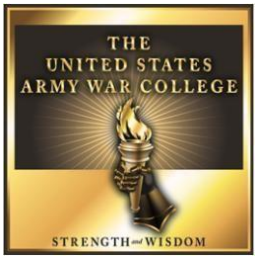
Strategy Research Project

Mission Command in Complexity: Opportunity on the "Edge of Chaos"

by

Lieutenant Colonel Leo Joseph Wyszynski
United States Army

Under the Direction of:
Captain Michael Hritz



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Abstract

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Mission Command in Complexity: Opportunity on the "Edge of Chaos"

In 2012, the Chairman of the Joint Chiefs of Staff, General Martin Dempsey, indicated that a future characterized by "increased uncertainty, complexity and competitiveness" would demand increased practice of the philosophy of mission command within the services.[1] Joint and Army doctrine, undoubtedly influenced by his views, advocates for military leaders to practice mission command—a method of leadership dependent on a shared understanding of the overall objectives and situation where subordinates have maximum flexibility to accomplish their role in the overall mission. The purpose is to generate timely, efficient, and effective action in this highly competitive and interconnected environment to allow leaders to capitalize on fleeting "windows of opportunity" in order to gain a position of relative advantage over an adversary.[2] Restated, leaders must select the right actions and apply them at the proper time and place to create desired change in their operational environment.

A critical assumption underlying mission command philosophy is that, in fact, it is possible to accomplish this difficult undertaking. Arguments made here contend that this assumption is valid, but that doing so is extremely difficult. Furthermore, current military doctrine is not sufficient to guide everyday leaders from the abstract theory of mission command to practice. If the U.S. military plans to employ mission command more broadly to increase chances of success, there are two logical and necessary questions. First, is there a methodology to assist determining when windows of opportunity will occur? Next, is there a process to help prescribe actions when they do in order to help to bring about the desired endstate?

The nascent field of complexity theory and, more specifically, the study of its sub-field of complex adaptive systems (CAS) offers valuable insights into both of these

questions. John Holland, a noted expert in complexity theory, offers “all well-studied CAS exhibit lever points, points where a small directed action causes larger predictable changes in aggregate behavior.”[3] The notion that the application of small resources can lead to significant outcomes has great appeal for a military commander looking to improve the probability of success when planning and executing a strategy or operation. A tool to help efficiently achieve outcomes would be a valued addition to military problem solving and a viable method to help actualize mission command. A focused survey of research on CAS can yield improvements to existing Joint and Army doctrinal planning and execution processes. When adapted to these military procedures, insights gained from practitioners of complexity study can prove useful in assisting commanders and staffs. Attaining post conflict stability goals in the chaotic aftermath of conflict is one area where they can be particularly helpful. However, they may be more broadly applicable through all phases of a conflict when similar conditions of system instability are present.

As opposed to invalidating current planning, execution, or targeting processes, aspects of complexity study offer useful augmentation to make existing problem-solving procedures more robust. Armed with them, a military organization is more likely to illuminate both a path to the desired end and the risks incurred on that journey. Ultimately, including them in military doctrine can assist leaders in transforming mission command from theory to practice.

To develop this argument that aspects of complexity theory will be a useful add to doctrinal problem-solving processes, four sections follow. The first describes what complex adaptive systems are and explains why techniques to model them are

applicable to today's contemporary environment. The second will examine tools that experts from various fields use to study and solve problems in CAS. This short survey will derive five specific recommendations to assist the military in planning and executing a strategy or operation. Again, the purpose here is not to develop new methods for doing so, but rather to enhance extant problem-solving doctrine, which already uses some elements of systems theory, to increase the probability of success.

The third section will use case studies of the transition from major combat operations to stability operations during Operation Iraqi Freedom and Operation Just Cause to test the validity of the five recommendations for inclusion into extant doctrine. These are useful case studies because they investigate post conflict environments, which are highly unstable systems. In each case, applying or failing to apply decisive interventions contributed significantly to the ultimate success or failure of the operation. Unstable systems such as these are said to be "on the edge of chaos."[4] In this state, it is theorized that new properties can rapidly emerge in systems, which offers promise (and potential risks) to military organizations looking to quickly instrument change.[5] Studying U.S. actions in Iraq and Panama shows the usefulness of the recommendations from the previous section to post conflict environments. Morover, it also suggests there could be a wider adaptation to problem-solving processes at all levels of war and across the spectrum of conflict to help ensure that military success leads to attainment of military and political ends.

The final section recommends that Joint and Army doctrine for planning, assessing, and targeting change to include the recommendations derived in this work. At a minimum, this could lower the risk that the transition from offense or defense to

stability operations would compromise the overall objectives of the conflict. However, it could also aid in other situations beyond post-conflict environments. In general, the practices gleaned from complexity theory can assist leaders in determining when, where, and what kinds of resources to apply to help achieve goals and understand the associated risks.

While many aspects of operational design, planning, and targeting already involve a systems approach, explicitly discussing how to apply complexity theory will help to demystify the concept of mission command. Rather than depending upon an over-reliance on military genius to identify decisive points and actions, a modified approach can draw on the expertise of a staff, interagency partners, and a wider audience, who all share collective interest in achieving common security goals. Doing so will assist the Joint Force or Army commander in taking the right actions when "windows of opportunity" open.[6]

What Are Complex Adaptive Systems and Why Should They Interest the Military?

Consistent with the characteristics of the world identified in a significant body of intelligence assessments, the modern-day operating environment should be considered a complex adaptive system. Consequently, it is appropriate for the military to employ techniques used to study these systems. Doing so increases the probably of success as opposed to continuing with current methodologies for planning and execution. This section describes what complex adaptive systems are. In doing, it will briefly examine the concepts of emergence and lever points to demonstrate the potential value that using tools to study and model a CAS can have on driving a system towards desired outcomes.[7] Next, it will look to intelligence assessments to argue that the strategic and operational environments where the military functions are and will continue to be CAS.

Therefore, because the military will operate in CAS, and because there are techniques that other practitioners use successfully to study and affect change in CAS, it is both useful and appropriate for the U.S. military to include these techniques in its own doctrine.[8]

To begin, Jason Brownlee, a complexity researcher, offers a basic definition of a complex adaptive system as an entity that is "composed of populations of adaptive agents whose interactions result in complex non-linear dynamics, the results of which are emergent system phenomena."[9] This is a helpful description, but each of its parts requires further explanation. As terminology varies among researchers, defining terms is important when discussing CAS.[10]

Agents are the individual parts or elements that make up the CAS. They vary, and researchers define them based on the system. For military applications, one could consider agents as people or groups of people. The aggregation of these people forms populations. Agents interact with each other as well as their environment. For instance, a combatant interacts with the local population as well as the physical terrain upon which he is fighting.

Complexity is a reflection of the sheer number of interactions between agents, along with the "inter-relationship, inter-action and inter-connectivity of elements within a system and between a system and its environment."[11] Complexity is characterized by non-linearity, or the fact that the interaction between two agents does not necessarily cause an easily predictable and additive result.[12] A common expression to describe system complexity is that the sum of the systems components is different than its parts. For example, two allied countries could form a coalition whose collective actions, goals,

or strategy might be distinctly different from that of an individual nation. The coalition's behavior is complex.

The adaptiveness of the system results from the fact that agents' behavior is not stagnant but changes over time. Agents are said to form schema which are essentially rules, derived from external feedback, that govern how they act.[13] Based on their interactions with each other and their environment, agents have the ability to "assign credit" or essentially rate and rank order the rules that form their schema over time.[14] Additionally, informed by interactions, agents can also add new rules to their schema.[15] The combination of reevaluation and discovery changes their behavior, and it also affects dealings with other agents. Consider a civilian preparing to loot property in a post conflict environment who observes another looter being detained by police. This incident will likely change his future behavior, and potentially that of others to whom he recounts the story. His schema has likely changed by him adding new rules and/or changing his existing ones concerning looting. Therefore, his future behavior adapts based on his past experiences.

Emergent phenomena represent the conditions that arise from relationships and interactions in a system. According to Holland, emergence "is an essential requirement for calling a system 'complex'."[16] There is scholarly discourse on the definition of emergence, and researchers discuss two potential types of emergence: strong and weak emergence.[17] Advocates of strong emergence, hold that it is impossible to predict or "deduce" future states from elements in the past. The second, weak emergence, holds the opposite view that you can "deduce" properties of a system from its parts although those emergent properties are "unexpected."[18] Scientists, economists,

computer scientists, and many other fields use the study of complex adaptive systems to explain complex interactions in their area of expertise and to assist them with solving problems.[19] Based on the fact that numerous examples exist where practical applications of complexity theory have led to the discovery of rules that allowed the effective prediction of future states of CAS, going forward, the term emergence and weak emergence will be used interchangeably. While emergence is covered in more detail later, it is important to note here that military implications are significant. The concept of emergence suggests that detailed examination of a CAS can lead to identification of patterns and relationships to inform model creation and help to predict future conditions in the real world. Moreover, it indicates that the possibility of discovering “lever points,” where small actions or interventions can have great effects on system behavior, is a reality of CAS behavior.[20] While discovering them may be difficult, the value that doing so offers in assisting selection of ways and means, is at least conceptually worth the effort as opposed to intuitively selecting them.

Armed with a basic understanding of what a complex adaptive system is, and the potential benefits of using techniques to model them, it is important to explain why the contemporary operating environment should be described as a CAS. First, as discussed above, the operating environment consists of people, families, tribes, societies, armed forces, and nations (and many other hierarchic groupings) any of which could be considered to meet the definition of agents. These agents clearly have sets of rules or schema that they use to regulate their behavior, such as cultural norms. They adjust these rules or create new rules based upon their experiences. The interaction of multiple agents with themselves and the environment creates complex, non-linear new

properties in the system that are non-additive and distinct from individual properties. Recall the example of coalition behavior potentially differing from member-state behavior. Finally, these emergent properties evolve from past states of the system, forming new rules, which one could potentially deduce from previous states of the environment. In other words, what happens today depends upon what happened yesterday or at some point previously. Although it is different, the future does not magically appear, it emerges from past events. For these reasons, the contemporary operating environment displays all of the characteristics to be defined as a CAS. (While there are other aspects of CAS, this description is sufficient for the scope of the research here).

The body of current U.S. intelligence indicates that this assessment will continue to be the case and that the level of complexity and interconnectedness in the world will only increase. Director of National Intelligence, Dan Coats, recently indicated the rapid increase of computer and smart device networking has significantly increased the ability of once disparate entities to affect each other.[21] The Army Operating Concept, *Win in a Complex World*, points to an environment that will be characterized by increased dynamic human interactions enabled by communications and technology.[22] Navy, Marine Corps, and Air Force assessments all make similar projections.

As the United States exists in a complex operating environment and assessments project this trend will continue, it is prudent to examine complexity theory for ideas and applications that can be adapted for military purposes. The concept of emergence advances the promising idea that proper feedback or interventions in a system can influence its agents' behavior.[23] Affecting desired change in the environment

is the military's reason for being, and, if strategy consists of using means and ways to achieve ends, as Andrew Hill suggests, "systems thinking is therefore essential to effective strategic leadership."[24] In successful applications, where discovering a lever point could result in achieving objectives while conserving American lives and resources, the benefits would clearly outweigh costs; however, this will clearly not always be the case. It would be erroneous to suggest that applying theoretical techniques to work with CAS will always result in selecting perfect interventions that create desired outcomes. Still, there are valuable reasons to try to do so. The inability to perfectly predict every property that emerges from a system does not mean there is not value in studying its elements. Having additional and likely better insights into a system's behavior and components, arms a leader with a more complete picture and reduces the risk of blind spots or faulty assumptions tainting decisions. Having justified the need, it is logical to look to a survey of complexity study to derive ideas and methods to improve Joint and Army problem-solving techniques.

Five Recommendations for the Military Derived from the Study of Complexity

Army and Joint doctrine contains a number of approaches for planning and execution that are effective and time-proven, but also imperfect. These include operational design, the military decision making process, the joint planning process, the targeting process, and the assessments process. While all of these, to some degree, touch on the need for and include aspects of a systems approach, current doctrine does not explicitly recognize the value of CAS research in helping to solve military problems. In order to improve these mission command processes, this section proposes the following five recommendations, derived from the study of CAS: 1) Establishing

Communities of Interest; 2) Defining Boundaries; 3) The Importance of Simulation; 4) Providing Feedback, and 5) Tempo.

Establishing Communities of Interest

Based upon the large number of interactions that occur in a CAS between significant numbers of agents and the difficulty in ascertaining the relationships between them, the effort to understand how a CAS functions must be a collaborative effort. The amount of information needed to understand and analyze all of the data is simply beyond the comprehension and expertise of a single person or even a single specialized group of experts. Gerhard Fischer, who studies complexity as it relates to computer and cognitive sciences, discusses two types of groups of professionals, communities of practice and communities of interest, that are important to consider when assembling the right expertise to understand and solve complex problems. Communities of practice consist of experts in a given field "undertaking similar work." Communities of interest "bring together stakeholders from different communities of practice to solve a particular (design) problem of common concern." They are essentially an assembly of representatives from various communities of practice that can integrate a broad range of knowledge to help understand all aspect of a complex problem.[25]

The military is a community of practice. When attempting to understand and achieve objectives in a CAS, military organizations need to form communities of interests to bring diverse and informed groups together to solve problems. Understanding the many layers and dynamics occurring among agents in a system requires multiple fields that can understand specific behaviors and techniques to influence them through the application of a range of resources. While the Army and the

Joint Force will bring an understanding of military concerns to bear on a problem, the other elements of national power—diplomatic, informational, and economic—are arguably just as important. A community of interest could consist of traditional joint, interagency, intergovernmental, and multinational experts, but could also extend to the other non-governmental partners in the private sector and educational institutions. In order to effectively understand actors and relationships and to avoid invalid assumptions, there should a competent authority to understand all applicable agents when assembling a team to plan a strategy. Collaboration between diverse team members will lead to insights and more informed hypothesis about how to affect the environment. While it is hard to quantify the effect, conceptually, the probability of understanding complex relationships will clearly be more informed with a broad range of experts analyzing them. In addition, a community of interest hedges against making invalid assumptions due to a lack of expertise to fully understand the system.

Defining Boundaries

When developing a model for the complex system, it is important to define the system type and to define the boundaries of the problem we are solving. Stephen Haines, who explores business applications of systems theory, characterizes system types in two ways—open or closed. A closed system has no external inputs or outputs. It is completely isolated. This rarely exists in the real world and certainly not in the complex operating environment. Open systems “exchange information, energy, or material with their environment.” CAS are open systems, where agents receive data or stimuli from the environment as discussed previously and then output data to other agents or the environment.[26]

Consequently, it is important to distinguish system boundaries to identify the origin of inputs, to determine what they consist of, and to understand their impacts. For inputs that do not arise from interactions of agents, the system boundary essentially determines whether the input comes from the local environment (inside the system) or externally (outside the system). Traditional military methods describe boundaries in terms of the area of operations defined by specific geographic boundaries, and the conceptual area of interest, which includes areas that can potentially influence the area of operations. Defining boundaries more broadly could be helpful because it allows problem solvers to investigate and better understand factors affecting agents. Furthermore, establishing a large boundary gives the opportunity to influence inputs (rather than assuming them as a given) as well as to understand system outputs.[27]

There are several important implications here with respect to including higher-echelon friendly agents into a model. In practice, military units normally consider the objectives two echelons above their own headquarters (a brigade would be concerned with a division and corps headquarters). Guided by doctrine they construct their boundary around these agents two levels up the chain of command. In a CAS, this may not be sufficient, and a better methodology may be to include an operational-level headquarters, strategic headquarters, and perhaps even national leadership within the boundaries of the system. These echelons define the ideal state for the CAS—the military and, ultimately, the political objectives that define strategic victory. Military actions to affect the CAS have the potential to affect agents outside of the system boundary. Without constant attention to these external impacts, there is the potential that a tactical action assumed to be taken well within the boundaries could cause a

situation outside the boundaries that frustrates higher objectives. Notwithstanding, understanding the schema of operational, and strategic agents could allow military organizations at a lower level to take actions with benefits at higher echelons, which is a critical aspect of mission command. Including national, strategic, and operational leadership as modeled-agents within the system's boundary mitigates strategic risk by ensuring interventions are always enacted with second and third order implications to higher objectives as a consideration.

Another reason to establish broader boundaries is that higher-level entities might control resources and authorities required to help understand or influence the system. Knowing where a particular authority lies and being prepared to access it rapidly enhances the ability to change the system by implementing the required resource when the opportunity arises. Additionally, understanding authorities and resources available at different echelons allows a commander to better express the benefits of having access to them and explaining the risks of going without.

The Importance of Simulation

Complexity theorist Mark Bedau's definition of (weak) emergence provides strong reasoning to use modeling when problem solving in complex adaptive systems. He defines (weak) emergence as follows: "A microstate of P of S with micro dynamic D is weakly emergent if P can be derived from D and S's external conditions but only by simulation."[28] In other words, the only way to determine weakly emergent macro conditions (P) of a system (S), is to perfectly understand the internal dynamics of a system and any external inputs and then create a model to simulate the passage of time. Bedau's theory suggests that if you perfectly understood the agents and their schema in system, as well as any external inputs and relationships with the

environment, then you could essentially predict the future. In effect, the model created to simulate reality would match the real world.[29] Notwithstanding, Bedau recognizes the limits of this theory as he acknowledges the impossibility of perfectly understanding all relationships and interactions in systems that lead to future states.[30]

Despite its limitations, this theory has important implications for military strategists and planners. An iterative model of a CAS with good representations of agents, schema, relationships, and system inputs and outputs, which is adjusted for each successive iteration to reflect changes, has the potential to predict what future states will emerge. Assuming the community of interest assembled to study the CAS has the right expertise and has defined their boundaries well to allow understanding of agents, inputs, and outputs, they should be able to create a detailed model of the CAS. While this will never be a perfect way to predict future events, the process of doing so has value not only in understanding the system and its relationships, but also the ranges of its potential outcomes. It would certainly provide more value than not doing so, or intuitively predicting complex outcomes. In doing, simulation would also help to better define risks and benefits of a given intervention.

In terms of the type of simulation to employ, one could argue the benefits of creating a computer driven one (and this may be appropriate if time allows). However, a community of interest assembled in a structured way to conduct an iterative simulation should be able to effectively model a CAS. The collaborative efforts of experts replicating agents' behavior and adjusting schema during successive iterations should allow them to create a useful model that is reflective of (but not a perfect match of) reality.[31]

Once created, they could use this model to test various hypothesis, derived from what they already know about the system, to evaluate the impact of various interventions. At its best, this process could identify the conditions when potential opportunities arise as well as potential lever points to drive the system towards goals. At a minimum, however, it would provide a practical way to assess various ways to employ scarce means. Furthermore, it could expose detrimental second and third order effects of intervention, particularly if system boundaries are defined broad enough as discussed above.

As planning shifts to execution, or as they collect more information, planners or operators can update their hypothesis. They could adjust their model accordingly, and, consequently, tweak their interventions if the system is not moving toward the desired endstate.

In essence, this type of simulation is what already occurs during planning processes in a wargame or in targeting and assessment meetings, however, in a less informed and collaborative manner. A critical difference recommended here is taking a more holistic approach to the process and focusing on changing agents and influencing the schema in the system. Also important is remaining cognizant of the second and third order effects to understand both collateral effects and how to affect the system in the future rather than more narrowly focusing on the temporal effects such as the destruction of a single target.

Providing Feedback

By understanding how to influence the schema that form in a system, one can help to influence agent behavior. Jochen Fromm identifies two forms of feedback or

what he calls “two basic forms of interaction which lead to weak emergence.”[32] These are depicted in the figure below:

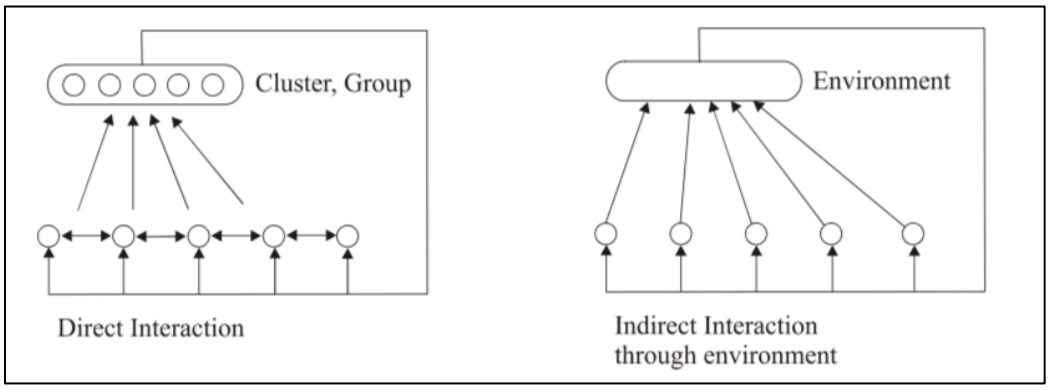

Figure 1. Direct and Indirect Interaction[33]

Direct interaction involves the interaction of agents in the system. Their interaction produces clusters or groups, which then affects behavior of agents that formed the group. An example of this type of interaction might be those that occur when two warring tribal leaders come together, establish a truce and a common governance structure. Their new unified power structure influences the ways or schema that both they and those in their tribes view and act. In indirect interaction, agents influence the environment and are then affected as they interact with the environment. An example of this might be those same tribal leaders working together to enact a common curfew for the collective regions that they control. This change to the environment also affects the schema that govern the individual tribes and tribal member behavior. As Fromm indicates these two types of interactions may not exist in isolation, but in combination. For example, the tribal coalition that forms in the first example might influence a regional government to create a curfew to influence everyone in the area to enhance stability.

Once introduced into an operating environment, military forces become part of the system. They must be prepared to act (intervene) directly or indirectly, or in combination, to affect the system based on the feedback they receive in order to shape the environment as depicted in the figure below.

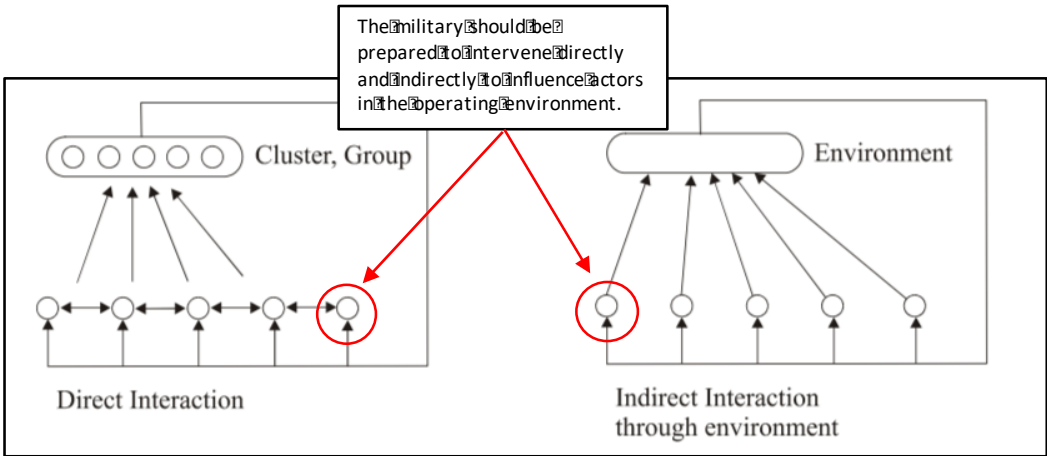

Figure 2. Military Interventions[34]

The feedback provided can either be positive to encourage behavior or negative to disincentivize it. It is also important to note that direct interactions could change the environment while indirect interactions can create unanticipated clusters.[35] Accounting for unexpected consequences such as these necessitates the use of an iterative process. As stated above, planners and operators should assess and alter their models to adjust interventions that are not having projected effects.

Tempo

When discussing mission command, General Dempsey highlighted the importance of tempo which he defined as the “ability to operate at the speed of the problem” to “rapidly exploit opportunities in both time and space” to influence the environment.[36] Understanding the rate at which a CAS is changing is a critical concern.

Ilya Prigogine proposes that complex adaptive systems that are “far from equilibrium” will adapt at a faster rate or at least have the potential to produce more future states.[37] A system out of equilibrium can be considered unstable in the sense that it changes more rapidly. In this case, relationships between agents would be difficult to ascertain without continuous monitoring because they are not constant. A system at equilibrium could be said to be stable with relatively fixed relationships and a slower rate of change. While a system out of equilibrium may look to be a promising place to intervene, it would be important to closely monitor a system with a relatively rapid cycle to assess and adjust feedback to this type of system. There is the potential for great changes in the unstable state between order and disorder, where the system is said to be on the “edge of chaos.”[38] Risks of applying feedback at potential lever points should be evaluated and closely monitored to ensure they result in the intended effect.

The period that one establishes for a planning simulation or an execution process (targeting or assessment for example) should be “tuned” to the system’s rate of change. Doing so will account for adaptation, and allow one to change the model and interventions accordingly with respect to assessments of the environment and agents’ behavior. Notwithstanding, there should be some method, to react to rapid changes in the system, which must be monitored at all times while the cycle is occurring to observe for results and detect unexpected or unintended consequences.

To summarize this second section, the military should amend Joint and Army doctrine for planning and execution processes to explicitly include the following five recommendations drawn from the study of complex adaptive systems:

1. **Establishing Communities of Interest**. Create broad communities of interest around the security issue at stake. The intent is to maximize the ability to understand and account for the behavior of all agents in the system. Collaboration will lead to better insights into relationships and consequently better hypothesis about how to employ means and ends to affect the system directly and indirectly towards desired objectives.
2. **Defining Boundaries.** Establish broad system boundaries to capture as many agents as possible who influence or have the potential for influencing the CAS. These boundaries should illuminate critical inputs and outputs from the CAS. Consider including operational, strategic, and national leadership as modeled agents to better enable achievement of political and strategic goals.
3. **The Importance of Simulation**. Use simulation to model the operational environment. Form communities of interests to create accurate models and then iteratively conduct the simulation with them to test the effects of various interventions. Apply interventions and then adjust the model and, in turn, future interventions, based upon assessments of progress towards desired objectives.
4. **Providing Feedback.** Apply positive or negative feedback directly to agents or indirectly through the environment based on hypothesis and projected windows of opportunity.
5. **Tempo**. Establish a process for simulation, planning, and execution where the period of the process iteration is “tuned” to the CAS’s rate of change.

Doing so will increase the chances of detecting rapid or unanticipated changes in adaptive agent behavior.

Analyzing the Five Recommendations in the Context of Post Conflict Environments

Investigating results at the strategic and operational levels of war provides evidence that the use or absence of use of the five recommendations above contributed or detracted from achieving national strategic and military objectives in the case studies of Operation Iraqi Freedom and Operation Just Cause. The following analysis focuses on the time when U.S. forces transitioned from major combat operations to stability operations—periods where the environments were extremely unstable as the authoritarian regimes of Saddam Hussein and Manuel Noriega ceased to control the population. This examination shows the value of applying techniques from the study of complexity in post conflict environments where the unstable systems hover on the "edge of chaos."[39]

The first analysis evaluates the role that communities of interest played in identifying and leveraging appropriate actions. The U.S. military and defense leadership did bring communities of experts together in both Operation Just Cause and Operation Iraqi Freedom. In Operation Iraqi Freedom, the information gleaned from communities of interest discourse was largely ignored. In Operation Just Cause, the concern for security during planning limited the role that they played prior to execution, but a synchronized interagency effort during execution mitigated this earlier lack of collaboration.

Just prior to execution of Operation Just Cause, General Kelly, the Joint Staff Operations Officer (J3), activated a crisis action team in the National Military Command Center consisting of staff experts to support General Thurman, the United States

Commander in Chief Southern Command (USCINCSO). The purpose was “to coordinate national support and guidance for USCINCSO and to respond to operational and politico-military issues as they arose” in Panama.[40] This stands in contrast to the planning effort, where the expertise involved did not extend beyond the military due to operational security concerns.[41] The crisis action team sought and coordinated expertise and assistance from the interagency to assist Southern Command (SOUTHCOM) efforts. Forming this team was decisive. In one instance, communication from the USCINCSO to the Joint Staff and the National Security Council led to the capture of Manual Noriega who was attempting to gain asylum in the Papal Embassy in Panama. The Department of State used diplomatic pressure to help influence the Vatican to deny him asylum. As a result, U.S. forces detained Noriega on January 3, 1990, paving the way for the new Panamanian leadership under President Endara. This visible change of authority had a stabilizing effect on the population.[42] Furthermore, it allowed the achievement of a stated political and military objective to detain Manuel Noriega.[43]

In contrast, the Department of Defense, and specifically OSD policy, actively worked to ignore and invalidate the Department of State’s (DoS) input on post conflict operations. For example, Secretary Rumsfeld directed the removal of Tom Warrick in January 2003.[44] He was a DoS employee who had worked for eighteen months on a plan for post-conflict Iraq and who Jay Garner, the U.S. lead for stabilization in Iraq, assessed as critical to the stabilization effort.[45] Furthermore, DoD did not form the Organization of Reconstruction and Humanitarian Assistance (ORHA) to head the stabilization until late January 2003, less than two months before the invasion began.

This did not leave sufficient time to assemble the appropriate expertise for planning. Further impeding the effort, Secretary Rumsfeld and OSD policy staff handpicked many of the people who would be running national agencies in Iraq but were inexperienced and unqualified to do so.[46] Lack of qualified experts hindered efforts to identify, resource and implement many necessary tasks to stabilize post-war Iraq particularly after the ground war ended and ORHA was put in charge of the stabilization effort.

The second area to analyze is the recommendation to select boundaries that keep operational and strategic leaders cognizant of higher-level aims. One of the critical reasons to do so with respect to military operations is to ensure that second and third order impacts are considered, particularly with respect to achieving political and military objectives.

In Panama, operational-level military leaders remained cognizant of overall political objectives while this was arguably not the case in Iraq. In other words, the area of interest for military leadership at the operational and strategic level during Operation Just Cause included strong considerations of national objectives where it was not always the case in Iraq. General Stiner and General Thurman, the operational-level commanders, quickly became aware that disorder threatened their ability to achieve their military endstate and the overall political endstate. This led to communications at the strategic level for more forces as well as for more forceful rules of engagement. In Iraq, the level of inaction from operational military leadership in response to the power vacuum that resulted following the disintegration of the Iraqi military is not consistent with the idea that United States Central Command (CENTCOM), the Combined Forces Land Component Command (CFLCC), or V Corps firmly grasped overarching political

objectives. If it had been, CENTCOM at least should have reconciled the fact that the security situation on the ground was completely contrary to the desired endstate of a stable Iraq. Instead of advocating for a fast withdrawal, CENTCOM might have argued for greater troop presence had they been more cognizant of the repercussions.

Ironically, multiple simulations and iterative planning sessions occurred prior to Operation Iraqi Freedom that indicated instability due to lack of civil order was likely after the conflict. These included a study at the Marine Warfighting Laboratory; a V Corps staff exercise conducted prior to the invasion, and the ORHA rehearsal at the National Defense University.[47] However, these results were either ignored, invalidated, or not brought to the full the attention of policymakers. Consequently, interventions that might have stemmed instability did not incur while the U.S. adopted some that furthered civil disorder. These include the U.S. civilian lead of the Coalition Provisional Authority, Paul Bremer, releasing an order to disband the Ba'ath Party, initial failure for U.S. forces to adopt stricter rules of engagement and a law enforcement role, and assignment of insufficient forces to maintain civil order. These failures contributed to a rapidly expanding insurgency frustrating political stability objectives.

During the Panama invasion, while iterative planning for combat operations occurred, the planning for the transition to stability operations and the stability operations themselves were largely ignored and compartmentalized. As a result, required civil-military assets were not available immediately after the invasion, and U.S. government civilian agencies were largely unprepared to conduct tasks that they had the resources and authorities to accomplish.[48] As stated above, these were overcome by rapid and decisive action from the operational and strategic leadership through

interaction of Southern Command staff with the Panama Crisis Action Team. Nevertheless, conducting a more robust simulation with civilian and military experts might have revealed this oversight prior to the invasion.

In terms of assessing the degree to which the U.S. military provided effective feedback to affect the schema to stabilize population of Iraq and Panama, the use of rules of engagement proves a useful area to explore. On day six of the invasion, General Thurman provided specific rules of engagement (ROE) aimed at curbing looting and civil disorder.[49] This negative feedback, helped to alter Panamanian behavior to bring the system to a stable state and create conditions that the new government was able to maintain.

In stark contrast in Iraq, immediately following the fall of Bagdad invasion, U.S. forces largely allowed looting to continue or at least they did not actively prevent it. Rules of engagement did not address looting nor were they changed to do so when the problem became evident.[50] In essence, this provided positive feedback for lawlessness. Seeing their fellow Iraqis not only unpunished, but instead rewarded with stolen state property, reinforced the looting behavior. This resulted in the disintegration of critical infrastructure needed both to run essential services and administrate the country.[51] In the estimate of one former Iraqi Diplomat, Faruq Ahmed Saadeddin, commenting on the post war situation: “if it had gone smoothly from the first day honestly, I believe this 100 percent: 95 percent of Baathists, the registered Baathists would have cheered, hailed America.”[52] Clearly, the lack of control by U.S. forces in the absence of Iraqi security led to compounding civil disorder as it undermined the authority of coalition forces.[53] Both in Operation Iraqi Freedom and Operation Just Cause, it is evident that small decisions or

actions, or, in other words, feedback can have drastic effects on the operational environment. In Panama, negative feedback in the form of strict rules of engagement pushed the environment towards stability while in Iraq the lack of feedback drove disorder.

Finally, analysis focuses on the impact of tempo—an examination of the pace at which operational and strategic leaders reassessed the situation and the appropriate interventions to steer the system towards the desired end state. In Panama, again the decision to establish The Joint Staff's Panama Crises Action Team was critical. Based on access to senior U.S. leadership, the National Security Council, and the Interagency, the team was able to rapidly coordinate interventions and authority needed to apply resources. Near continuous assessments relayed from the operational level to the strategic level resulted in timely decisions concerning ROE as well as national public statements, and diplomatic efforts to complement military ones.[54]

Both civilian and military leaders failed to reassess the situation in Iraq frequently enough and to change their assumptions as disorder continued to rise across Iraq. Coalition Provision Authority (CPA) Order Number 1, "De-Baathification of Iraqi Society," and Number 2, "The Dissolution of Entities," under CPA lead Paul Bremer, provides strong evidence that civilian policymakers were ignoring the current disorder and failed to revise their appraisal of the system in a timely fashion. It also indicates that operational-level military leaders failed to advise senior policy makers on these effectively as they occurred. These policies resulted in 400,000 potential security forces, and the professional leadership to employ them, being effectively unemployable, creating two problems—a pool of potential insurgents and a lack of professionals and

bureaucrats.[55] Many consider this one of the “most questionable American foreign policy decisions in living memory.”[56] For the military, as discussed previously, operational level leadership from the Combined Forces Land Component Commander or V Corps should have taken action to address looting of government facilities. In both cases, failures to monitor and react to the situation at the right tempo contributed significantly to instability.

The body of evidence investigated here from these case studies suggests there is value in understanding and applying elements of complexity theory to help plan and execute operations. In Panama, employing aspects of these recommendations contributed to achieving military and political objectives despite a lackluster post-conflict planning effort. Also, in retrospect, the effects of applying a tailored ROE and the simple act of detaining Noriega may provide strong evidence that lever points exist. If commanders act decisively at the right time and with the right intervention, limited resources can have a tremendous positive effect on a system. Maintaining a community of interest through the effort of the crisis action planning team certainly helped advance the effort in Panama. Notwithstanding, the transition from combat to stability operations in Iraq appears to have been guided more by individual intuition and assumptions rather that the collaborative action of experts. Despite the fact that knowledgeable professionals projected data from simulation that revealed the risks of instability following regime change, civilian and military leaders did not leverage them to put the right interventions into place. Furthermore, the failures of operational and strategic leaders in Iraq to continuously evaluate system conditions and enact appropriate actions to bring the country towards the desired political endstate made victory illusive.

Conclusion

The study of complexity, and the resultant techniques to solve problems of complex adaptive systems, offers valuable tools and insights to military planners. As seen in the examples of Iraq and Panama, the five recommendations made here can significantly assist planners in understanding the environment and commanders deciding when, where, and what interventions to apply during conflict. While the phase transition from offensive operations to stability operations offers an ideal opportunity to guide the operating environment from the “edge of chaos” to stability, it remains possible that application of these principles would be useful through all phases of conflict.[57] Consequently, the U.S. military should consider explicitly adding them as well as a discussion about CAS into operational design, planning, targeting, and assessment doctrine.

If these recommendations are enacted in a command structure, the organization will learn much more about the environment it is charged to affect. It will be more likely to identify trends that reveal windows of opportunity and lever points. Based on increased knowledge from studying the system, the commander will have a much better understanding of the probability of success of an intervention or course of action as well as its second and third order effects. Moreover, he or she will have a better assessment of risks associated with these decisions. Continuous analysis of the current state of the system in comparison to the desired end state (objectives) would guard against actions that might lead to a military endstate but undermine grander political objectives. In turn, this knowledge of risk would inform how much control to cede to a subordinate or to a member of the community of interest in applying interventions, allowing a commander to

better delegate authority to the correct level without endangering the ultimate political objectives.

In conclusion, when the character of the next conflict emerges from the fog of the increasingly complex operating environment, it is unlikely that a single omniscient commander is going to be able to pierce through the haze to alone identify the actions required to achieve success. In contrast, the commander enabled with a community of interest that can illuminate the best interventions to drive a complex adaptive system towards the desired state while mitigating risk will be much more likely to have authorities and resources aligned to enable him or her to identify and capitalize on opportunities when they arise. That commander will have the tools to put the theory of mission command into practice.

Endnotes

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[2] Ibid., 2-4; U.S. Department of the Army, *Mission Command*, Army Doctrinal Publication 6.0 (Washington, DC: The Department of the Army, March 12, 2014), 2-5, http://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/adp6_0.pdf (accessed January 2, 2018).

[3] John H. Holland, *Complexity: A Very Short Introduction* (Oxford, United Kingdom: Oxford University Press, 2014), 25.

[4] M. Mitchell Waldrop, *Complexity* (New York: Touchstone, 1992), 292-294; Waldrop examines the work of Doyne Farmer and Christopher Langdon in describing the phrase “edge of chaos.” Waldrop credits the phrase’s first use to Langdon who used it to discuss cellular change in systems.

[5] Ibid.; Waldrop develops the theory of transition at the “edge of chaos” being widely applicable by drawing on the work and propositions of Doyne Farmer.

[6] Dempsey, *Mission Command*, 3.

[7] Holland, *Complexity A Very Short Introduction*, 10-12.

[8] Andrew Hill, *The Devil You Know: Strategic Thinking in Complex Adaptive Systems*, Faculty Paper (Carlisle Barracks, PA: U.S. Army War College, July 2017), 1 and 18; Dr. Hill presents the case for the value of using systems thinking and the study of CAS as a tool to assist military leaders understanding and making decisions in the strategic environment. His thoughts and the subsequent teachings at the Army War College inspired this research to determine potential methods that the study of complexity could better augment military processes.

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[13] Gell-Mann, *Complex Adaptive Systems*, 18-19.

[14] Holland, *Complexity A Very Short Introduction*, 26-29.

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[27] Hill, *The Devil You Know: Strategic Thinking in Complex Adaptive Systems*, 3-4.

[28] Mark A. Bedau, *Weak Emergence*, (Portland, OR: Reed College, July 26, 1999), 4, http://people.reed.edu/~mab/papers/weak.emergence.pdf (accessed December 10, 2017); Bedau also published this in a different format in 1997 see Mark A. Bedau, "Weak Emergence," in *Philosophical Perspectives: Mind, Causation, and World*, Vol. 11, ed. J. Tomberlin (Malden, MA: Blackwell, 1997), 375-399.

[29] Holland, *Complexity A Very Short Introduction*, 83-84; Holland's discussion of the value of models influenced this statement and informed the implications drawn from Bedau's definition of emergence.

[30] Bedau, "Weak Emergence," 6 and 23-26.

[31] A chief risk to using this "human based" simulation would be that a number of social, psychological, and organizational considerations could bias the results. The community of interest should consider and account for such biases when developing models.

[32] Fromm, *Types and Forms of Emergence*, 9.

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[50] Timothy Reese and Donald Wright, *On Point II: Transition to the New Campaign,* 90-92.

[51] Ibid.

[52] Ibid., 90.

[53] Ibid.

[54] Cole, *Operation Just Cause the Planning and Execution,* 45.

[55] Reese and Wright, *On Point II: Transition to the New Campaign*, 94-95.

[56] David Houghton, *The Decision Point* (New York: Oxford University Press, 2013), 238.

[57] Waldrop, *Complexity*, 292-294.