

SYSTEMS THINKING FOR STRATEGIC LEADERS

Colonel (Retired) Charles D. Allen
Professor of Cultural Science

Colonel (Retired) Glenn K. Cunningham
Professor of Joint Land Operations

Dr. Janeen Klinger, Ph.D
Professor of Political Science

U.S. Army War College

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Strategic thinkers and statesmen often begin their analysis by assuming a linear cause and effect relationship similar to a move/countermove exchange in chess.

Although such linear formulations are a useful starting point for strategic leaders, they can be misleading. Systems thinking provides an alternative that highlights the limits to linear reasoning. For centuries the basic approach of science relied on linear logic and a belief that the best method for understanding any phenomenon was to break that phenomenon into parts that could be studied independently. Doing so was thought to simplify a problem, thereby making it more manageable for the scientist. The approach assumed the whole to be studied was simply equal to the sum of its parts. The logic of this linear thinking and its associated mechanical metaphors was transferred outside of the natural sciences and applied to many other disciplines.

Beginning in the 1950s, the above mechanistic approach as the best method for gaining knowledge of the natural world began to be questioned. Underlying the emerging view was recognition that the whole was *not* merely the sum of its parts but rather something more. Consequently, a new approach organized around the concept of “systems” took root. Some of the scientific pioneers of the systems approach were concerned that the expansion of knowledge was so great that it resulted in excessive specialization that prevented scientists from communicating across disciplines so that, for example, physicists and biologists were isolated from one another. Therefore the pioneers of a systems approach aimed to create a general systems theory that could

identify the existence of laws that might apply to similar structures in different fields.

Ludwig von Bertalanffy, one of systems theory's early proponents, saw the purpose of systems theory as "an important means in the process of developing new branches of knowledge into exact science, i.e. into a system of mathematical laws."¹ Such a conception of systems theory implied that it promised greater certainty with increased ability to predict than the earlier mechanistic approach.

Given the original quest for greater certainty via systems theory, the most natural application was as a tool from engineering science. The close affinity between systems theory and engineering meant that key concepts and vocabulary developed for engineering were adapted to other contexts. Terms like input-output, open and closed loops, feedback, and equilibrium became pervasive in any discipline applying a systems approach. Yet the systems in an engineering context tended to be relatively closed ones like the classic example of a thermostat. The dynamic behavior of such a closed system is quite different from open systems in that the former allow for greater certainty and prediction. For example, a person knows what the response of a thermostat will be when one adjusts the temperature up or down. In contrast, a more open system, like a political system, cannot be expected to respond to some stimulus, say a stock market collapse, in any predictable pattern. The unpredictability of open systems stems in part from the fact that many more variables are at work than in a closed system. Ironically, initial systems theorizing and thinking sought greater certainty and control to facilitate prediction and enhance interdisciplinary communication. However, when the concepts

were applied to more open systems like organizations or societies, the expected results did not materialize.

What then are the aspects of a systems approach that are most helpful for strategic thinking? Systems thinking applied to the kinds of open systems that strategic thinkers deal with provides a caution against the hazards of simple linear cause and effect reasoning. A starting point for appreciating differences between systems thinking and linear thinking lies with the definition of “system.” A system is a set of units (or elements) that are interconnected in such a way that changes in some elements produce changes in other parts of the system. And, the changes induced in other elements will not necessarily be proportional to the initial change. This disproportion between input and output is captured nicely in the aphorism, “the straw that broke the camel’s back.” In the realm of economics the disproportion between input and output is also captured in the law of diminishing returns where, at a particular crossover point, returns will decline despite increased input. In addition, the system as a whole exhibits properties or behaviors that are different from its individual parts. Following from the definition of system, two key characteristics are especially useful for strategic thinkers: interaction and interconnections.

The remainder of this essay will move from our rather abstract discussion in the introduction to illustrate the application of systems thinking to three concrete areas of interest for strategic thinkers:

1. Organizational management which initially conceived of organizations as closed systems but gradually came to view them as open systems dominated by interactions and interdependencies.

2. International politics which is perhaps the most open of all open systems and the environment where strategic thinkers operate.

3. Contemporary joint doctrine as it applies a systems approach to campaign analysis and design.

Systems Thinking and Organizational Leadership

As we think of an organization, we tend to look at its structure as a wiring diagram that depicts departments and functions in the form of a bureaucracy—hierarchical and well defined. Military organizations, in particular, have a long history of such structure and processes. Gareth Morgan captured this “Image of Organization” as a machine metaphor.² The organization is viewed as a closed system with inputs, internal processes, and outcomes. Each part of the organization fits together by design so the smoother and more standardized the operation; the more efficient is its production. One familiar mental image may be of Henry Ford’s assembly line to build the Model T automobile. People and equipment operated in a prescribed and routinized process to provide consistent quality for mass production.

The view of organizations as closed system was supported by the scientific management concepts of Frederick Taylor who sought to reduce all production into component processes, define key activities, minimize variations, and then manage the

performance of workers with precision. This scientific approach saw direct cause and effect relationships in what happened on factory shop floors. The role of leaders in general, and strategic leaders in particular, was to remove any fluctuation in the external environment to allow for the predictability of both inputs and outputs. As such, strategic leaders designed internal systems that demanded greatest efficiencies from workers, acquired resources for production, and either captured or developed demand for the products in the population. In other words, strategic leaders were the only “thinkers” in the organization – most other direct-level roles in such a system were intended to only be “doers.”

As one would expect, this “machine” metaphor, while potentially effective in a stable, predictable environment, had some drawbacks. Imagine the consternation when experiments undertaken at Western Electric’s Chicago Hawthorne Works to determine the increase in worker performance based on the amount of light demonstrated there was no appreciable difference.³ It turned out that the presumed causal relationship (better lighting leads to better performance) was not supported since the workers performance improved simply because they were the object of study and employees felt that management cared about their well-being.

The emergence of larger and more complex organizations led to the discipline of systems analysis and the rise of Operations Research and Systems Analysis (ORSA). The ORSA-types sought to identify all key parameters of (closed) production systems by observation, measurement, and analysis. Analysts then developed mathematical models and simulations to determine the “optimal” design of systems and processes.

This approach attained prominence in military circles with the whiz kids of Secretary of Defense Robert McNamara in the 1960's. In the 1980's, the emphasis on system analysis led to systems engineering with the focus on design and control.⁴ Army officers will remember the emergence of Battlefield Operating Systems (BOS) and System of Systems Analysis (SoSA) as the Army tried to quantify combat operations in the era of Air-Land Battle. The methodology for systems analysis was to observe potentially critical events, collect data to reveal trends, establish causal relationships, and then seek to design systems with control mechanisms to attain optimal performance. Attempts to quantify large-scale combat operations to reduce the fog and friction of war led to a false sense of certainty. Who would have predicted the 100-hour War of Operation Desert Storm or the limitations of Shock and Awe after six years of Operation Iraqi Freedom?

Organization theorist and systems thinking pioneer, Professor Russell Ackoff presented another perspective of organizations as human enterprises with people as integral components and organizations as part of open systems. His approach of "systems thinking" challenged the purely scientific approach by examining social, cultural, and psychological aspects of people in organizations. The focus on the scientific reductionism of processes by managers resulted in them doing things "right" within well-defined structures. Ackoff offered that systems thinking was required by leaders to determine what were the "right" things to do for organizations. The holistic view of organizations coincided with the acceptance that an organization was more than the sum of its parts. As part of an open system, there are organizational interactions

with the external environment that are beyond the control of management as well as internal feedback mechanisms that indirectly influence operations in unforeseen ways. As we talk about systems thinking, the terms dynamic, non-linear, second and third-order effects, and unintended consequences are used to describe actions within organizations. The desire to have a “well-oiled machine with clock-like precision” does not mirror the reality of organizations. There were other intangibles that defy quantification—e.g., affect, motivation, cohesion, organizational climate and culture, and leadership—which either support or detract from organizational performance. Here, Morgan suggested two other metaphors of organizations respectively as an organism or a brain to denote a system that interacts with its environment and one that adapts and learns.

The treatment of an organization as an entity that actually “learns” was uniquely introduced by Peter Senge and captured in his book, *The Fifth Discipline*.⁵ He noted that something was missing in our understanding of organizations as systems when:

- >75% of re-engineering efforts fail to achieve targeted improvements in performance.
- Many initiatives to reduce cost in one part of a system result in increased cost elsewhere.
- The vast majority of restructuring efforts fail to achieve intended synergies and generate unintended consequences.
- Large-scale projects tend to overrun schedule, budget or both.

- Metrics result in more reports and administrative burdens but shed little light on the levers that can be pulled to meet targets.

Senge offered a view of organizations as social activities that perform best when all members are able to contribute to achieve their goals. While some have called this empowerment, systems thinking is the critical competency within an organization that develops the synergy of the other four disciplines.⁶ Systems thinking provides a framework for understanding and explaining organizational processes and how they perform over time. The use of system thinking models helps members to understand complex problems; to develop shared team understanding while suggesting ways to leverage complex problems; and to identify and test solutions. Senge's 11 Laws may seem trite but ring true as we examine our experiences in organizations. The first law, "Today's problems come from yesterday's solution," illustrates not only the need to see the bigger picture over time but also helps us realize our attempts to solve one problem may have the unintended consequences that lead to future challenges.⁷ The eighth law, "Small changes can produce big results-but the areas of highest leverage are often the least obvious," highlights the uncertainty in establishing causality and predicting the magnitude of change within a system.⁸ This should cause us to look for solutions in unexpected places.

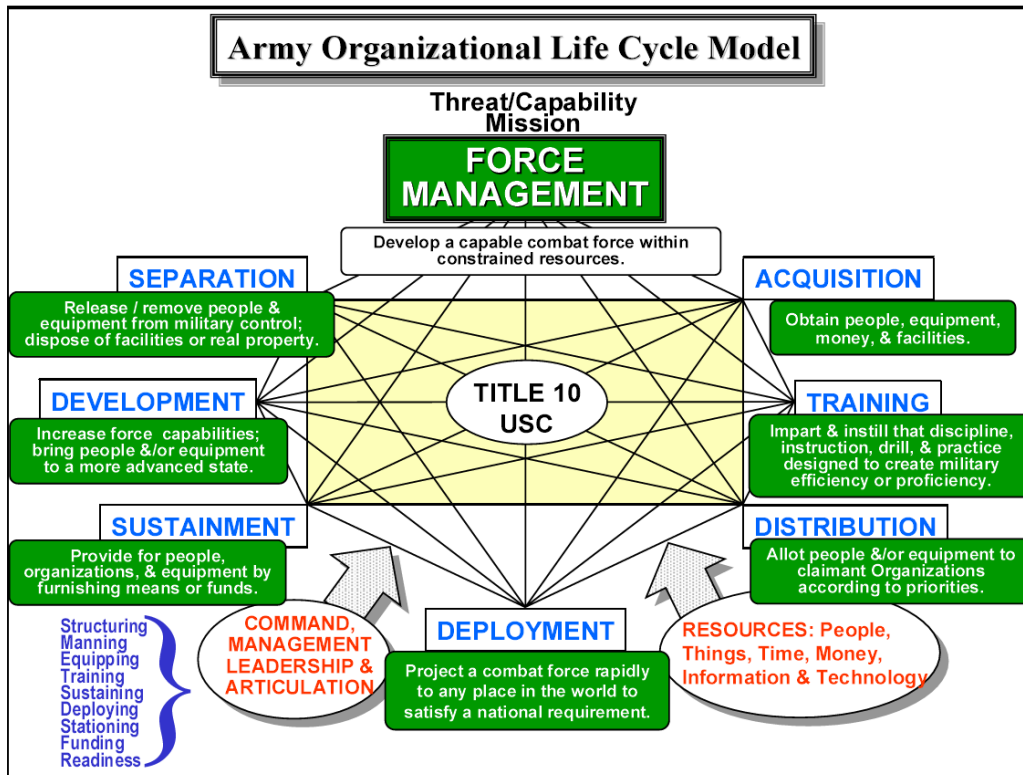


Figure 1. The Army Organizational Life Cycle Model

Senge’s insights apply to the Department of Defense and its Armed Services which are undeniably large, complex organizations composed of systems within systems. A review of any DOD organizational chart will illustrate the functions and assignment of responsibilities to provide a product or service in the pursuit of National Defense. Figure 1 Army Organizational Life Cycle Model (AOLCM) depicts the linkage of systems for acquiring, developing, employing and then retiring resources. A vivid example is personnel—the Army recruits, trains, and educates people, then assigns them to perform missions until they are eventually released from service. Some may naively believe that such a personnel system is a simple linear process, but in truth, it is inherently complex. Consider the complexity of the career of a typical US Army War

College Army student. Their 18-plus years- of service are characterized by 4-5 promotions, 2-3 deployments, 10-12 jobs at 5-6 different locations, 4-5 formal educational opportunities, and 8-9 moves for the Soldier and family. The personnel system is interdependent with systems for compensation, promotion, healthcare and family support. The personnel system is also influenced by operational concepts to determine the types of people needed to man weapons systems and equipment to fight according to Army doctrine. There are series of interactions that have second and third order effects as well as unintended consequences. Hence, any decision on military personnel should consider its relation to other functions.

The U.S. Army realizes that simple linear depictions do not validate cause and effect relations and looks for intervening variables and interactions between the variables. For example, Army recruiters may have believed that a simple appeal to patriotism of an American citizen in the wake of 9-11 would result in a successful enlistment. Yet experience suggests an economic component (search for employment), a social component (role of influencers), and legal component (need for waivers) are all factors that affect the success of recruiting efforts. By solving the problem of meeting annual recruiting goals, the Army found that an increased number of enlistees had gang affiliations. Enlistees with those waivers, however, were promoted earlier to sergeant, reenlisted at higher rates, and received more medals for valor.⁹ The latter was an unexpected benefit.

Another contemporary example *of unintended consequences* is illustrated by the application of the Army Force Generation (ARFORGEN) in support of global

operations. With the planned drawdown of US Forces in Iraq and the revised strategy in Afghanistan, some unprogrammed units were accelerated in the deployment cycle. The preponderance of the Brigade Combat Teams and supporting units will be from I Corps and Fort Lewis Washington. Fort Lewis is also home to the ROTC Summer Camp, Warrior Forge, and relies heavily on locally based units for support. To meet the requirement, other units across the US were tasked for the ROTC mission. Imagine the surprise when the Army Chief of Staff was approached by a spouse who complained that her Soldier was spending 45 days of his Dwell time at Fort Lewis as cadre for Warrior Forge. Interconnectedness and unintended consequences abound in the most mundane decisions within large and complex organizations.

Systems Thinking and International Politics

As noted in the introduction, the mechanistic metaphor that tended to characterize systems thinking was drawn from engineering. Such a conceptualization is more problematic when applied to more open political and social systems. International politics provides a case of the most open of all the social systems and two system characteristics are especially important for the strategist to keep in mind when formulating strategy against the backdrop of the international system: interconnections and interaction. These two characteristics generate some basic rules of thumb for understanding the dynamics of international politics. Let us examine the implication of each characteristic in turn.

The interconnection among the elements (states) of the international system creates a structure that has greater causal impact than the internal characteristics of the units. In other words, the causal effect of structure is one reason that very different kinds of states behave in a similar manner. For instance, the Cold War rivalry between the US and the USSR resembled the rivalry between the ancient Greek city states of Athens and Sparta. A related corollary suggests that the common sense (or linear) thinking that explains state behavior in terms of state preference and power will often be misleading. The system's structure--that is where actors are positioned within the system—must also be considered when explaining particular outcomes. Thus, the peace in Western Europe after the two bloody wars of the twentieth century was generated by the particular structure of the international system and not the internal character of the individual states.¹⁰

Interconnections are also the reason for the truism that many outcomes in international politics will be unintended. As Robert Jervis observes: "When the interconnections are dense, it may be difficult to trace the impact of any change even after the fact, let alone predict it ahead of time, making the system complex and hard to control."¹¹ Diplomats and statesmen will find it difficult to know what their actions will cause and at a minimum can be sure that actions will lead to wide ranging effects. From a practical standpoint this means that no matter how well targeted actions are; they will have multiple effects. The effects of interconnections in the international system may even be more pronounced in the current era of globalization making it ever more difficult for statesmen to calibrate their actions to the desired effect.

The Japanese decision in 1940 to form an alliance with Nazi Germany illustrates just how interconnections can subvert the intentions of a state. The Japanese apparently believed the alliance would add the power of Germany to its cause thereby deterring the U.S. from opposing Japan's occupation of China. In a world of only linear effects, the Japanese reasoned that the greater input in the form of greater power would dissuade the United States. However, the interconnections generated by systems effects led the U.S. to see Japan as linked to the state that was a serious menace to Europe whose security was a higher priority to the United States. So for the U.S., Japan's actions magnified the threat that it presented and had the opposite effect from what Japan had intended.

A third impact that system interconnections have in international politics is that the behavior of a state can alter the environment in such a way that actions or policies that worked once will not work a second time. Statesmen that assume a past successful action can be taken again with the same impact are likely to be surprised. A good example, also drawn from World War II, that illustrates this dynamic is Hitler's assumption that because Britain and France backed down over Czechoslovakia to sign the Munich agreement they would also not respond when Germany attacked Poland. But Hitler's actions had changed the environment and with it British and French calculations about the nature of the threat he posed. Often the error in trying to utilize a successful policy again is the unstated assumption that *other things being equal* the outcome will be the same. However, in complex and open systems other things are rarely equal which is why applying historical analogies can be so problematic. (See the

lesson on the uses of history for greater examination of problems associated with such analogies.)

The second characteristic of systems that have a great impact in international politics involves interactions. The fact that no state action can take place in a vacuum but rather prompts responses from other states means that it is here that “feedback” (both negative and positive) comes into play. It is a well-known observation of military planners that any plan must consider the fact that the enemy gets a vote. This observation is recognition of the importance of interactions and feedback within a system. The fate of any state’s policy or strategy depends on those adopted by others. This factor is one reason that state’s often start wars that they end up losing.

The impact of interactions and an associated negative feedback is central to the underlying dynamic in international relations known as the security dilemma. The dilemma stems from the fact that states tend to seek to maximize their power by increasing the resources devoted to their security. By doing so, states are able to threaten others who are likely to respond with efforts to neutralize or counterbalance the effort of the first state. The end result is that no state is more secure than when the process began and the first state was unable to maximize its power as intended. Similarly, the balance of power illustrates the negative feedback found in international politics and states can be expected to balance against any state that might threaten their security so that any move that could bring a state great competitive advantage can be expected to generate opposition from others. The North Korean attack on the south in 1950 can be looked at this way. That attack was sanctioned by both the USSR and

the PRC on the assumption that the North Korean advance would strengthen their position in Northeast Asia against the US and Japan. However, the attack had the opposite effect because it led the United States to triple its defense budget, conclude defense treaties around the globe and transform NATO into a functioning military organization.

Another classic example of feedback, this time of the positive type, in international politics can be found in the domino theory. The domino theory holds that even small defeats for a state can produce a positive feedback because its adversaries and allies will infer that it is weak and likely to retreat in the event of a challenge. Positive feedback in this case can lead to the cascading of challenge-retreat and challenge and retreat.

Given the impact that the interconnection and interaction characteristics of systems have on international politics, how can strategic thinkers and statesmen best address these effects? One way to take into account system generated interconnections is to pursue dual policies. One variant of a dual policy is the classic one of offering carrots and sticks to another state. Another variation of dual policies involves the recognition that a policy towards one state might have an impact on a third state. Thus, when the first President Bush decided to sell F-16s to Taiwan, a move likely to threaten the PRC, he also waived restrictions on the export of several high technology projects to mainland China.

A second way of coping with system effects is for actors to pursue an indirect approach to their objective. Indirect approaches in diplomacy are difficult and at times may seem counterintuitive. For example, one way that Germany convinced the French to allow British entrance into the common market was to put forward policies that both Britain and France opposed. This approach changes the incentive to actors as one means of moving them in a direction they might not otherwise go. The indirect approach to diplomacy is especially difficult for democracies because the approach may appear to be leading the state in a direction opposite of where it wants to go and thereby generate public opposition. In the final analysis, an awareness of the limits to linear reasoning and an understanding that statesmen and strategists are operating in a system, may enable them to compensate for results that would otherwise occur.

Systems Thinking: Reflections in Current Doctrinal Applications

The final area that illustrates a systems thinking approach is current joint doctrine. A system, as doctrinally defined, is a functionally related group of elements forming a complex whole.¹² Any theater of war may present a complex array of intermixed physical, geographical, psychological, social, political, and economic factors that frustrate attempts to attain certainty of action by determining simple, linear cause-and-effect relationships. Accordingly, many military theorists have pragmatically posited that military operations must be approached from a systems perspective. In the ancient world, Xenophon, a contemporary of Plato, described just such a situation when he connected the importance of agriculture to military affairs.¹³ In fact, Xenophon recounts Socrates' description of an army as a complex system capable of presenting wicked

challenges, a passage that somehow does not seem all that out of place in 21st century military operations:

When it is in disarray, nothing is more chaotic, it's no problem for the enemy to overcome it, and it's an ignominious sight for those who wish it well and of no use to them at all—it's a jumble of donkeys, hoplites, baggage-carriers, light-armed infantry, cavalry and carts. How can they move like that, when they get in one another's way—walkers impeding runners, runners being frustrated by those who have stopped, carts hindering cavalry, donkeys in the way of carts, baggage-carriers obstructing hoplites? And suppose they need to fight—how could they manage to fight in this state? The contingents who have to withdraw from the advancing enemy are quite capable of trampling the hoplites.¹⁴

Carl von Clausewitz, the influential 19th century Prussian theorist of military affairs, captured the complexities of the battlefield system of systems in two images: *friction* and the *fog of war*. Friction addresses the difficulty of attempting to operate within a system using linear, mechanistic approaches, compounded by the element of risk: "Everything in war is very simple, but the simplest thing is difficult. The difficulties accumulate and end by producing a kind of friction that is inconceivable unless one has experienced war. . . . This tremendous friction, which cannot, as in mechanics, be reduced to a few points, is everywhere in contact with chance, and brings about effects that cannot be measured, just because they are largely due to chance."¹⁵ Fog refers to the uncertainties of system analysis in such a milieu, where the significant links and

nodes are not necessarily visibly connected, and many system attributes are beyond a commander's direct control. Clausewitz observed, "The general unreliability of all information presents a special problem in war: all action takes place, so to speak, in a kind of twilight, which, like fog or moonlight, often tends to make things seem more grotesque than they really are. . . . Given the nature of the subject, we must remind ourselves that it is not possible to construct a model for the art of war that can serve as scaffolding on which the commander can rely for support at any time."¹⁶

The 21st century, with the globalized and digitally enhanced nature of human enterprises of all sorts, presents particularly compounding structural and interactive complexities, so that commanders must approach operations as a holistic system of subsystems. While technology promises higher degrees of control, precision, and predictability, it simultaneously creates such a density of information that potentially adverse systems interconnections may be obscured. With the proliferation of digital information processing systems on the, modern battlefield, commanders must bear in mind that in systems analysis, more detail does not necessarily lead to greater clarity. Information can instead result in paralyzing clutter if knowledge is not managed and filtered, resulting in a state of *information intoxication*, a situation wherein data proliferates past the point of comprehension. In many ways, information acts like alcohol—a small amount is liberating, too much impairs functioning, and in excess it becomes toxic.

This data density is complicated even more by the temporal factor of adaptive interventions on the part of the many actors, who may be supportive, neutral, or

adversarial. Such complex adaptive systems “exhibit coherence under change, via conditional action and anticipation, and they do so without central direction.”¹⁷ Such an operational environment poses problems that can be variously well-structured, medium-structured, or ill-structured, thus defying easy discernment and presenting no uniform, definitive way of formulating solutions.¹⁸

The electronic information age allows for great advances in military affairs, in that collaboration and information sharing can proceed simultaneously at multiple levels. Similarly, the same electronic advances allow for precision guided munitions that increase the lethality of attack. Command and control is enhanced and can be exercised at longer ranges. Still, the old requirements for leadership remain in effect. Discipline, experience, and judgment are more important than ever. The commander must add value or risk defeat.

What has changed is the range of issues facing that commander. An operational or strategic commander can no longer focus on purely military matters within his operational environment and ignore other subsystem or related system elements. Certainly potential adversaries realize this, as it is clear that US military power is an overwhelming factor. If an enemy cannot hope to prevail militarily, that foe is likely to choose another actionable domain within the battlespace in an attempt at successful operations. Instead of a military-to-military confrontation, modern warfare is likely to mean applying all elements of national power (diplomatic, informational, military, and economic) against adversary systems (political, military, economic, social, informational, and infrastructure).¹⁹ The terrorist attack on the World Trade center on September 11,

2001, using nonmilitary commercial aircraft as a mode of suicide attack, was just such an attempt to inflict economic damage and introduce social disruption through asymmetric means.

Moreover, military operations take place in and across a spectrum of conflict, yet this continuum is prone to ambiguous interconnections. Such interconnectivity may consist of geographic overlaps, indistinct transitions, varying magnitudes of military activities, and contemporaneous political-military-economic-social interactions that are perhaps best described as “a spectrum of conflict and operational themes.”²⁰ Along this spectrum, violence can range wildly from the occasional criminal attacks of a stable peace to the ongoing full-nation hostilities of general war. Operational themes include, but are probably not limited to, peacetime military engagement, limited interventions, peace operations, irregular warfare, and major combat operations. These thematic descriptions may not occur in sequence or in isolation, but may well surface simultaneously as an admixture of activities sometimes termed *hybrid warfare*.²¹

Clausewitz posited two ways out of this systems-generated conundrum. The first was to recognize that just as all things in war are complex and cause friction, not all things are equally important or equally difficult. Tactical tasks are relatively self-contained and logistical concerns are restricted along certain channels of action by the limitations of time and space. They also can more easily be characterized by simple cause-and-effect relationships. However, as the functions to be performed become more strategic and thus increasingly intellectual, the more the commander’s cognition and experience becomes of paramount importance. Secondly, Clausewitz postulated

that a senior commander should remain adaptable and not be bound by doctrine, but guided by theory, which is “intended to provide a thinking man with a frame of reference for the movements he has been trained to carry out, rather than to serve as a guide which at the moment of action lays down precisely the path he must take.”²²

This Clausewitzian focus on uncertainty emphasizes a key role of the commander in framing the strategic or operational problem to be addressed by military planning, as echoed in contemporary doctrine. The commander must appreciate the context of the operational environment facing him or her and must further be able to assess the relative qualities and values of systemic operational factors in mitigating uncertainty’s potentially adverse effects. U.S. Army Field Manual 3-0 describes this key commander contribution as a holistic process that seeks to understand the enemy situation and the operational environment in which the enemy operates, visualizes the end state and the effects and events necessary to bring that end state about, describes the ends, ways, and means available to apply towards that end state, and thereafter direct missions and tasks and control warfighting functions. The primary tools used to initiate and guide this process, which must be undertaken in some detail by the commander’s staff are: the initial commander’s intent, the commander’s planning guidance, and the commander’s critical information requirements.²³ Because systems effects generate unpredictability that may require subordinate leaders to deviate from plans or adapt operations rapidly, perhaps without advance consultation, these tools mandate that a commander assume a personal stake in developing them as stable reference points from which to gauge deviation.

The commander's responsibility to visualize campaign design and communicate it succinctly and thoroughly to his subordinate planners and commanders cannot be delegated, but are in fact foundational to command and constitute essential contributions to mission success. This unalterable responsibility was described by Field Marshall Sir William Slim:

I suppose I have published dozens of operations instructions and orders, and I have never written one myself because I have always had excellent staff officers who could do it. But, there is one part of an order that I have always made a point of writing myself. That is the object [that is, the commander's intent]. I do recommend it to you, gentlemen, that when long orders are being written for complicated operations, you take up your pen yourself and write the object in your own words so that object goes down to everybody.²⁴

Notably in a coalition context, Slim's "everybody" would include multinational partners of various tongues and cultures, so that extreme care needs to be exercised to craft a statement of commander's intent that can survive the nuances of translation into a multiplicity of languages.

Thus, on the modern battlefield, the commander cannot be a passive approval authority for the insights, initiative, and industry of others. He or she must be an additive part of the process and make a personal, positive contribution to mission success. Indeed, the commander may well be the only person with the requisite

experience, long-range time horizon, judgment, and intuition who is in a position to make those additive contributions to initial staff inputs and estimates.

Such a systems approach, of course, is not confined to land operations, but is fundamental to all joint operations. In this joint doctrinal context, operational art is directly applicable to campaign design. Operational art involves the formation and utilization of a conceptual and contextual framework as the foundation for campaign planning, joint operations order development, and subsequent execution of the campaign.²⁵ Thus, a systems perspective is at the forefront of campaign design, in which the commander and his staff planners comprehend the operational environment in terms of nodes (objective, tangible elements in the system) and links (the functional, physical or behavioral relationships between them). The overarching paradigm for analysis is known by the acronym PMESII: the interconnected political, military, economic, social, informational, and infrastructure spheres (see Figure 2). This systems perspective enhances the ability of the commander and planning staff members to visualize the totality of the system and identify those key nodes and links that appear critical, actionable, or targetable.

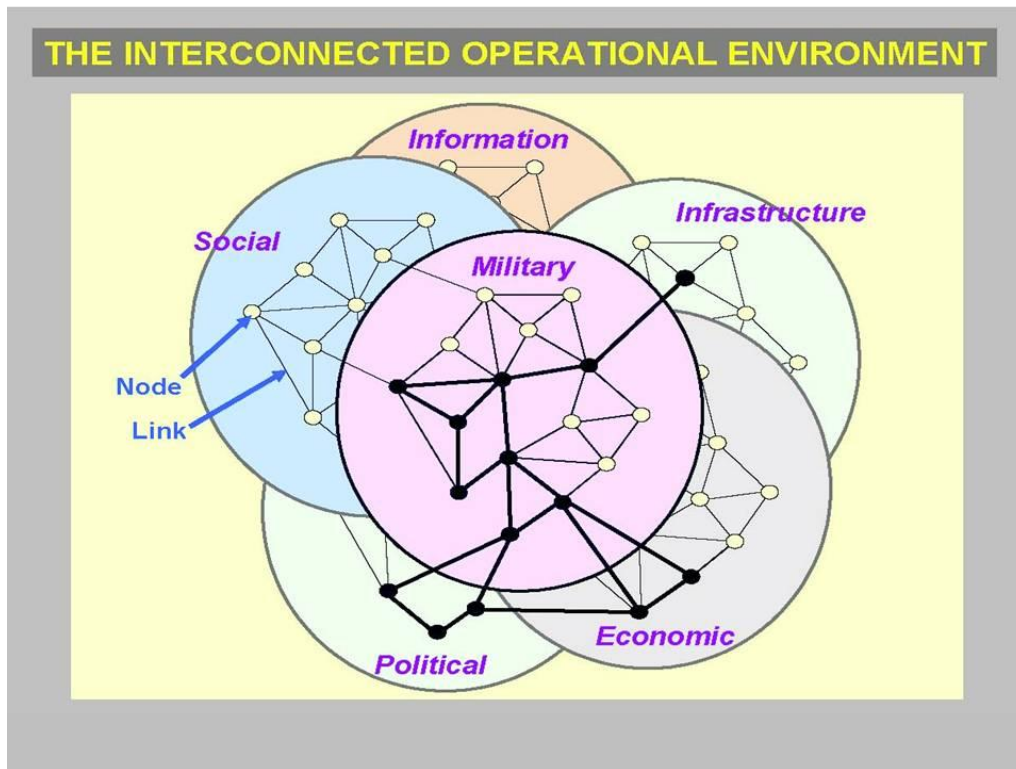


Figure 2. The interconnected operational environment, illustrating the complexity and interaction of nodes and links, across PMESII domains.²⁶

It is important for planners and analysts to examine the operational environment with enough specificity to identify potential nodes and links that are critical to the functioning of the system. These key nodes and links have the potential to become decisive points for military operations, if it appears that injecting change to these elements of the system, whether by targeting or other means, will be advantageous to the joint force and lead to success. Such key nodes and links are often those very elements that are interactive across several subsystem domains within the overall

operational environment, and hence are likely places to exert U.S. instruments of national power to bring about the effects and accomplish the objective necessary to secure the desired political-military end state.²⁷

As we have noted throughout this essay, the nature of complex systems defies rational analysis and linear thought. There is no magic talisman that will eliminate friction, evaporate the fog, and crystallize an appropriate course of action in an operational environment that is comprised of numerous interrelated subsystems. The resulting complexity, intransparency, internal dynamics, and human cognitive limitations place heavy demands on planners and make decision making, in systems, imprecise and risk-prone.²⁸ Hence, a common tendency is to pursue imprecise and vague objectives, which are often actually multiple objectives. This poses potential problems for campaign design and planning because the pursuit of such multiple ends, with limited means and restricted ways, implies that many factors must be simultaneously addressed and many criteria for measures of effectiveness satisfied at once. Consequently in any action taken risks are increased.²⁹ To overcome these problems, one of the most important determinations facing a commander and his or her staff is the identification of centers of gravity.

The Clausewitzian concept of *center of gravity* is a useful construct by which commanders and planners can gain insight into the complicated, interlocking systems making up the operational environment in order to set priorities, and coordinate and synchronize efforts across the range of warfighting functions. Clausewitz described his concept in this way:

One must keep the dominant characteristics of both belligerents in mind. Out of these characteristics a certain center of gravity develops, the hub of all power and movement, on which everything depends. That is the point against which all our energies should be directed. Small things always depend on great ones, unimportant on important, accidentals on essentials. This must guide our approach. . . . [Only] by constantly seeking out the center of his power, by daring all to win all, will one really defeat the enemy.”³⁰

Clausewitz’s concept has immense importance for systems thinking. That is, the selection of a center of gravity serves to solidify the commander’s understanding of the operational environment and identify those elements of the system against which planning should be directed and where and how operations should be executed. Centers of gravity are those “characteristics, capabilities, or sources of power from which a system derives its moral or physical strength, freedom of action, and will to act.”³¹ Joint Publication 5-0 suggests characteristics of centers of gravity, emphasizing that centers of gravity may be transitory, shift over time or between operational phases, and may be largely intangible at strategic levels. That is, a center of gravity is an *analytical tool*, not a magic talisman. There may be more than one, but for campaign design and planning purposes, it would be wise not to let them proliferate. Multiple centers of gravity tend to dilute both planning focus and operational concentration of effort, making it more difficult for commanders and staff planners to discern interconnectivity throughout the complex operating environment.

The characteristics of centers of gravity specified in Joint Publication 5-0 make repeated references to inconstancy and mutability which implicitly links this concept to a systems approach for campaign design. That is, for a variety of reasons, a center of gravity may change over the course of a campaign. Failure to recognize such changes may produce severe consequences.³²

Thus, “the essence of operational art lies in being able to produce the right combination of effects in time, space, and purpose relative to a [center of gravity] to neutralize, weaken, defeat, or destroy it. In theory, this is the most direct path to mission accomplishment.”³³ However, as with most attempts to influence or alter elements within a system, this is not an empirical, mathematically precise process. It can be facilitated, however, by adherence to a consistent methodology of campaign analysis.³⁴

Under such a methodology, the center of gravity constitutes that part of the operational environment against which planning and operations will be pressed.³⁵ It may not be a specific node or a particular relational link, but rather will consist of a judiciously identified and deliberately selected limited set of nodes and related links (Figure 3). In this context, it becomes less imperative that a center of gravity be

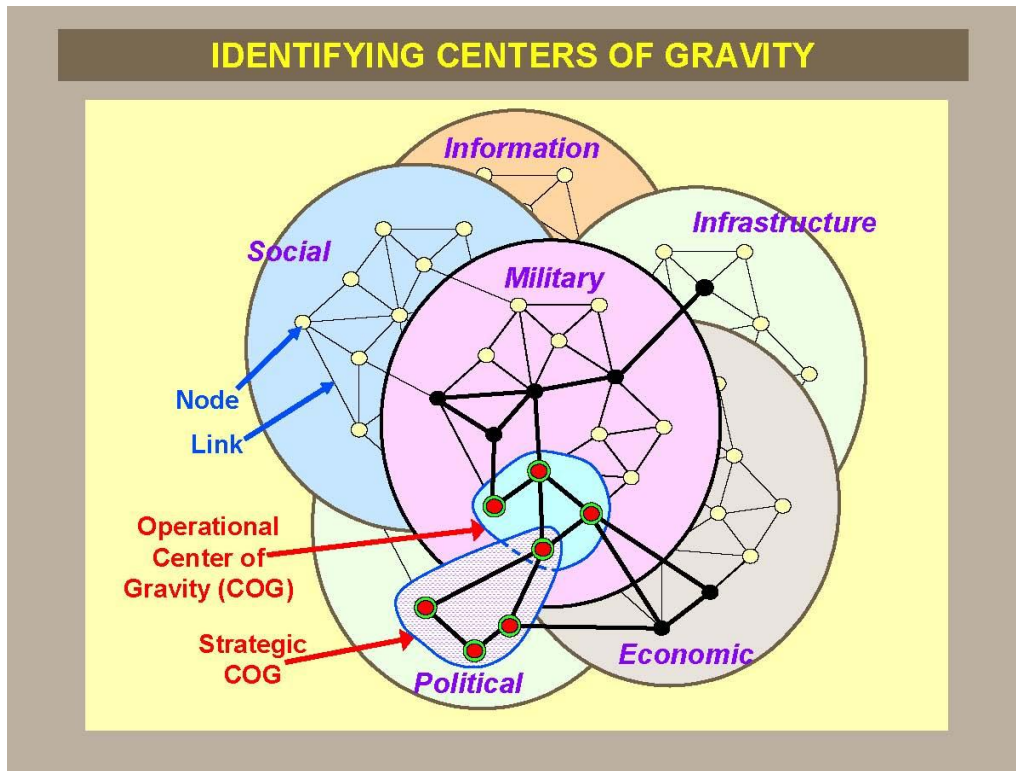


Figure 3. Identifying centers of gravity as a systems component, that is, as a judiciously selected set of nodes and links that establish a frame of reference to guide future planning.

precisely, absolutely, and irrevocably correct. While assuredly it cannot be arbitrarily or capriciously determined, it is far more important that it be reasonable and credible than that it be exactly, immutably right. A center of gravity is a construct, a mental model on which to predicate analysis and planning. Continued situational awareness of the unfolding of events as a campaign progresses will refine and clarify the appropriateness of the center of gravity selected. This lack of certainty should be no impediment to resolute action; rather, it is simply the nature of warfighting as a systems activity requiring perspicacity and adaptability on the part of commanders and planners alike.

As Clausewitz suggested, "War is the realm of uncertainty; three quarters of the factors on which action in war is based are wrapped in a fog of greater or lesser uncertainty. A sensitive and discriminating judgment is called for; a skilled intelligence to scent out the truth."³⁶ Center of gravity selection is no more certain. That said, without the identification of a reasonable center of gravity as the foundation of analysis, there is no place to enter the system and begin credible planning.

A historical example of center of gravity linked to commander's intent illustrates the interconnections of these concepts. In the American Civil War, President Abraham Lincoln had difficulty finding a commander with the solid grasp of essentials, long-range vision, and unrelenting determination to persevere against Confederate President Jefferson Davis and his chief general, Robert E. Lee. General Ulysses S. Grant's experiences in the West had convinced him that the South simply did not have enough forces or resources to sustain a drawn-out conflict. His strategic vision was both simple and center-of-gravity oriented, and hence all the more effective. In concert with the reliable George B. Meade, he would put unrelenting pressure on Lee in Northern Virginia, allowing him no chance to regroup and resupply his Confederate forces. Meanwhile, in the West, William T. Sherman would slash the Confederacy to pieces, so that no forces, arms, or supplies could find their way to Lee. To Meade he issued clear intent: "Lee's army will be your objective point. Wherever Lee goes, there you will go also."³⁷ To Sherman, he wrote: "You I propose to move against Johnston's army, to break it up, and to get into the interior of the enemy's country as far as it is possible, inflicting all the damage you can against their war resources."³⁸

Starting from the frame of reference provide by identification of a center of gravity, other factors must also be considered:

- *Critical capabilities.* Those means that are considered crucial enablers for a center of gravity to function as such, and are essential to the accomplishment of the specified or assumed objectives.
- *Critical requirements.* Those essential conditions, resources, and means for a critical capability to be fully operational.
- *Critical vulnerabilities.* Those aspects of critical requirements, which are deficient or vulnerable to direct or indirect attack that will create decisive or significant effects.
- *Decisive points.* Those geographic places, specific key events, critical systems, or functions that, when acted upon, allow commanders to gain a marked advantage over an adversary or contribute materially to achieving success.
- *Lines of Operation.* First, those *logical* lines that connect actions on nodes and decisive points related in time and *purpose* with objectives. Alternately, those *physical* lines that define the interior or exterior orientation of the force in relation to the enemy or that connects actions on nodes and decisive points related in time and *space* with objectives.³⁹

What is critical in this analytical process is that these factors not be generated or considered in isolation as separate lists. If the campaign analysis process is to be effective and efficient, these factors must be considered as part of the interrelated system in which they appear, and so commanders and analysts must be sure to

establish and remain cognizant of the relationships that exist among them. In other words, critical vulnerabilities stem from critical requirements, which in turn have been derived from critical capabilities. Decisive points might well be determined from any of those critical factors, but the very fact that they are determined to be decisive mandates that they be attended to as part of campaign design and planning. Similarly lines of operation should not be determined arbitrarily, but should logically or physically sequence actions taken to address related decisive points.

Understanding the operational environment as a complex, interrelated system is central to operational art. The campaign analysis process set forth in current doctrine accepts the systemic nature of warfighting and seeks to impose a consistent, reasonable model on the system to mitigate uncertainty and facilitate further analysis and planning on the part of commanders and staffs. Campaign design and planning cannot eradicate friction and the fog of war, but it can enable a resolute and insightful commander to frame the nature of the campaign and impose his or her will on an unruly and ever-changing operational environment. A systemic approach to campaign design can enhance a commander's appreciation for the operational environment in which he or she must attain objectives, accomplish missions, and reach end states. The central role of the commander in campaign design is reflected in his or her personal involvement in the identification of the center of gravity and crafting a statement of commander's intent. Returning to Xenophon, "For military commanders too: there are some aspects of military matters in which commanders differ in the sense that some are better than others, not by virtue of intelligence, but obviously because they take

responsibility. I mean, there are matters which all commanders know (as do most civilians), but not all of them put their knowledge into practice.”⁴⁰

Conclusion

This paper has attempted to illustrate systems thinking concepts across three distinct domains—organizational management, international politics, and military doctrine—for strategic leaders in each of these areas of interest. Professor John Camillus has insightfully identified strategy as a wicked problem that requires active management by business leaders.⁴¹ By extension to our three domains, the complexity and ambiguity of our contemporary environment present the need to adapt to changes and overcome challenges which are characteristic of wicked problems which cannot be solved. The intractability of wicked problems does not alleviate leadership responsibility to understand, tame, and mitigate the effects of dynamic systems that we use to address strategic issues. These issues arise in determining the what, the why, and the how in many of our human endeavors—the essence of strategic ends, ways, and means that lies at the heart of the strategic thought process. Strategic leaders should use the systems thinking perspective in attempting to formulate effective international policies to achieve national interests, to develop national military strategy and campaign plans, and to lead organizations that are charged with executing US policy and strategies.

¹ Ludwig von Bertalanffy, “An Outline of General System Theory,” British Journal for the Philosophy of Science 1 (1950):134-165.

² Gareth Morgan, Images of Organizations (Thousand Oaks, California, Sage Publishing, 2006)

³ The well-known Hawthorne experiments conducted from 1924 to 1932s and effects are detailed in Morgan, 2006.

⁴ The U.S. Army emphasized the ORSA approach in the 1980's with a separate MOS identifier (49A) for officers and the United States Military Academy established Systems Engineering as an academic major in 1988.

⁵ Peter Senge, The Fifth Discipline: The Art and Practice of the Learning Organization (New York, Doubleday/Currency, 1990)

⁶ The four other disciplines are shared vision, mental models, personal mastery, and team learning. See Senge, pp. 12-13.

⁷ Ibid., pp. 57-58.

⁸ Ibid., pp. 63-65

⁹ Lolita C. Baldor, "Study: Recruits on waivers get promoted faster," May 1, 2008 The Associated Press http://www.armytimes.com/news/2008/04/ap_militarywaivers_042908/ accessed April 11, 2009.

¹⁰ Indeed, one political scientist derived a systems theory of international politics based on this observation. See: Kenneth N. Waltz, *Theory of International Politics* (Reading, Massachusetts: Addison-Wesley Publishing Company, 1979).

¹¹ Robert Jervis, System Effects: Complexity in Political and Social Life (Princeton, New Jersey: Princeton University Press, 1997), 17. Many of the examples used to illustrate system effects in this section are taken from this book.

¹² U.S. Joint Chiefs of Staff, *Joint Operation Planning*, Joint Publication 5-0 (Washington, DC: U.S. Joint Chiefs of Staff, December 26, 2006), III-7.

¹³ Xenophon, "The Estate-Manager," in *Conversations with Socrates*, trans. and eds. Hugh Tredennick and Robin Waterfield (London: Penguin Books, 1990), 289-359.

¹⁴ Ibid., 317-18.

¹⁵ Carl von Clausewitz, *On War*, trans. and eds. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), 119-120. [Original work published 1823.]

¹⁶ Ibid., 140.

¹⁷ John J. Holland, *Hidden Order: How Adaptation Builds Complexity* (Reading: Addison-Wesley, 1995), 55.

¹⁸ U.S. Department of the Army, *Commander's Appreciation and Campaign Design*, TRADOC Pamphlet 525-5-500 (Fort Monroe: U.S. Army Training and Doctrine Command, January 28, 2008), 5-11.

¹⁹ U.S. Joint Chiefs of Staff, *Joint Operation Planning*, Joint Publication 5-0, III-16-III-19.

²⁰ U.S. Department of the Army, *Operations*, Field Manual 3-0 (Washington, D.C.: U.S. Department of the Army, February, 2008), 2-3–2-5.

²¹ James N. Mattis and Frank Hoffman, "Future Warfare: The Rise of Hybrid Wars," *United States Naval Institute Proceedings* 131, no. 11 (November 1, 2005): 18–19 in ProQuest Research Library (accessed April 27, 2009).

²² Clausewitz, *On War*, 141.

²³ U.S. Department of the Army, *Operations*, Field Manual 3-0, 5-2–5-9.

²⁴ Slim, Sir William, "Higher Command in War," *Military Review* 70, no. 5 (May 1990): 10–21. [His remarks to the US Army Command and General Staff College, Fort Leavenworth, KS, April 1952.]

²⁵ U.S. Joint Chiefs of Staff, *Joint Operations*, Joint Publication 3-0 (Washington, DC: U.S. Joint Chiefs of Staff, September 17, 2006), IV-3.

²⁶ U.S. Joint Chiefs of Staff, *Joint Operation Planning*, Joint Publication 5-0, III-17.

²⁷ *Ibid.*, III-18.

²⁸ Dietrich Dörner, *The Logic of Failure: Recognizing and Avoiding Error in Complex Situations* (Reading: Addison-Wesley, 1996), 37. See also Herbert A. Simon, *Administrative behavior: A study of decision making processes in administrative organizations*, 4th ed. (New York: Free Press, 1997), 92. [Original work published 1945.]

²⁹ *Ibid.*, 51.

³⁰ Clausewitz, *On War*, 595–596.

³¹ U.S. Joint Chiefs of Staff, *Joint Operation Planning*, Joint Publication 5-0, IV-8.

³² *Ibid.*, IV-9.

³³ *Ibid.*, IV-9.

³⁴ Joe Strange, *Centers of Gravity & Critical Vulnerabilities: Building on the Clausewitzian Foundation So That We Can All Speak the Same Language*, in *Perspectives on Warfighting* No. 4, 2nd ed. (Quantico: U.S. Marine Corps University, 1996).

³⁵ U.S. Joint Chiefs of Staff, *Joint Operation Planning*, Joint Publication 5-0, IV-8.

³⁶ Clausewitz, *On War*, 101.

³⁷ Bruce Catton, *Grant takes Command* (Boston: Little, Brown & Co., 1969), 153.

³⁸ J. F. C. Fuller, *The Generalship of Ulysses S. Grant*, Reprint ed. (New York: Da Capo Press, 1991), 221. [Original work published 1929].

³⁹ U.S. Joint Chiefs of Staff, *Joint Operation Planning*, Joint Publication 5-0, IV-11, IV-16, & IV-20.

⁴⁰ Xenophon, "The Estate-Manager," 353.

⁴¹ John C. Camillus, "Strategy as a Wicked Problem," Harvard Business Review 2008, 86 (5), 98-101.