Modeling Coercive Behavior in OneSAF

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ABSTRACT

Simulations have primarily represented conventional force on force battles, with predictable outcomes – the side with the most firepower in the right place at the right time wins. This engenders a relatively simple training environment for both execution and review, but does not expose training units to the irregularities and complexities of the operational environment in asymmetric warfare.

Behaviors are normally tasks performed by either a unit or an entity to accomplish a singular goal. Typically, behaviors have no more impact on the game after the action is completed—they are first order effects. However, Coercive Behaviors by threat forces, like kidnapping or other intimidating behaviors lead to second and third order effects beyond the initial physical action. Coercive actions cause a variety of effects including: constraining or enhancing the amount and quality of information a commander or side receives, spawning of additional enemy forces from the populace (dynamic side change), migration of populace, and additional violent acts or coercive actions from the population. Training in this environment dictates that commanders consider second and third order consequences to their own and their adversary's actions, thus getting beyond the force on force paradigm (without role players and white cell injects).

Commanders must have a strong grasp of the positive and negative impacts of their actions and the actions of their opponents on the population within their area of interest, as well as upon local, regional, and national attitudes. Where noncombatant populations are concerned, commanders must balance risk vs. reward for every operation they undertake. Currently, no simulation adequately portrays coercive effects nor consequently stimulates commander's thinking and decision process in this regard. As a step in rectifying this deficiency and toward filling this training and experimentation gap, the TRADOC Intelligence Support Activity - Models and Simulation Directorate (TRISA M&SD) has taken the initiative to create and integrate Coercive Behaviors into OneSAF.

This paper discusses Coercive Behaviors, second and third order effects of a coercive action, and the implementation of the actions and effects into OneSAF. It also discusses the challenges and benefits of coercive and persuasive psychological operations in military simulations.

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Introduction

Traditionally, simulations have been limited to force on force battles where one side defeats the other and the simulation exercise is completed. However, with the focus on asymmetric warfare it is clear that the complexities of the Contemporary Operational Environment (COE) are not well portrayed and current maneuver models are lacking in true characterization of the COE. The shifting landscape of political, economic, and military dynamics (over time), commonly seen in stability operations (SO) or counter-insurgency (COIN) operations, pose development problems for Models and Simulation (M&S). The inability to properly represent these dynamics in M&S forces commanders and their staffs into a steep and unforgiving learning curve upon entry into the SO/COIN environment. Here competing forces struggle for dominance and control; their actions generate second and third order effects and in some cases the psychological impact exceeds (sometimes dramatically) the initiating events (or the first order effect).

OneSAF was originally designed and developed as a Brigade and below entity level simulation following the same force on force paradigm of previous simulations. But, both the architecture of OneSAF and its relative youth as a developmental program enable its modification into a useful COE training and experimentation tool.

Modeling coercive actions/tactics in OneSAF begins with developing "Behaviors." Behaviors model the cognitive aspects of a unit or entity. This enables units to sense, acquire, identify, shoot, move, communicate, react to fire, and negotiate differing terrain without constant input from an operator. Coercive Behaviors are models of cognitive actions by individuals, groups, and forces to compel or convince other individuals, groups, and forces to comply, acquiesce to or join their effort through physical or psychological means and their consequential effects.

Coercive Behavior methods may be active, passive, lethal, non-lethal or a combination of two or more Behaviors. Coercive Behaviors are based on cyclical dynamics, which allow an entity or unit to perform actions that spawn second and third order effects. The third order effects have the potential to spawn additional actions (Reactive Events) that can trigger additional Coercive Behaviors. This feedback dynamic may result in a small problem growing rapidly into a crisis in the simulation if the commander does not understand how to manage them. The integration of Coercive Behaviors into OneSAF will groom our leaders to better understand, mitigate, and defeat coercive actions in ongoing and future conflicts. In addition it supports analyses needed in experimentation to determine force structure and related acquisition decisions.

Overview

Currently there are six Coercive Behaviors planned for implementation into OneSAF. The Coercive Behaviors are; Intimidation by Physical Presence (En Masse), Intimidation by Physical Presence (Infiltration), Assassination, Kidnapping, Hostage Taking, and Sabotage. For the purpose of this paper, coercion is defined as the practice of compelling a person or group to behave in a certain way through unlawful means (whether through action or inaction) by the use of threats, intimidation or some other form of pressure or force.

We began the conceptual modeling of Coercive Behaviors for OneSAF by examining the Joint Non-Kinetic Effects Model (JNEM) methodology (ref 1.). The JNEM model calculates the impact of force activities on noncombatant group satisfaction levels through four Noncombatant Soft Factors: Autonomy, Quality of Life, Culture, and Safety. In addition, the soft factors act upon a dynamic Cooperation Matrix that determines information exchange rates between forces and noncombatants.

The Cooperation Matrix determines how much information a given side shares with all other sides. If one side implements an action which reduces that

side's cooperation rating with other sides, the amount of information passed and received declines. Coercion is a counter to this relationship in order to force the exchange of information form an otherwise non-compliant side.

Table 1. Cooperation Matrix & Coercion

Level	Cooperation Matrix % Range band	Coercive Methods
Always Cooperative	99%-100%	Influencing methods
Very Cooperative	71%-99%	Influencing methods
Cooperative	51%-70%	Influencing methods
Marginally cooperative	36%-50%	Only use Physical Presence (No violent methods)
Uncooperative	21%-35%	Can use all forms of Coercion
Very uncooperative	1%-20%	Violent Coercion (Can't use Physical Presence by itself)
Never cooperative	0%-.9%	Coercion Ineffective

Conversely if cooperation increases, larger quantities of information are exchanged, and less, or no, coercion is necessary. Within JNEM, reliability of that information is static and governed by a subject matter expert (SME) defined reliability vector. The Cooperation Matrix can then be used to determine which methods of coercion are useful, if any. (Table 1. Cooperation Matrix & Coercion) The types of Coercion that can be used are population group based; if a population is very hostile towards a given side, nonviolent types of coercion have no effect. If a population is cooperative, coercive methods may not be necessary, and their use can damage relations with the group.

The four Noncombatant Soft Factors are "concerns" represented by slopes that reflect each civilian or civilian group's degree of satisfaction (or mood) with other groups (including force groups) or individuals. They are:

Autonomy: a measure of a group's ability to achieve its goals; in particular these goals correlate to self-governance.
Quality of Life (QOL); measures a group's access to essential services, including water, power, public transportation, commercial markets, and hospitals. In addition, sanitation, health, education, employment, food, clothing, and shelter are also rolled up under QOL.
Culture; measures whether a group's traditions, taboo's, sacred sites and artifacts are denigrated or respected.
Safety; measures the degree to which a group's members fear for their life (both from hostile attacks and from collateral damage as well as environmental concerns). Their environmental concerns include: life threatening disease, starvation, and thirst.

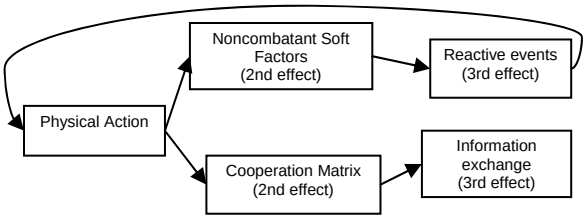
The satisfaction levels for each soft factor or concern together determine a group's composite mood. In addition, each group has a demeanor (defined by a SME for that type of group), which can allow them to have reactions more violent than normal. At various thresholds, along the slope of satisfaction levels and composite Reactive Event(s) may be spawned (e.g., a certain level of coercion causes some groups to pass intelligence to the force coercing them).

Reactive Events respond to various coercive activities and reflect change within the cooperation matrix. They include: side change (support to various force groups), strikes, riots, attacks, exposing hostile combatants, and so on. Simulating these actions provides new challenges for commanders and battle staffs. Reactive Events stimulate second and third order effects requiring command and staff attention. If a Reactive Event is not addressed in a timely fashion, a small event may grow into a large disaster.

Many of the base actions for Coercive Behaviors are already implemented into the OneSAF GUI. But they currently only allow the first order action, e.g., for assassination the threats player would select the Assassination behavior, input the target and the type of weapon to be used and select start. The action would run and that would be the end of it. The enhancement of the base behaviors to Coercive Behaviors is primarily implementing the Soft Factors and Cooperation Matrix into OneSAF, and then enabling the behind the scenes calculations for the Cooperation Matrix and Soft Factors. Similar changes could be made for other Behaviors in the future to provide Influencing Behaviors, which would allow Civil-Military Operations and Relief Agencies to have an affect on the Soft Factors and the Cooperation Matrix.

The implementation of Coercive Behaviors in OneSAF follows a pattern whereby each coercive action spawns two second order effects and each second order effect spawns a third order effect. (**Figure 1. Behavior Effects Diagram**)

Figure 1. Behavior Effects Diagram



One of the second order effects impacts the Cooperation Matrix. The Cooperation Matrix rates each side's information flow with another side. The rating is depicted by a number ranging from 0 to 100. The higher the number, the larger the amount of information can be learned from that side's database. This mechanism governs information exchange between sides. It affects the amount of information the commander receives from the battlefield through situation reports, civilian activity reports (a concept from JNEM which gives a general idea of how the population in an area is feeling/thinking) and targeted human intelligence gathering. Coercive Behaviors are designed to be used against sides that have a cooperation rating less than 50%. Ratings higher than 50% may only warrant the use of Influencing methods, similar to Civil-Military Operations, to increase information flow. Employing coercive methods on a group rated at 50% or higher is detrimental to achieving and maintaining population support, and would, therefore, not be employed.

The other second order effect changes one or more of the Soft Factors. Satisfaction from Soft Factors is rated on a scale of -100 to +100, with +100 being the best possible satisfaction. When a Soft Factor is impacted, either a slope or level change results. These changes to the individual Soft Factors are updated to the composite satisfaction matrix (mood). The composite satisfaction matrix gives the general mood of a group. The simulation setup determines how often the composite satisfaction matrix is updated. If the groups' mood level declines, Reactive Events may occur. There is a 1 percent cumulative chance for a reactive event to happen for;

Every 1 point dropped on the composite satisfaction scale between 50 and 100

Every 2 points dropped on composite satisfaction scale between 0 and 50

Every 3 points dropped on composite satisfaction scale between -50 and 0

Every 4 points dropped on composite satisfaction scale between -100 to –50

At some point, a rule of diminishing returns reduces the overall cumulative chance for a Reactive Event to occur else a Reactive Event is triggered too often.

The increase in the number of points it takes to increment the chance of a Reactive Event to occur is indicative of a population group being less affected, thus less likely to have an Reactive Event, when moving from a bad situation to a slightly worse one as opposed to going from a good situation to a slightly less good situation.

If a Reactive Event is triggered, a determination of which of the 6 possible Reactive Event categories occurs (**Table 2. Example of Possible Reactive Events to Coercive Action**). A second random number determines which Reactive Action occurs in that category. Each Coercive Behavior has its own table of Reactive Events (similar to Figure 3) to draw upon with input from SMEs. This will reflect possible outcomes inline with the original coercive action. Thus a more violent action, like assassination, would have a higher chance of a more violent Reactive Event than an action, such as intimidation. The coercive actions and Reactive Events are planned to impact a 96 hour scenario.

Integrating Coercive Behaviors Into Onesaf

The Coercive Behaviors focus on the civilian population and their response to Coercion over a period of up to 96 hours (short term). The following Coercive Behavior discussions focus on multiple levels of effects:

First order effects showing physical actions.

Second order effects determining impacts on the Soft factors and the Cooperation matrix.

Third order effects and their impact on Reactive Events and information exchange.

Table 2. Example of Possible Reactive Events to Coercive Action

Reactive Event Category	Reactive Action 1	Reactive Action 2	Reactive Action 3	Reactive Action 4
Coercive Action Against Coercer	Assassination	Kidnapping	Hijacking	Sabotage
Individual Action–Support Coercer	Information Nugget (to Coercer)	Side Change		
Group Action - Support Coercer	Demonstration	Demonstration (Riot)		
Individual Reprisal Against Coercer	Murder	Theft/Vandalism	Information Nugget (to allied)	
Group Reprisal Against Coercer	Demonstration	Demonstration (Riot)		
Apathy - Reduce Intel to both sides				

Coercive actions in Italics

The matrixes used for this behavior reflect short term effects; long term effects are still in the early development stages and are not addressed in this paper.

Intimidation by Physical Presence – Occupy En Masse (IPPEM)

IPPEM is intended to replicate a group that has targeted a non-cooperative population center and exhibits the following qualities:
Very few government or coalition forces present
Weak government support within the area
The local police force is perceived to be ineffective or corrupt.

This criterion sets the stage wherein a group can occupy the town unopposed and force the cooperation of the population. The occupation orderable behavior follows this or a similar scenario. First, the occupying group uses a small reconnaissance element to confirm the absence of government or coalition forces before they enter the town. Then, once the conditions are set the group uses speed and shock to overwhelm the town. Examples of locations likely to be occupied are government center/offices and associated public places as well as open air markets, schools, and religious facilities. These locations provide the occupying force an immediate coersive impact on the population gathered in and around the occupied area. This occupation occurs quickly so intimidation is felt immediately. The group is armed, but will not use their weapons for other than display purposes, unless the use of a weapon is necessary (e.g., they are fired upon or meet life threatening resistance). The occupation of the population center is the action which causes the first order effect of intimidation. This affects the satisfaction level in three of the four Noncombatant Soft Factors: Safety, Autonomy and Quality of Life.

When Safety is impacted there is either a slope or level change in the groups' degree of satisfaction dependent on the amount of intimidation (**Table 3. Example of a Change to Safety Soft Factor**).

Table 3. Example of a Change to Safety Soft Factor

Initial soft factors for Group A

Composite	Safety	Autonomy	QOL	Culture
50	50	50	50	50

Time 0 Initial level change

Composite	Safety	Autonomy	QOL	Culture
47	40	50	50	50

Day 1 Slope Change

Composite	Safety	Autonomy	QOL	Culture
46	35	50	50	50

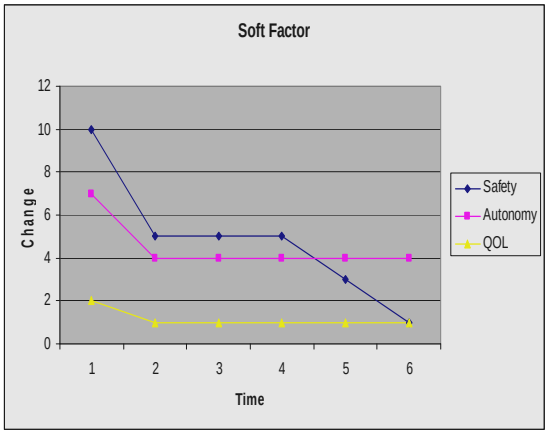
Day 2 Slope Change

Composite	Safety	Autonomy	QOL	Culture
45	30	50	50	50

Autonomy is also affected by intimidation, but compared to Safety, Autonomy level and slope changes are less. Over time the slope change for Safety levels off and the slope change for Autonomy does not, eventually making Autonomy impacts greater than those experienced by Safety. The impact

on Quality of Life is less than the impact of either Safety or Autonomy. There is an immediate, but small, level change in QoL and over time it continues to decline. This reflects that the occupiers want control of the population, and they may or may not take punitive action that could generate resistance. (Figure 2. Example Slope Change Graph) As the three Noncombatant Soft Factors decrease the probability of a reactive event increases.

Figure 2. Example Slope Change Graph



For the occupation and the resulting coercion to be completely successful, the insurgents require a number of insurgents equal to 10% of the total population in order for the total effect of coercion to take effect, resulting in a 30% change to cooperation matrix per the JNEM methodology. This exponentially scales down to a 5% change when the number is 2.5% of the population (i.e., 25 insurgents per 1000 of its total population). Insurgent presence greater than 10% of the population has no additional effect. (**Table 4. Scaling Matrix**) The scaling factor and 10% coverage fraction may be adjusted by SMEs before simulation runtime.

The amount of effective coercion caused by IPPEM is a function of the number of counterinsurgent forces in the area. If counterinsurgents are present then effectiveness of coercion is reduced. When counterinsurgents enter an area, it takes a period of time for them to be effective in reducing the insurgent's coercion – it should not be an immediate effect. There are default values to effectively reduce the insurgent's coercive effect. Matching the insurgent's numbers reduces the coercive effect of physical presence by 20%. As counterinsurgent numbers increase in an area, insurgent's coercive impact is lessened due to reduced operational activity, being captured, or attrition. Eventually counterinsurgents saturate an area so that there is no noticeable insurgent impact. When the counterinsurgents are five times the amount of insurgents, the coercive effect of physical presence is negligible. At this point the insurgents must increase their numbers, move to a new area, go to ground and wait for the counterinsurgents to leave, or revert to a more aggressive method of coercion. However, these default values may be changed by SME input to insure applicability in different environments.

Table 4. Scaling Matrix

# of insurgents (D1)	# of counter insurgents	Coercive effect
25	0	5%
25	25	4%
25	50	3%
25	75	2%
25	100	1%
25	125	negligible

* This is for a population of 1000

The number of insurgents needed to cause the Coercive effect can be changed based upon the Demeanor (D) Rating of the insurgent. For example, an insurgent rated D1 counts as 1 insurgent, a D2 rating counts as 1.5 insurgents and a D3 rating counts as 3 insurgents. A population of 1000 would require 100 D1s, or approximately 34 D3s for the full coercive effect to occur. IPPEM in a village or neighborhood is never attempted with a group that is less than 2.5% of the population.

Intimidation by Physical Presence – Infiltration (IPPI)

The IPPI Behavior represents how a group takes control of a town over a period of time through intimidation. The group infiltrates in small numbers (3-5 personnel), and conducts reconnaissance to determine the disposition (i.e., demeanor) of the town and the number of personnel needed to conduct intimidation. Infiltration takes place over a period of days or weeks and is focused in and around markets, areas of worship, and businesses. Initially, the group will not use their weapons for other than display purposes, but must possess an ability to rapidly escalate the level of coercion.

IPPI affects two of the Noncombatant Soft Factors: Safety and Autonomy. When Safety is impacted there is a change in the groups' degree of satisfaction dependent on the amount of infiltrators in the area. There is an immediate drop in the degree of satisfaction; varying from a small to large level of

change depending on how many infiltrators are perceived to be in the area. As time progresses and the coercive group remains, the occupied population's Safety satisfaction rating experiences a slope change. Autonomy is also affected by IPPI. The level and slope changes are less for Autonomy than for Safety, however over time the slope change for Safety levels off and the slope change for Autonomy continues on a downward trend. As negative Autonomy and Safety factors lower the composite satisfaction rating, the chances for a Reactive Event increases. The additional calculations for IPPI to be successful from a game perspective are the same as IPPEM.

Coercion by Assassination

Assassination is a deliberate action to kill a political leader or VIP, versus the killing of common people, which is considered murder. The insurgent group assassinates or murders people it cannot intimidate, who have left the group, or who have some symbolic significance for the enemy or world community.

Assassination impacts the satisfaction levels of two of the four Noncombatant Soft Factors; Safety and Autonomy. If a religious leader is assassinated, Culture is impacted as well. When the assassination impacts Safety there is either a slope or level change in the groups' degree of satisfaction. Initially, there is an immediate drop in the degree of satisfaction; this is a small level change. As time progresses, the occupied group's Safety rating experiences a slope change. Assassination effects Autonomy as well. The default values, (i.e., level and slope changes for Autonomy) are less than Safety. Over time the slope change for Safety and Autonomy levels out. Assassination of a religious leader results in a level change in Culture, otherwise there is no impact on Culture. When the Assassination Reactive Event Matrix is created, it will define a default percentage chance a Reactive Event occurs. These chances either increase or decrease based on the type leader assassinated and the amount of time passed since the assassination. The chance of a reactive event occurring is dependent on whether the assassinated leader is a local, regional, or national leader, and the effects are restricted to the leader's area the influence.

Coercion by Kidnapping

Kidnapping is a covert seizure of one or more persons to obtain specific results and is normally very difficult to execute. The kidnapper(s) may remain unknown to the public for an extended period of time. Media attention is initially intense but decreases over a period of time. Successful kidnapping requires elaborate planning and logistics. The risk to the kidnapper(s) may be less than the risk associated with a hostage situation. There are several events that must occur sequentially in order to conduct a successful kidnapping. Separate and distinct cells within the kidnapping group accomplish these events. Initially a leadership cell identifies the purpose for the kidnapping and then determines the targeted individual(s). Next a reconnaissance cell identifies where and when the kidnapping occurs based on the target's daily routine(s). The reconnaissance cell also identifies multiple routes for ingress and egress to and from the kidnapping site. After the kidnapping occurs, the cell conducting the kidnapping hands the person(s) kidnapped over to the cell responsible for holding the captured person(s).

Coercion by Kidnapping impacts only the Safety Noncombatant Soft factor. The Safety factor reflects the emergent concerns of groups as members are both threatened with kidnapping or are actually kidnapped. A kidnapped person receives an assigned numerical value ranging from 1 to 5, with 5 having the greatest negative impact on the Safety satisfaction rating. The appropriate numerical value is SME defined and determined during exercise design.

When Safety is impacted there is an immediate drop in the degree of satisfaction. As time progresses the group's degree of satisfaction experiences a slope change and eventually levels off. If the group's composite satisfaction (or mood) rating declines enough a RE occurs. As previously discussed, the victim has an impact rating of 1-5, and each level has its own RE Matrix. If the victim has a value of 5 there is a greater chance for a more violent RE than if the victim has an impact rating of 1.

Coercion by Hostage Taking

Hostage taking is typically an overt seizure of people to cause a group to refrain from acting, in a particular way, often under threat of serious physical harm to the hostage(s). The hostage takers use the safety they gain while holding the hostages to gain publicity, and negotiate concessions or ransom. Unlike kidnapping, where a prominent individual is taken, the hostages are usually not well known figures in the enemy's society. The planning and execution phases of a hostage taking and a kidnapping or hijacking are similar.

The conceptual modeling for this Coercive Behavior is still in the development stage. Coercion by Hostage Taking impacts only the Safety Noncombatant Soft factor. The Safety factor reflects the concern population groups have as their members are either held as hostages or fear being taken hostage. Both the initial level change and the ongoing slope change are projected to be mild. If a Reactive Event is caused due to this action, the events are projected to be counter-hostage taking (e.g., Mexican drug cartels), protests or intelligence about the hostage taking group.

Coercion by Sabotage

Sabotage is the planned destruction of a group's infrastructure in order to inflict both psychological and physical damage, or obstruct normal operations. The sabotaging organization normally focuses its sabotage actions at elements of the civilian infrastructure. Therefore, the Quality of Life Soft Factor is the main factor affected and experiences either level or slope change. Planners preparing sabotage actions may consider numerous techniques, such as bombing, arson, and contaminants.

The conceptual modeling for this Coercive Behavior is still in the development stage. Coercion by Sabotage principally impacts Quality of Life and to a lesser degree, the Safety and Autonomy Noncombatant Soft Factors. Safety and Autonomy are impacted by the group's feeling of an inability to maintain order, stability or control the environment around them. Reactive events are projected to be mainly protests and intelligence.

Conclusion

Our nation's involvement in conflicts world-wide demonstrates that the military, now and in the future, must cope with enormous complexity. Commanders must understand the impact of coercion and consequent second and third order effects across noncombatant populations. Simulations and models must provide new ways to train commanders to develop and maintain cognitive thought processes that allow them to adapt to the fluid COE. The approach outlined in this paper will be implemented in OneSAF over the next year or two enabling robust representation of coercion effects.

References

1. Jet Propulsion Laboratory (2007). JNEM 2.0 Analyst Guide (from JNEM electronic documentation files)
2. U.S. Army. (2006) FM 3-24 Counterinsurgency, Washington, DC: U.S. Government Printing Office.