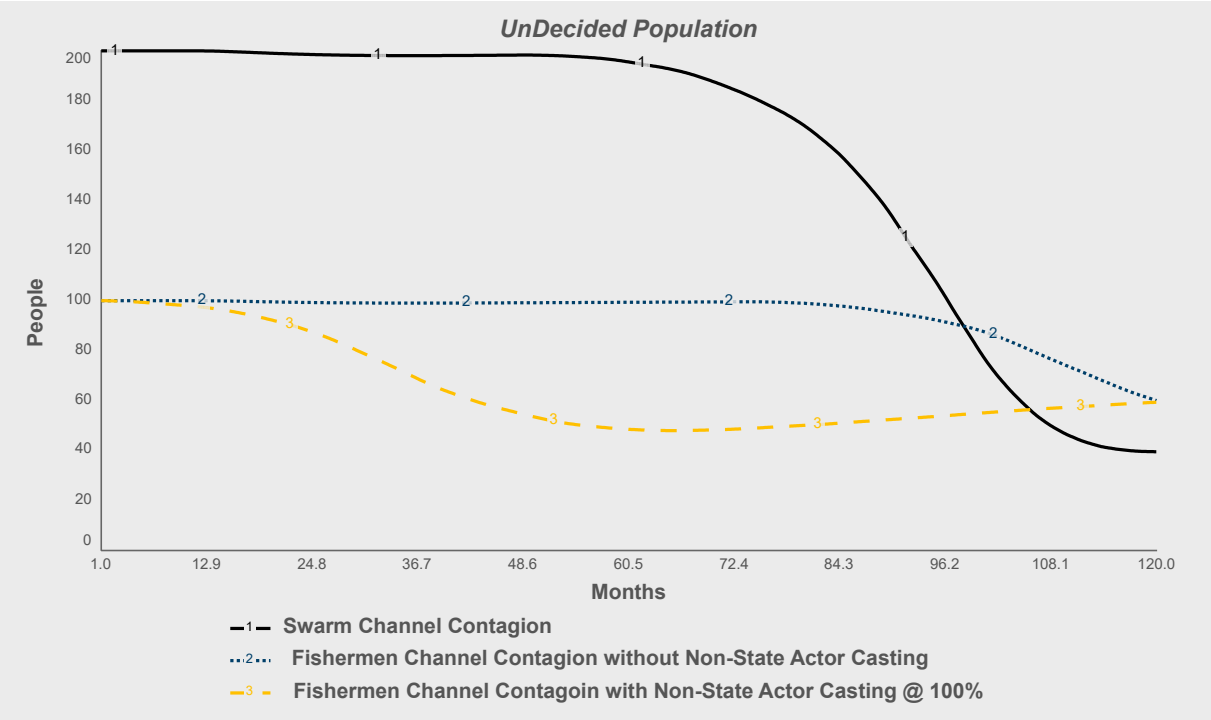
D-10 CHANNEL ANALYSIS

D-10.1 Swarm vs. Fishermen Channel

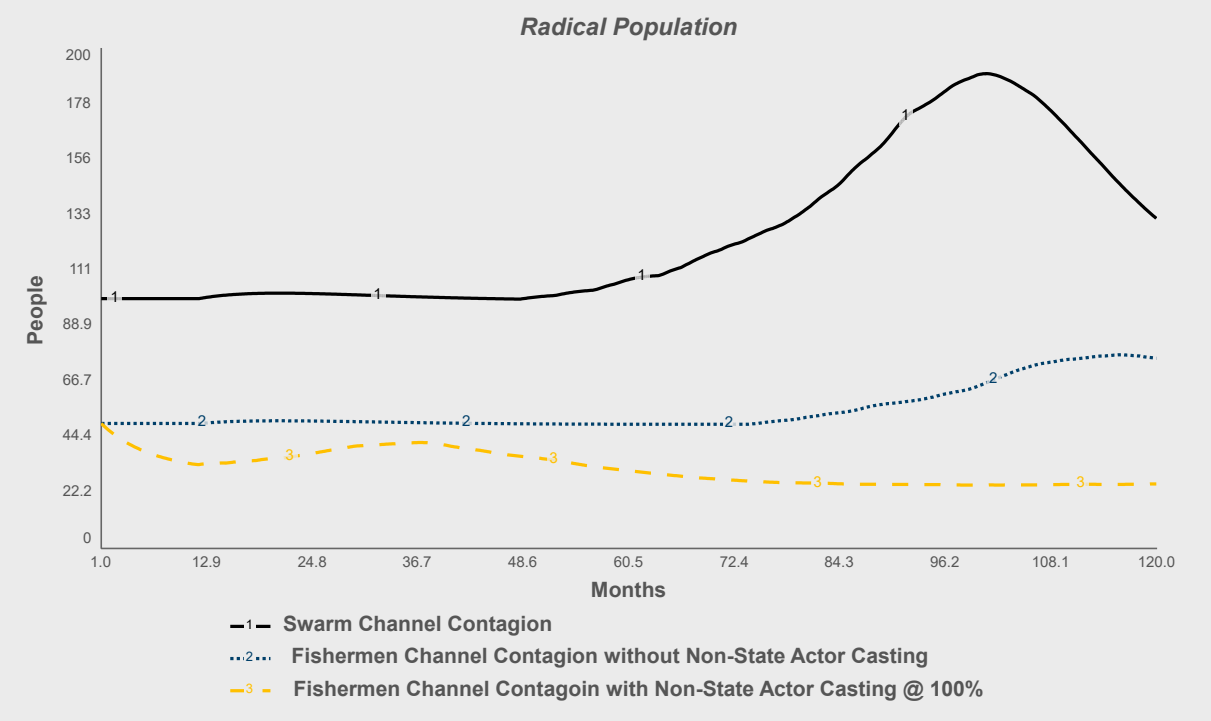
Moderate Population



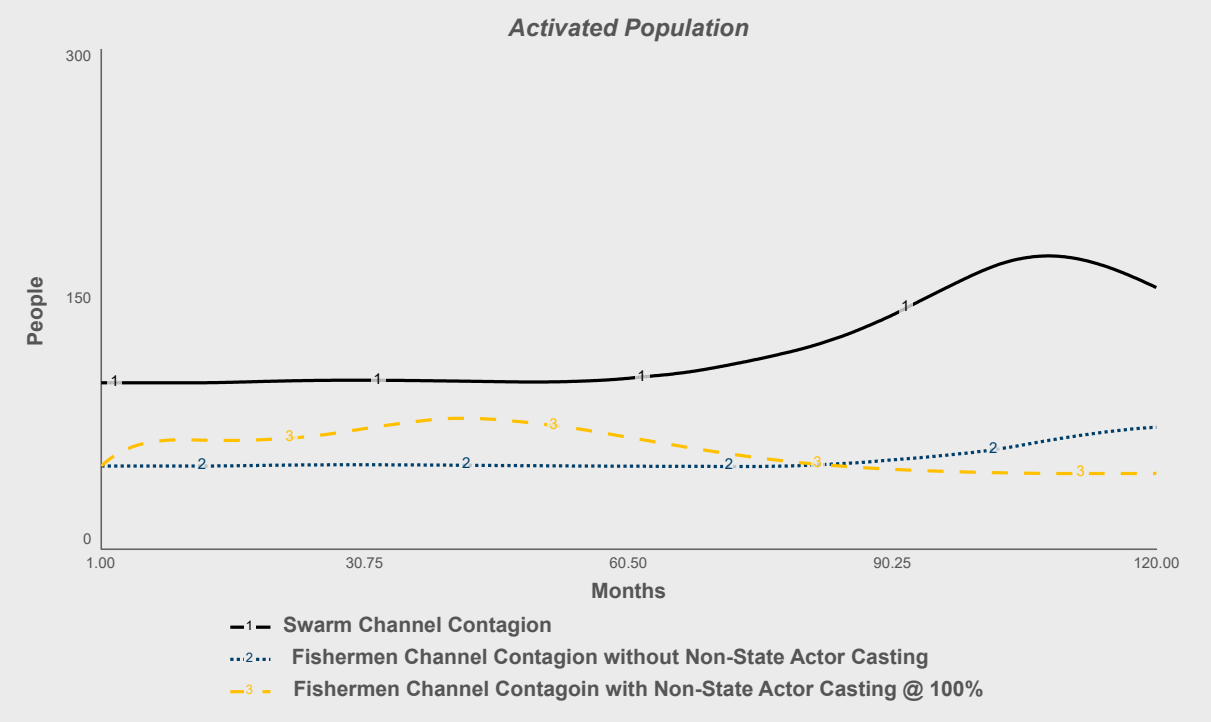
Undecided Population



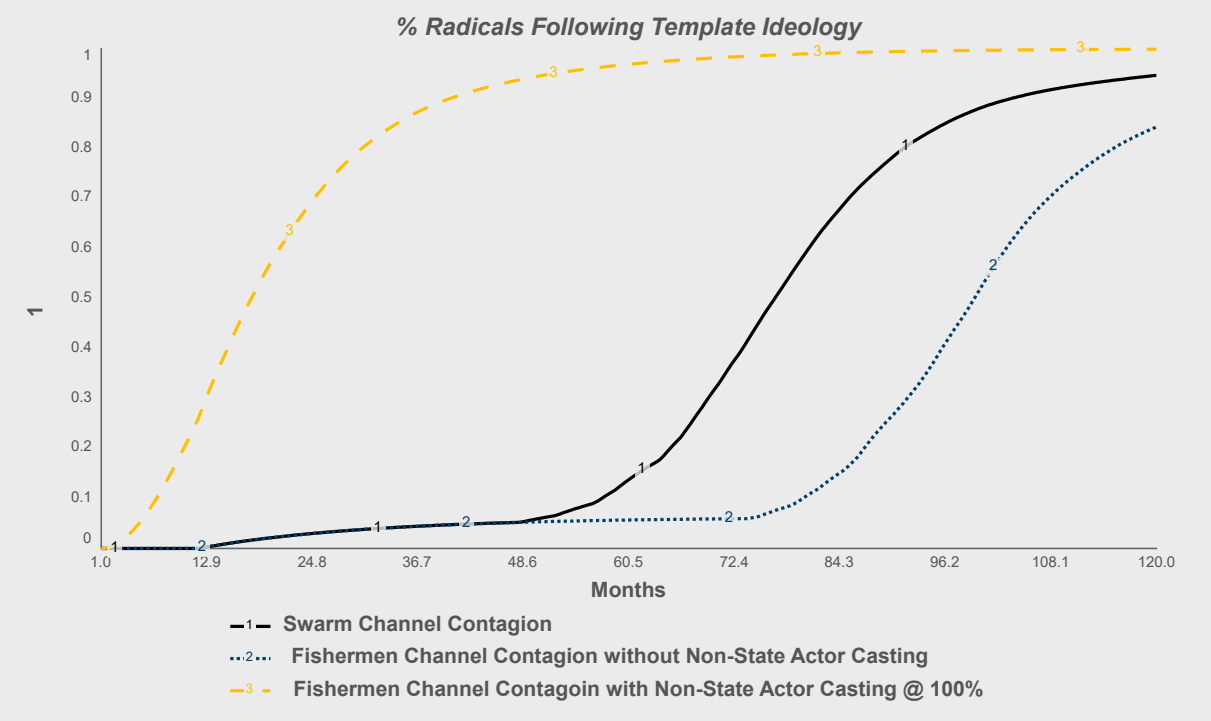
Radical Population



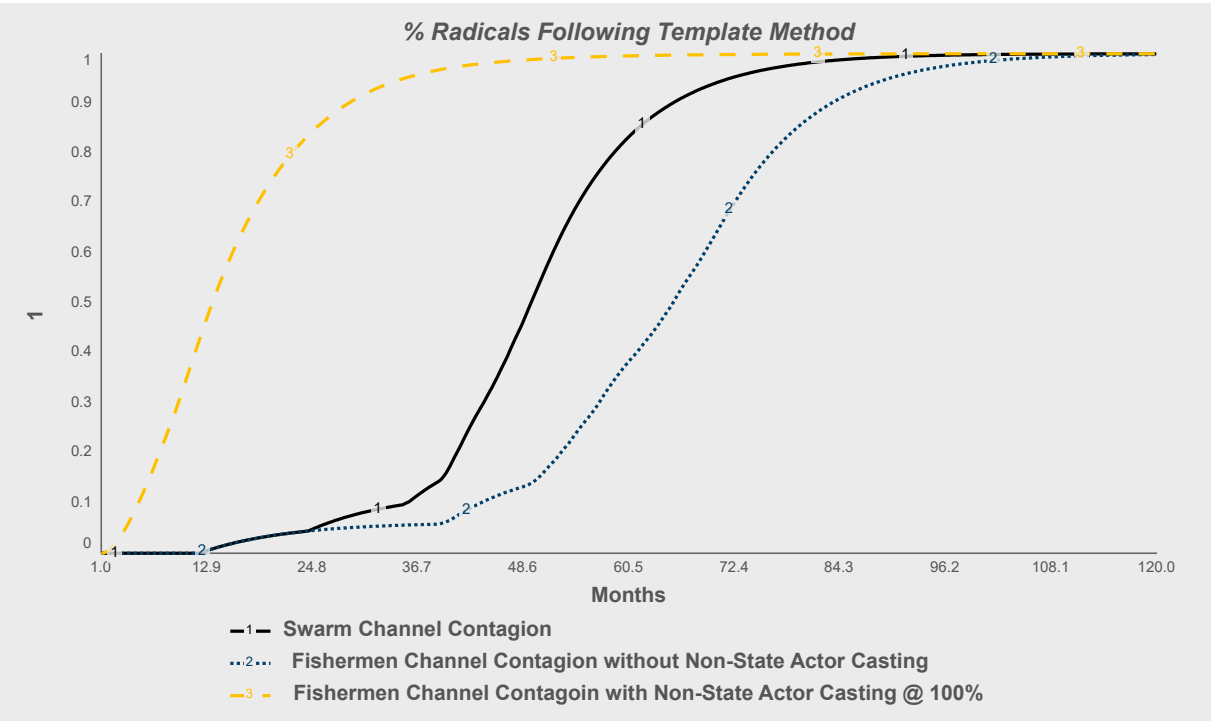
Activated Population



% Radicals Following Template Ideology



% Radicals Following Template Method



Ending Values

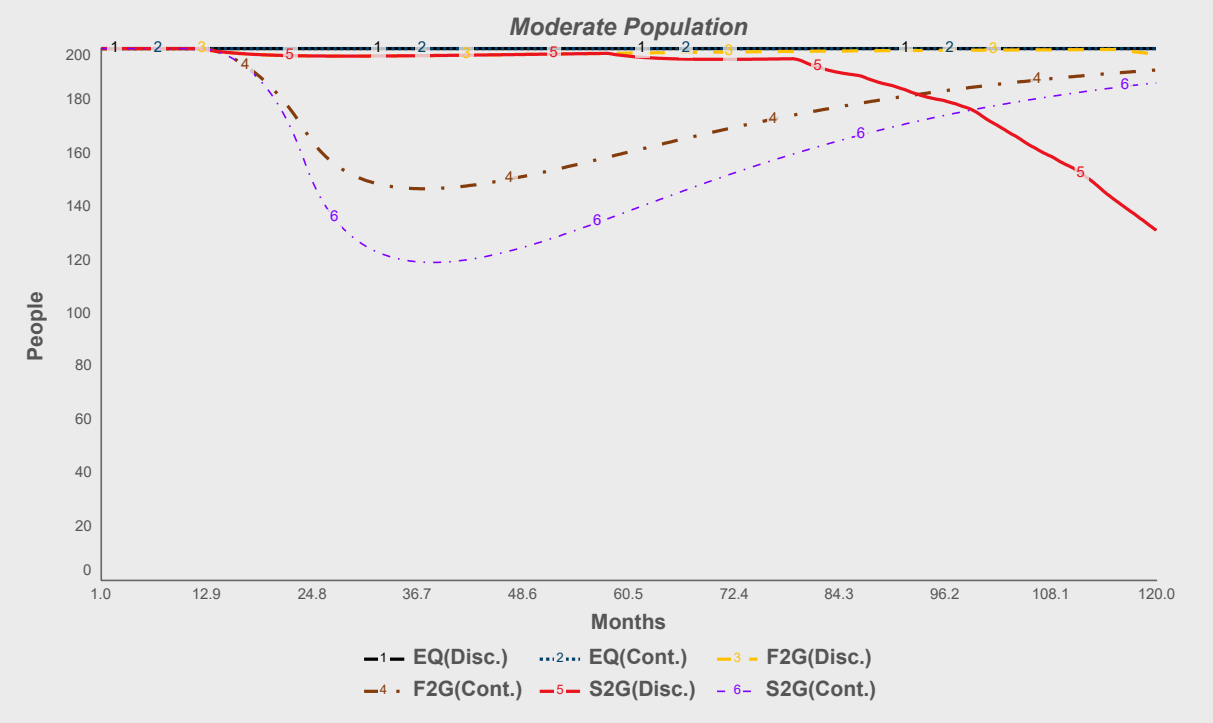
Run	*Total Attempted Incidents*	*Failed Incidents*	*Total Contagion Incidents*
Swarm Channel Contagion	719	342.4	234
Fishermen Channel Contagion without Non-State Actor Casting	318	186.6	60
Fishermen Channel Contagion with Non-State Actor Casting @ 100%	360	113.7	224

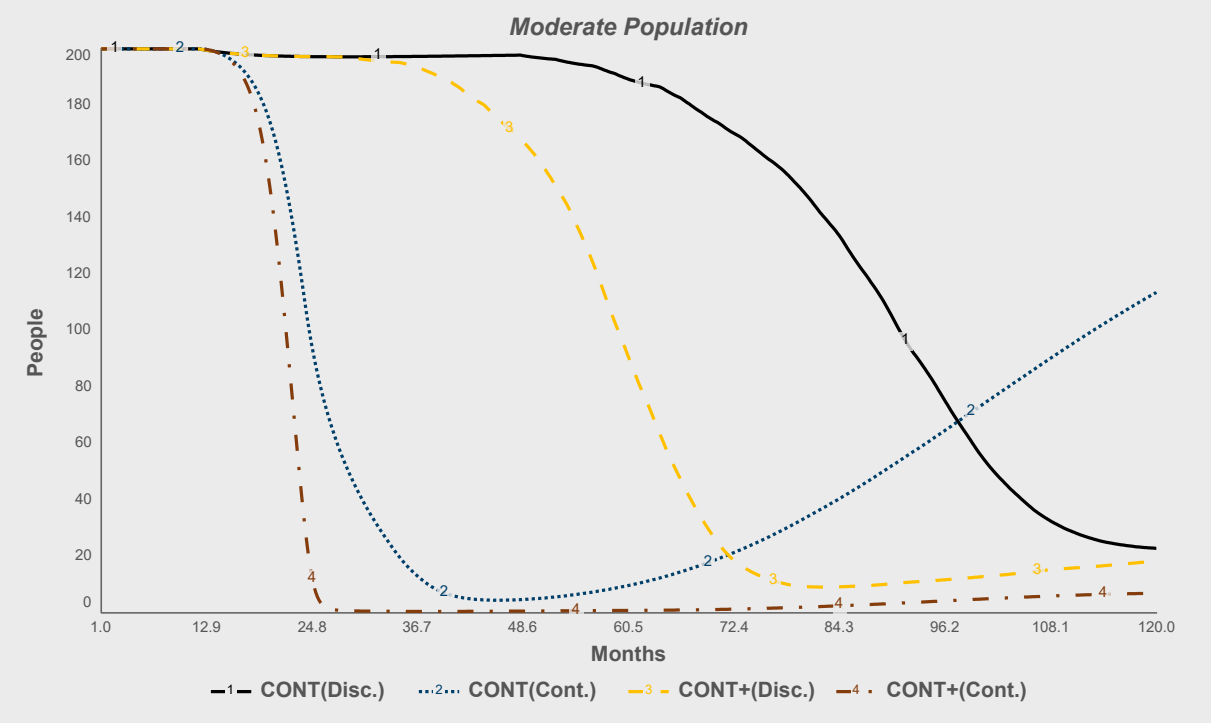
Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

D-11 FORMULATION ANALYSIS: DISCRETE V. CONTINUOUS

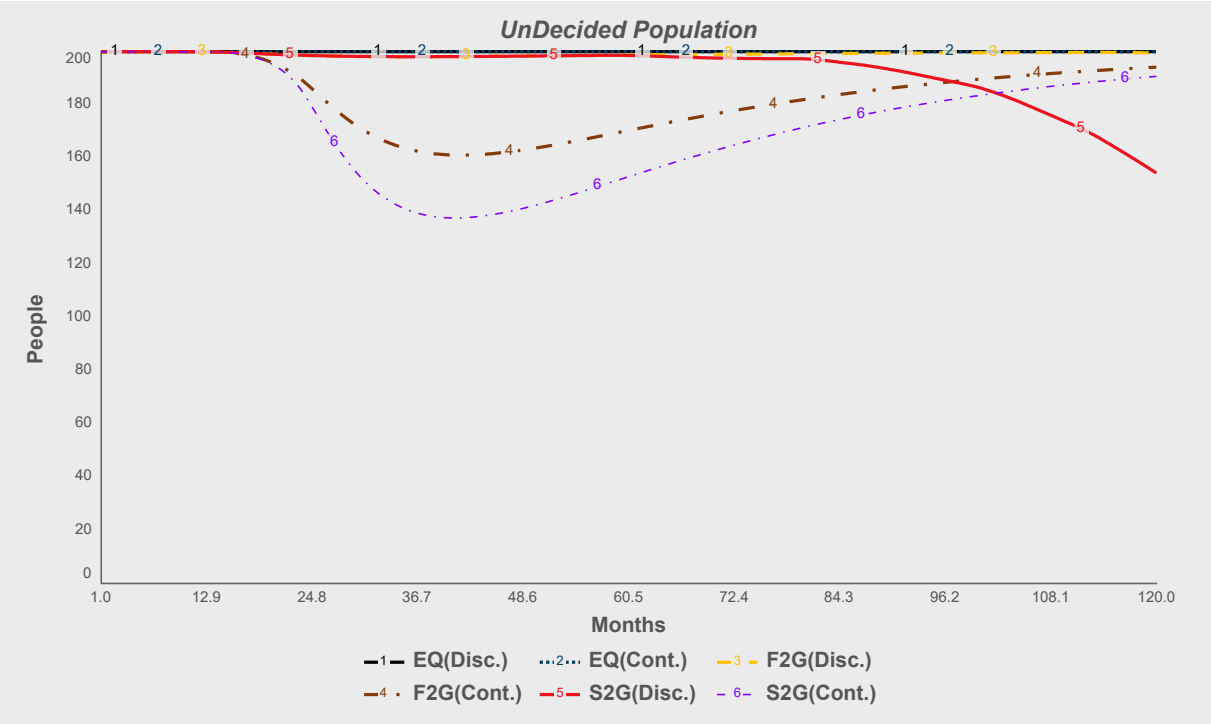
D-11.1 Discrete Formulation of Incidents vs. Continuous

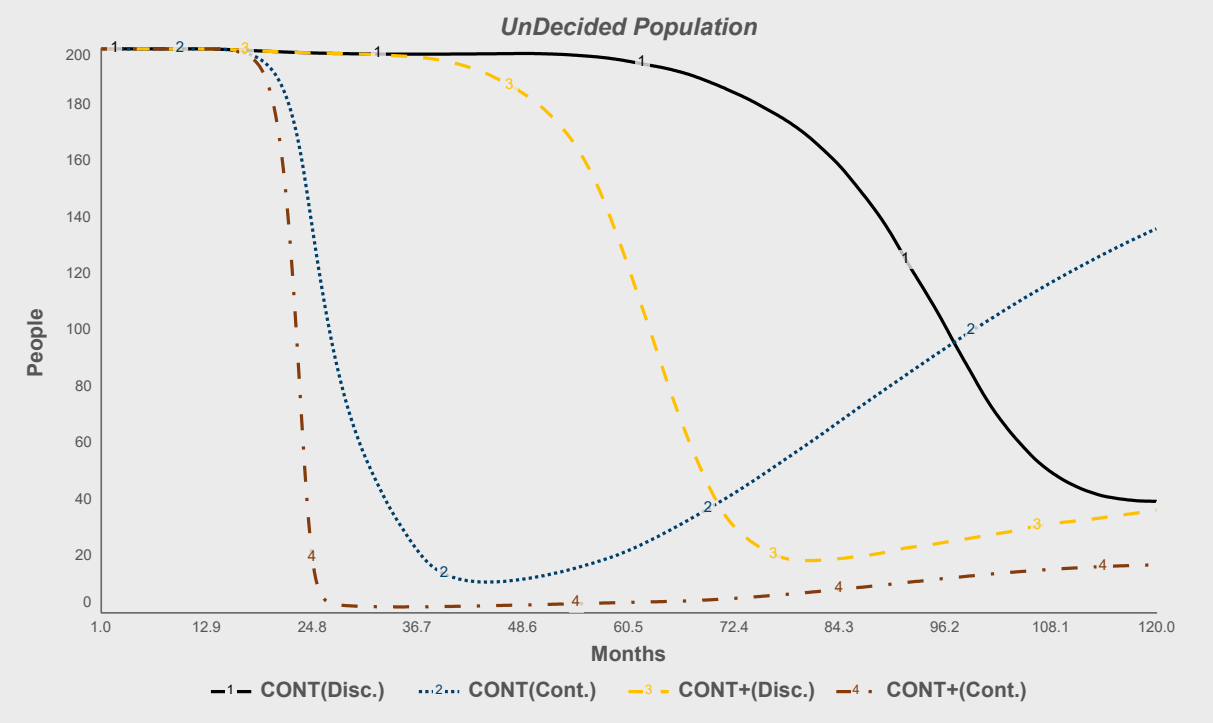
Moderate Population



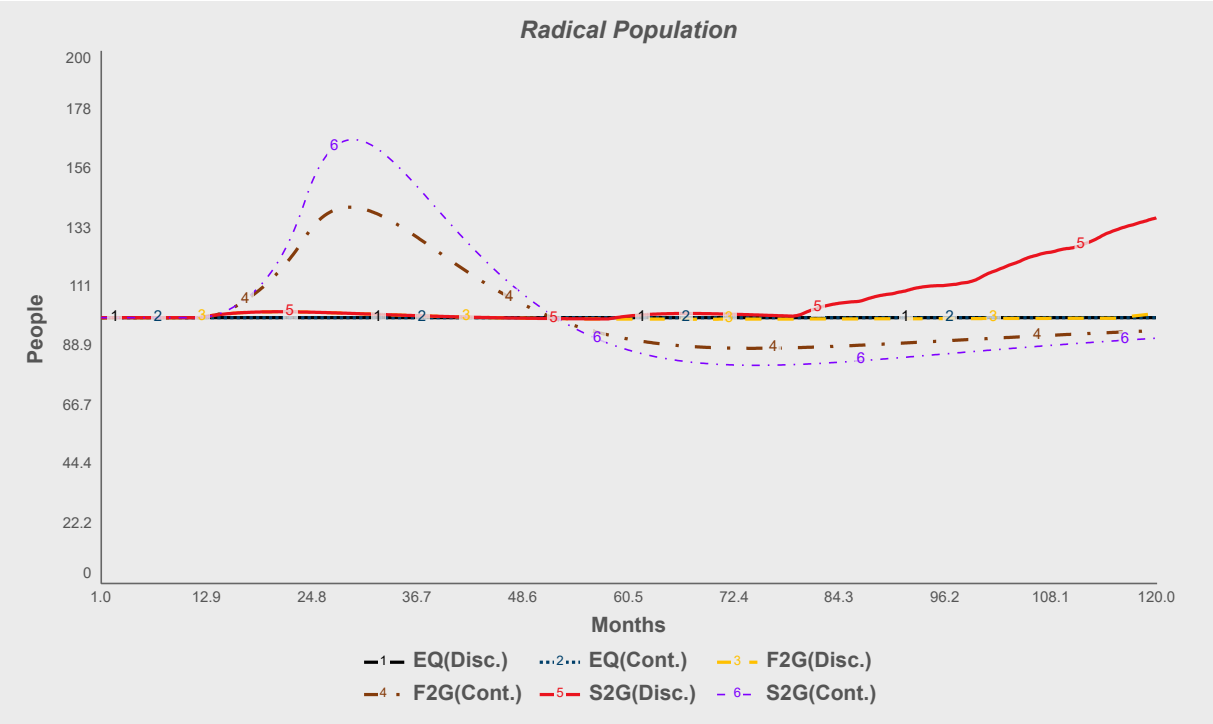


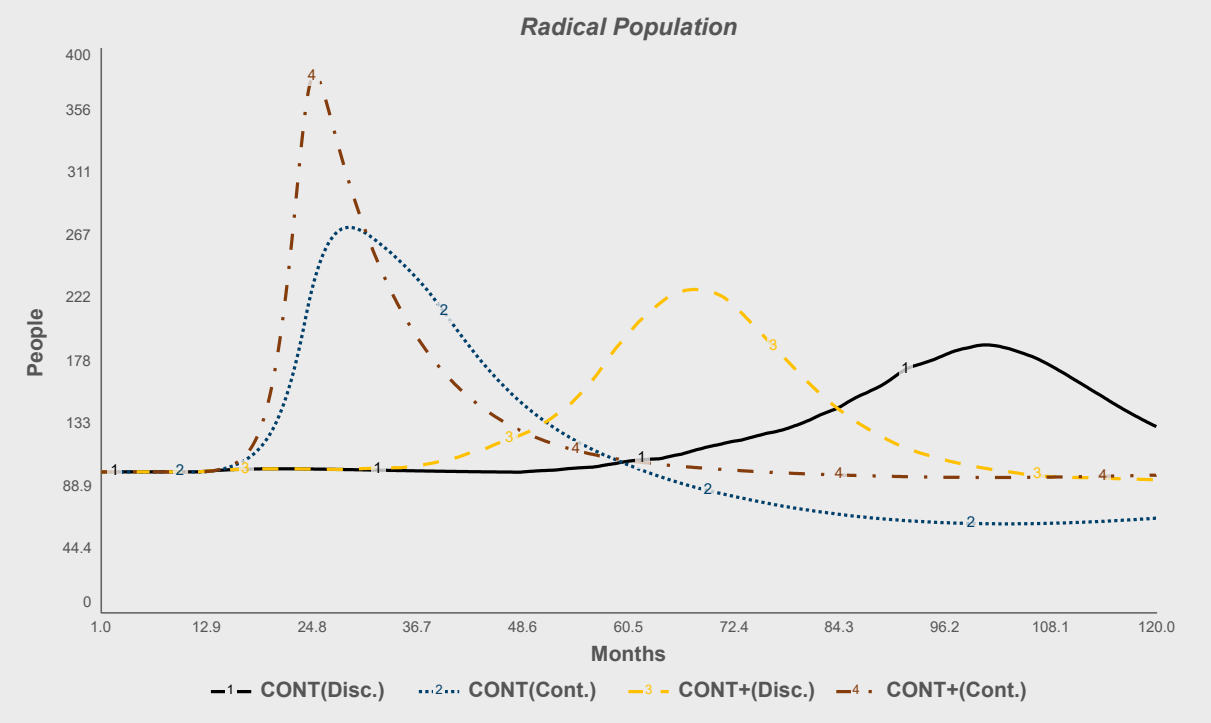
Undecided Population



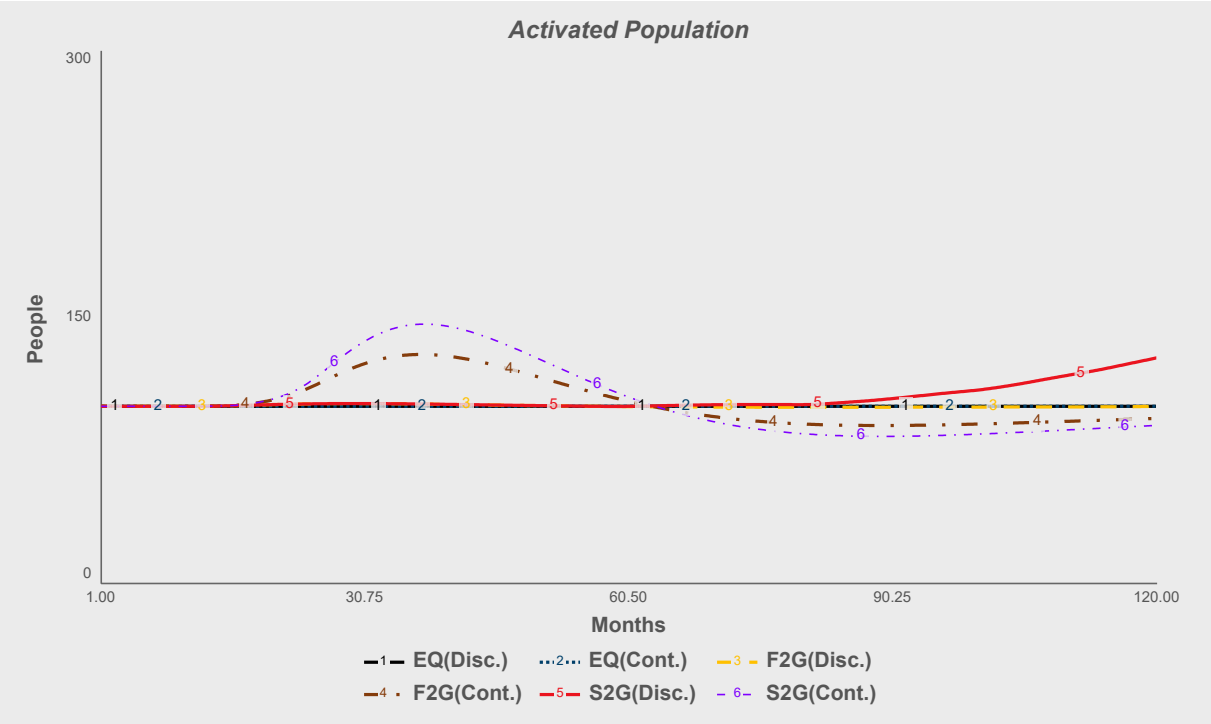


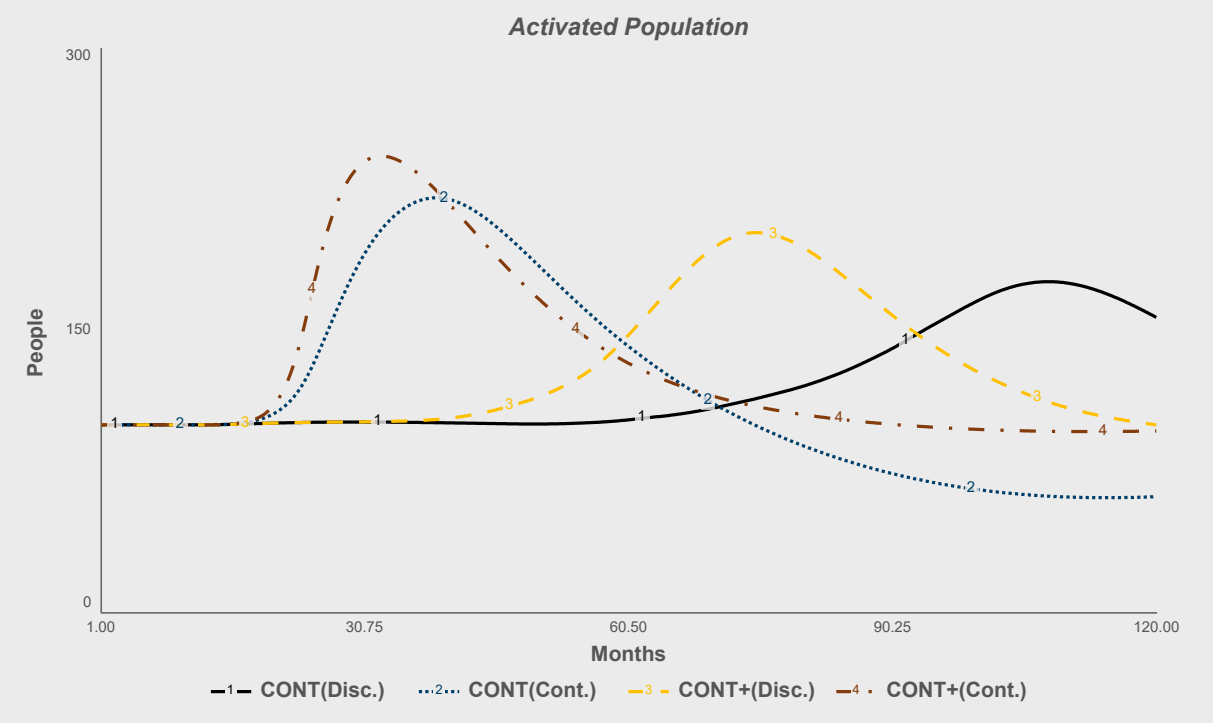
Radical Population





Activated Population





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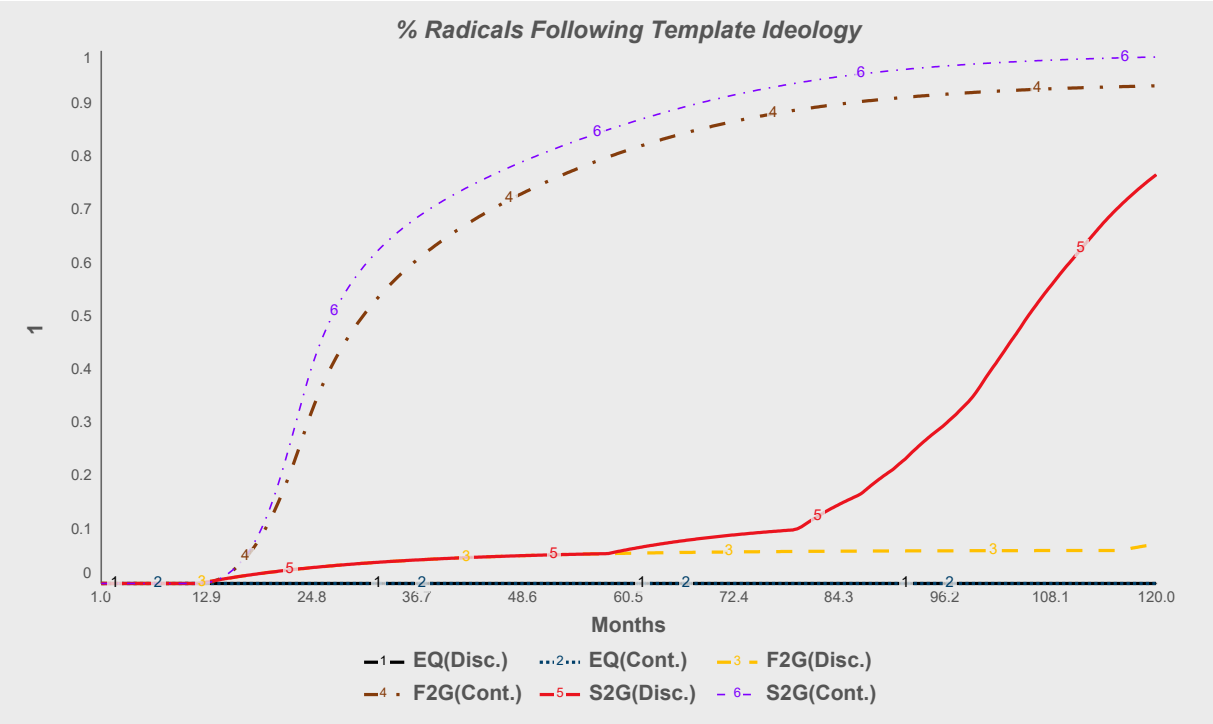

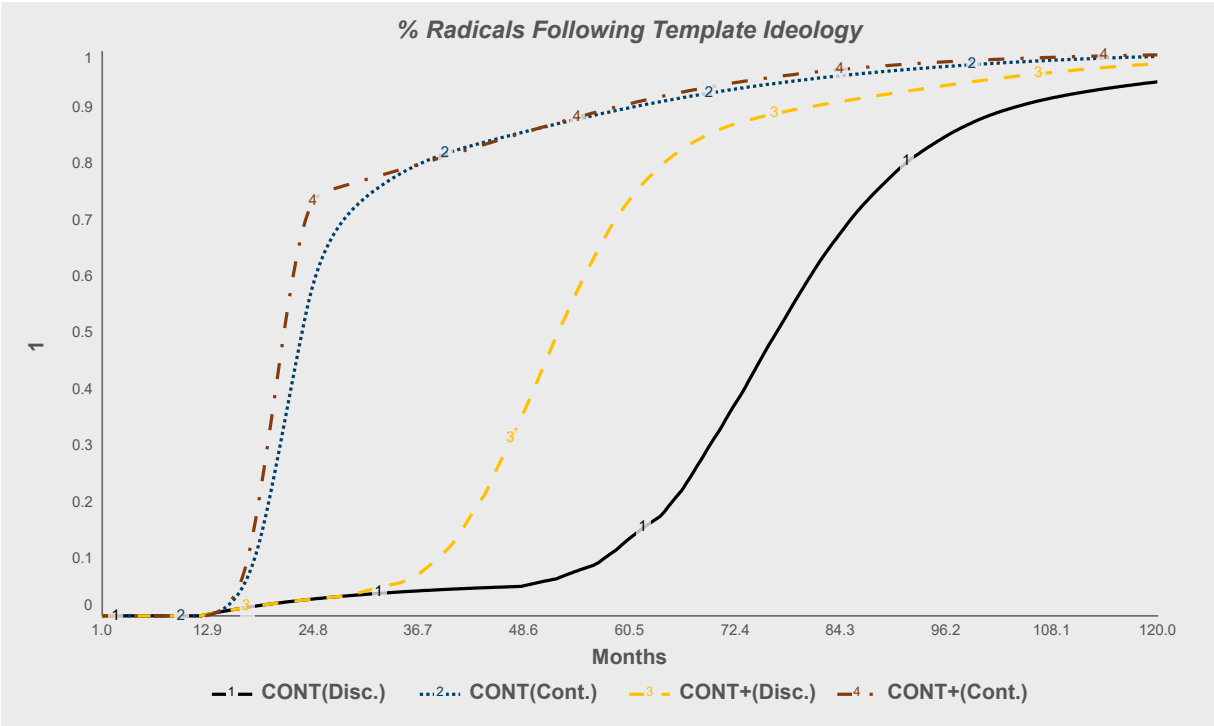

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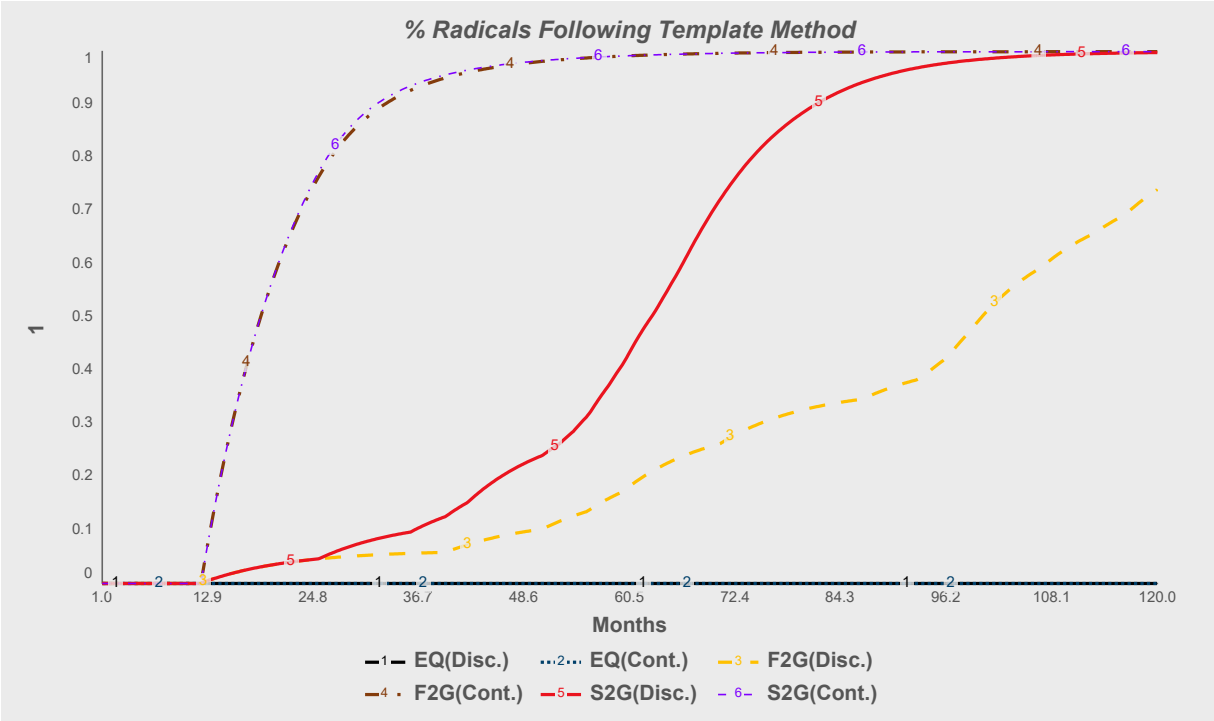
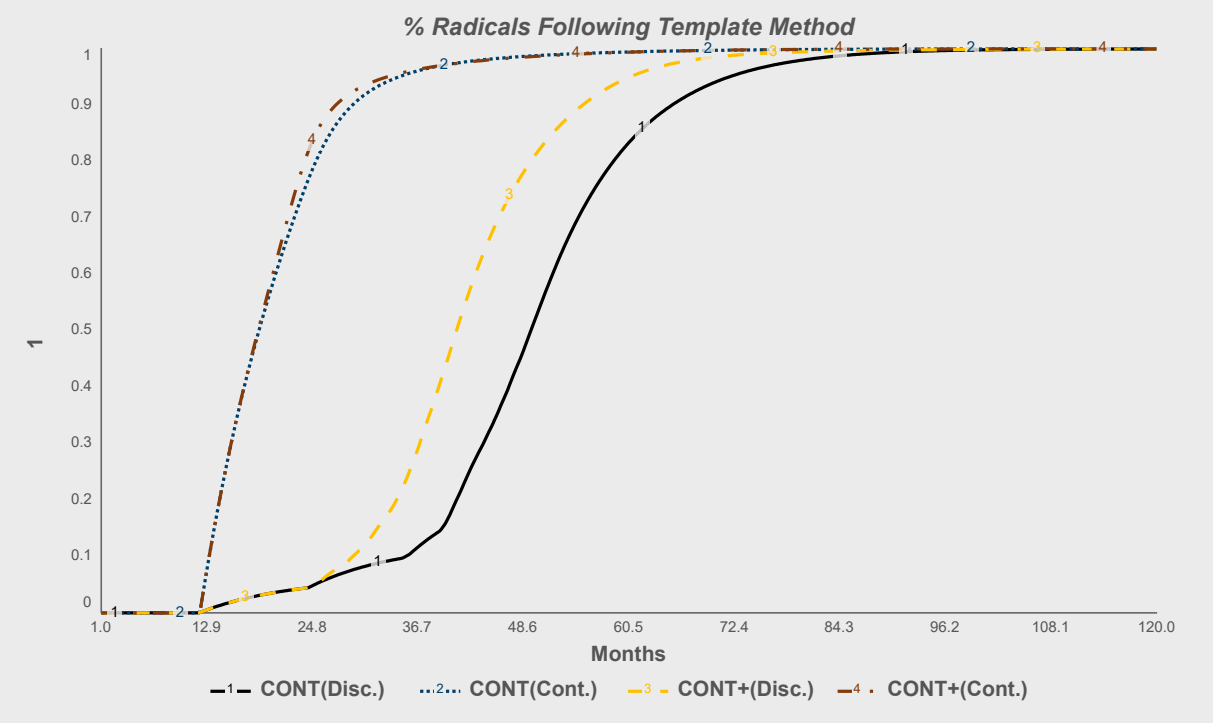




Ending Values

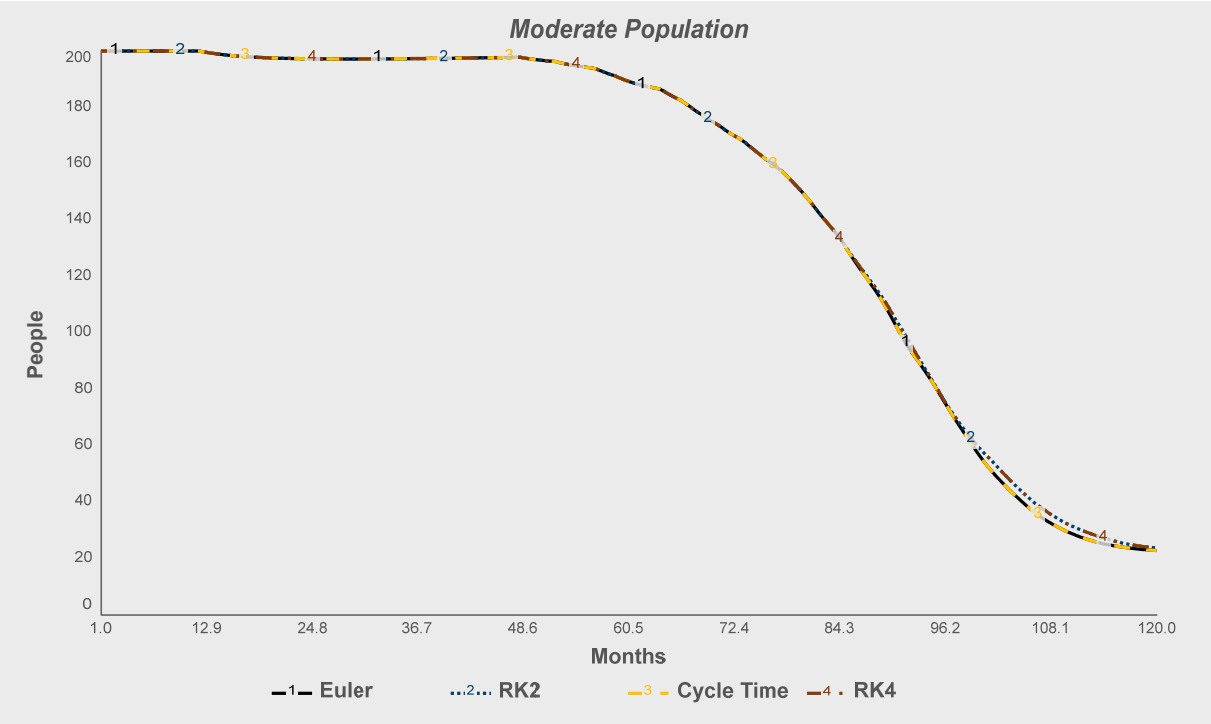
Run	*Total Attempted Incidents*	*Failed Incidents*	*Total Contagion Incidents*
EQ(Discrete)	118	117	0
EQ(Continuous)	118	117	0
F2G(Discrete)	119	102	1
F2G(Continuous)	121	40.7	65
S2G(Discrete)	247	146	37
S2G(Continuous	246	79.7	135
CONT(Discrete)	719	342	234
CONT(Continuous)	705	232	414
CONT+(Discrete)	1.54k	665	695
CONT+(Continuous)	1.57k	487	940

Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

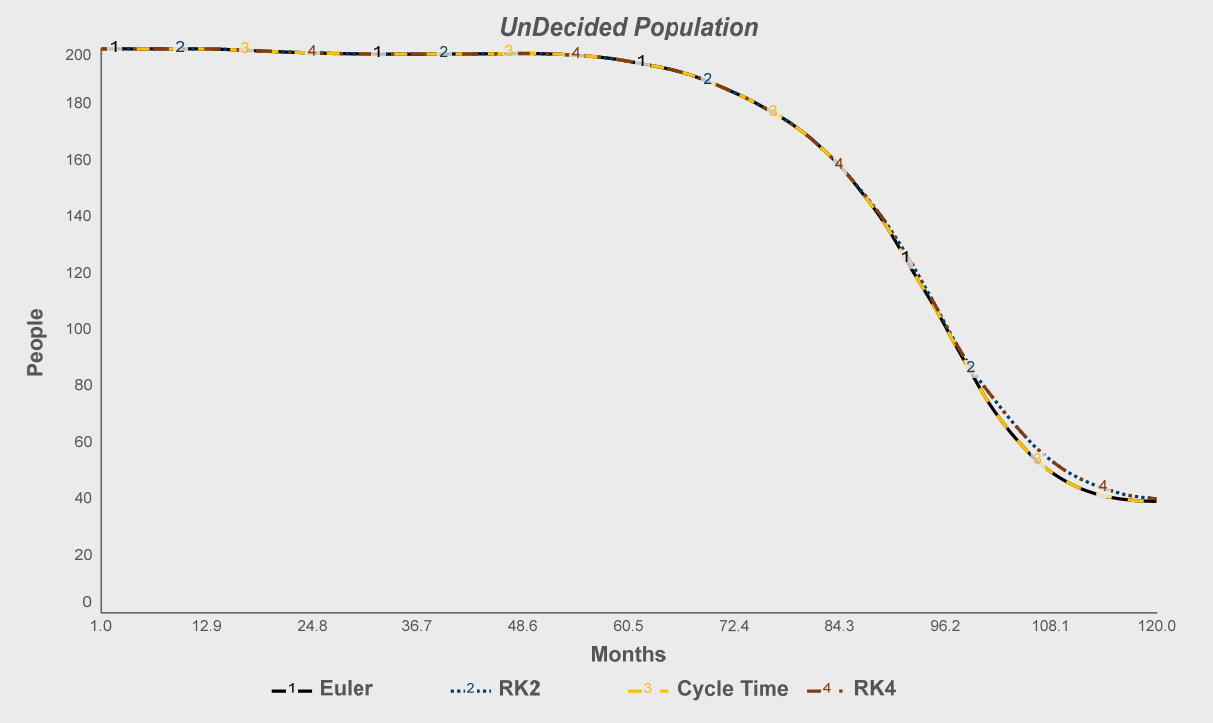
D-12 INTEGRATION ANALYSIS: CONT Behavior Mode

D-12.1 Comparing Euler, RK2, Cycle Time and RK 4 Integrations across CONT Behavior Mode

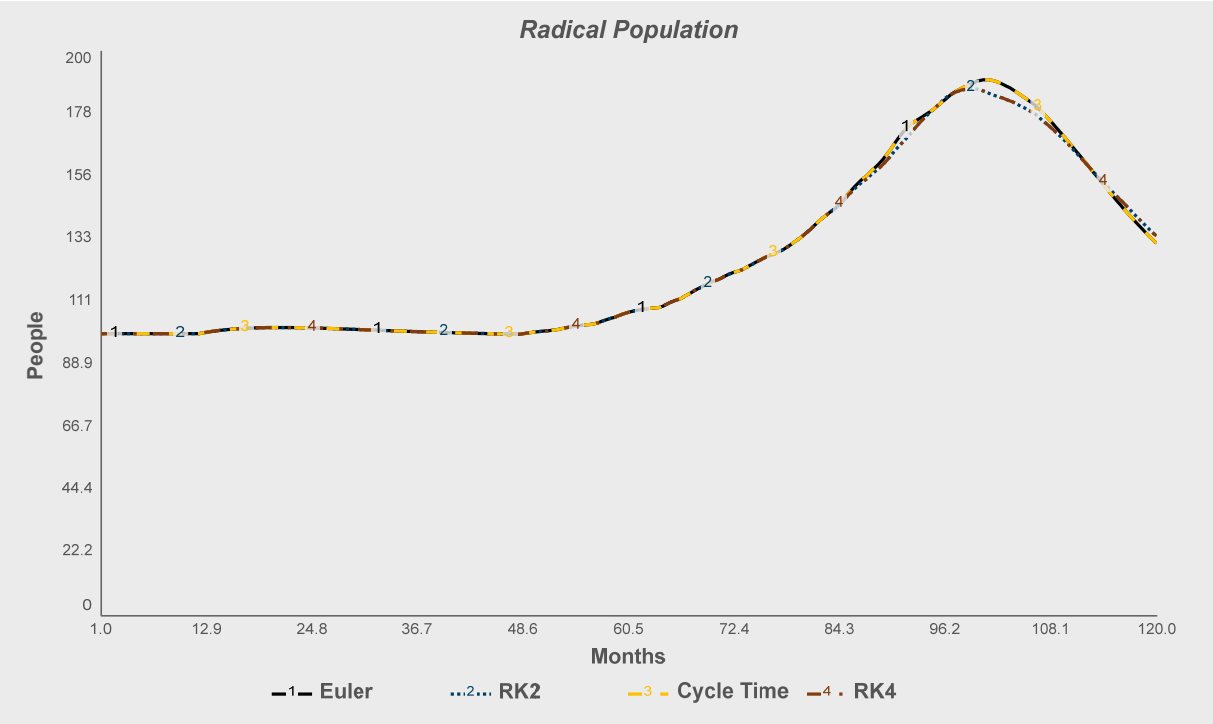
Moderate Population



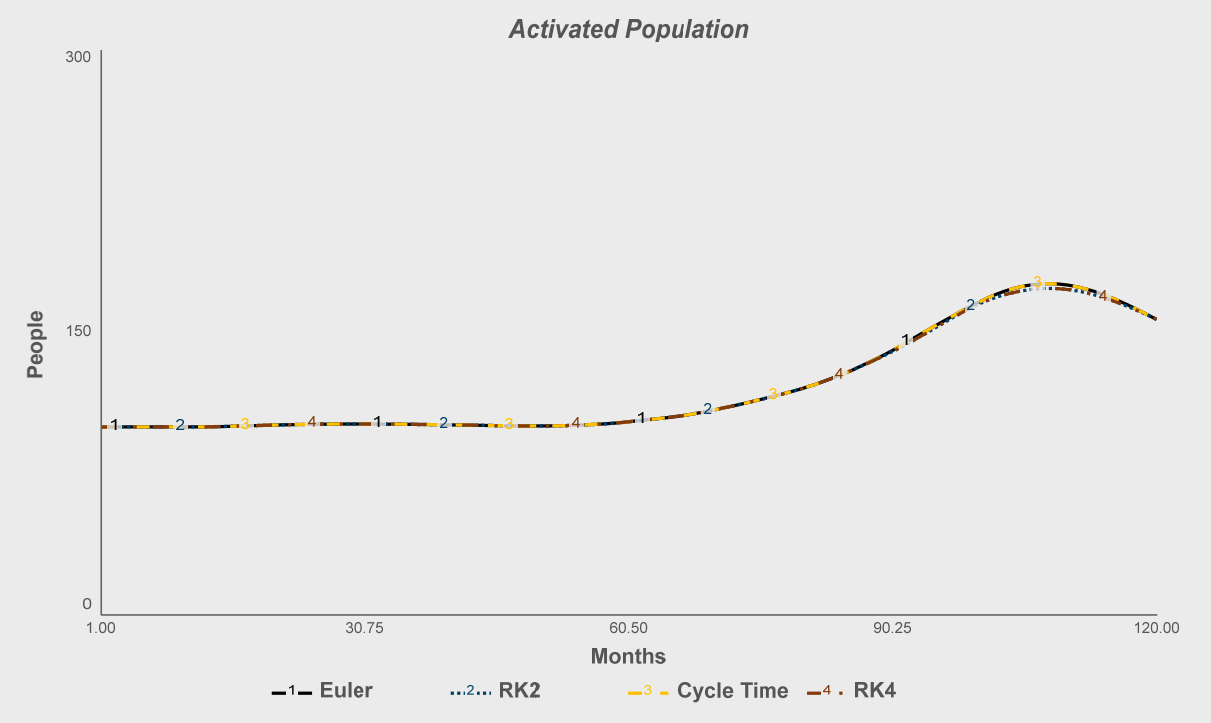
Undecided Population



Radical Population



Activated Population



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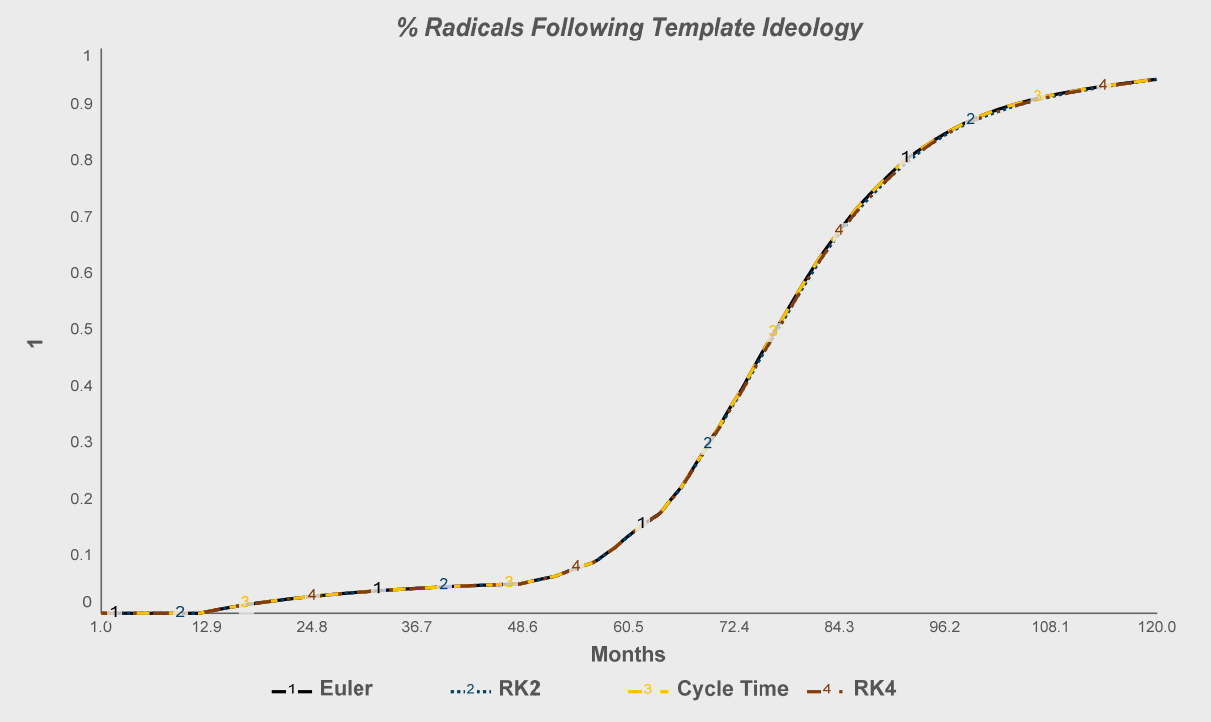

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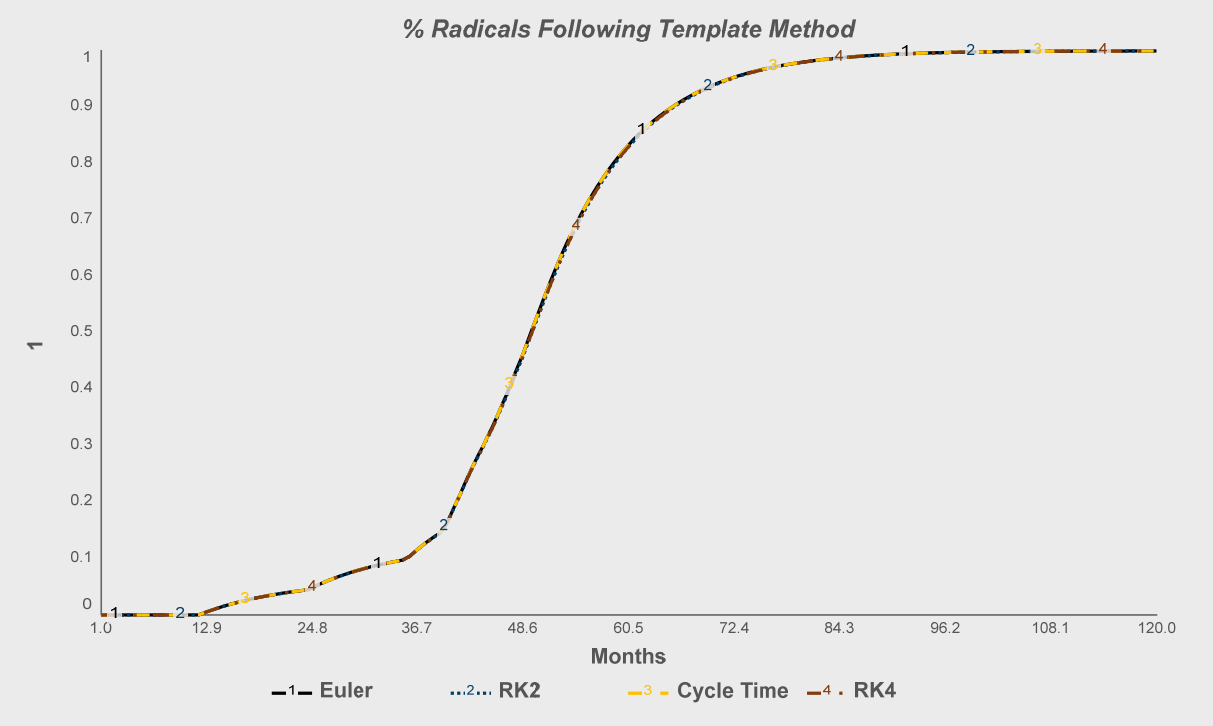

Ending Values

INTEGRATION ANALYSIS

Run	*Total Attempted Incidents*	*Failed Incidents*	*Total Contagion Incidents*
Euler	719	342	234
RK2	716	344	227
Cycle Time	719	342	234
RK4	716	344	227

Summary of Initial Findings & Additional Ambiguity Statements for this Experiment

E-1 Bibliography of Sources in the Supplementary Materials

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