TRANSFORMING HOW WE FIGHT

A Conceptual Approach

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Transformation has been defined correctly as a process rather than an end state. Still, nagging questions linger. What is the purpose of transformation? Toward what goal is military transforming headed? What do we want the future military to do? What should it look like? How should it fight? The transformation, to be meaningful, must lead coherently from a present state toward an envisioned future condition. Transformation, therefore, is most precisely a strategy designed purposefully to achieve a cogent vision of the future. Absent this articulation of purpose, transformation risks moving in the wrong direction—or in no direction at all. The key, to paraphrase Secretary of Defense Donald R. Rumsfeld, is to have the right ladder standing against the right wall.

The struggle from which such a purpose may be derived has been a powerful subtext of the transformation debate and has indeed informed arguments over war planning against Iraq. In the meantime, the services have pursued a disaggregated transformation—each trying to improve what it does best. Problems naturally arise with this approach, particularly in areas such as joint interoperability and lift, by air and sea—areas that are crucial for effectiveness at the joint level but that might get low priority from an individual service perspective. Still, it is important not to rush; making the intellectual effort to get the vision right is crucial. Heading, however purposefully, in a self-defeating direction would be disastrous.

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Up to this point, unfortunately, the debate about transformation and the future of the military has remained largely rooted in technology. We need to update our understanding of the nature of war and use it as a touchstone. The future will belong not necessarily to the most technologically advanced combatant but the one that understands the nature of war and can most effectively cope with and exploit it. Such understanding is a necessary backdrop for the development of vision and thereafter the intellectual, cultural, organizational, and technological components of transformation.

This article seeks to expand the debate to the necessary scope by proposing a set of ideas to synthesize the enduring nature of war with contemporary technological realities, to bridge the gap between new technology and broad transformation. These ideas emerge from five critical postulates about the enduring nature of war:

1. Information in war is "essentially dispersed."
2. War is Chaotic.
3. Combatants in war are complex adaptive systems.
4. War is a nonlinear phenomenon.
5. War is the realm of uncertainty.

The insights from those postulates suggest that our armed forces will be most effective if we master the following concepts:

1. *Decentralization:* create and exploit a knowledge advantage by empowerment at the appropriate levels.
2. *Complexity:* gain a complexity advantage by maximizing the number of meaningful interactions with which the enemy must cope simultaneously or nearly so.
3. *Resilience:* sustain balance and equilibrium in our own force while creating and exploiting instability and disorder in the enemy.
4. *Tempo:* sustain an intensity of operations over time with which the enemy cannot cope.

The apparent lessons from conflicts over the past ten years point to an emerging paradigm about transformation, known as the "information technology revolution in military affairs" (IT-RMA). Simply put, this increasingly popular thesis suggests that information superiority plus precision munitions equals victory.[1] Decision makers will have a "near-omniscient view of the battlefield" that will enable them to direct precision munitions onto targets with such rapid and lethal effect that enemies will be reduced to "awe," "shock," or "paralysis," and in any case be "locked out" of the objectives they wish to pursue. Either way, in this view, the enemy will have no choice but to give up.

Embedded in the paradigm is the assumption that standoff precision munitions delivered primarily from air or sea forces will have maximum effect on the enemy with minimal risk to American lives and of collateral damage. A related assumption is that an omniscient view of the battlefield will make centralization of authority possible, indeed inevitable.[2] Recent events in Kosovo and Afghanistan illustrate the new reality.[3] Indeed the commander in chief of U.S. Central Command was reportedly admonished for a DESERT STORM–like plan for invading Iraq and was told to make it "look more like Afghanistan."[4]

By continuing to focus almost exclusively on technology, the U.S. armed forces risk developing strategies, force structures, and warfighting concepts that are at odds with the nature of war.[5] As Secretary Rumsfeld has argued, transforming America's military means changing "how we think about war," encouraging a culture of creativity and risk taking.[6] Transformation, therefore, has important intellectual and cultural components, which must turn technological advances into a more effective military.[7] Consideration of these other components of transformation, however, has too often devolved into little more than a glib hype of exhausted adjectives. Failure to come to grips with cultural and intellectual elements of transformation risks dooming the U.S. armed forces to "expensive irrelevance" and inconsequential lethality.[8]

THE NATURE OF WAR

It is time to challenge the validity of the prevailing IT-RMA thesis by examining some key aspects of the nature of war and offering alternative concepts that, if pursued, would move the U.S. armed forces along the path of true, rather than merely technological, transformation.

Information in War Is Essentially Dispersed

The Nobel Prize–winning economist Friedrich von Hayek (1900–92) argued that information is "essentially dispersed" in the "extended market order." Although economic theory often translates uneasily from a business to a military context, Hayek's concept is useful for analyzing individual and collective human behavior. The idea provides a conceptual foundation that can enable leaders to liberate and direct the creative genius of their people and organizations.

Hayek viewed the market as an evolutionary process of discovery and adaptation in which individuals gather, process, and interpret information and make choices to maximize their interests. What appears to be a chaotic market reflects in fact a "spontaneous order" that is beyond any central designing intelligence.[9] "Modern economics explains how such an extended order can come into being," suggests Hayek, "and how it constitutes an information-gathering process, able to call up, and put to use, widely dispersed information

that no central planning agency, let alone any individual, could know as a whole, possess, or control."[10]

Hayek argues that information, knowledge, and understanding are dispersed in space and time. Human beings perceive, interpret, and understand information and make decisions that reflect the lenses through which they view the world. In the terms of modern psychology, the rationality of individuals is bounded by such factors as experience, bias, education, and emotion.[11] As a result, two people can look at the same picture and derive completely opposite conclusions and accordingly take radically different courses of action to pursue their interests.

The apparent dissonance can be explained, in part, by the difference between "explicit" and "tacit" knowledge. Explicit knowledge is concrete information of the sort that can be entered into databases and information systems; tacit knowledge comprises the implicit information and processing capabilities that individuals possess as a result of their cognitive maps and perceptual lenses.[12] Tacit knowledge comes into existence and manifests itself in ways peculiar and specific to context. It is drawn upon only in particular circumstances. It shapes the way we behold information, how we create knowledge and understanding, and the degree to which we consider each item relevant and appropriate to a situation.

The essentially dispersed nature of information suggests that the fusion of explicit knowledge onto a situational-awareness screen does not result automatically in homogeneity of interpretation and decision. Different people, looking at the same situation, perceive different crises and opportunities; they make different assessments of risk; and they ultimately make different decisions about how to maximize the effectiveness of themselves and their organizations. Shared situational awareness of physical relationships on the battlefield, therefore, does not mean shared appreciation of how to act upon the information. The essentially dispersed nature of information will remain salient in warfare. Our challenge is to "leverage" it.

War Is Chaotic

Chaos theory is a relatively new and complex branch of science and mathematics, the implications of which for human systems have only begun to be explored.[13] Chaos contends that a system contains a certain complex order that is determined by the nature and interrelationships of each element within it and by each force that acts upon it. Elements within the system interact with one another and with external inputs. The system also interacts with the "feedback" from the first interactions, creating "system perturbations" (subsequent orders

of effects) that shape the system and ultimately make it unpredictable. The result is a peculiar order.

Chaos need not imply disorder. A Chaotic system can be stable or unstable. It is stable if "its particular brand of irregularity" persists in the face of disturbances (inputs), or if it returns eventually to its particular brand of irregularity. The inputs generate certain responses from the system that may be immediately unpredictable but stable over time.[14] A Chaotic system is *unstable* if inputs result in a permanent change in the system's regime of behavior or nature.[15] Chaotic systems are thus complex and deterministic.[16] Because of the system's complexity, it is impossible to predict with absolute fidelity the impact of specific inputs or interactions.

War is Chaotic.[17] Clausewitz argued that "war is more a true chameleon that slightly adapts its characteristics to the given case." The dominant tendencies in war—the famous "trinity" (passion, probability and chance, and reason) and "triangle" (people, military, and government)—give each war in general, and its combatants in particular, unique characteristics. Depending on context, these tendencies, singly or in combination, can be resilient or fragile with respect to particular inputs and interactions. "Our task therefore is to develop a theory that maintains a balance between these three tendencies [of the trinity], like an object suspended between three magnets."[18] Such insight is an implicit recognition of the Chaotic nature of war and of the combatants that participate in it.[19]

In a similar vein, Clausewitz described the criticality of "moral factors" as the true measurement of an organization's combat capability. He eschewed the attempt to reduce war to fixed formulas, equations, and calculations of raw numbers.[20] The continuing interaction of opposites with deterministic systems makes war uncertain and unpredictable. Strength in moral factors gives resilience to the organization, but such resilience is not itself a fixed quantity—moral factors can grow or recede over time. A strong and confident army can become demoralized; an unconfident and untested force can develop high morale. The Chaotic nature of war endures. The challenge is to turn the fact to advantage.

Combatants Are "Complex Adaptive Systems"

Human organizations are complex and adaptive.[21] The individuals and teams within the system react to inputs and adapt to changes. Sometimes those adaptations are consciously designed to maintain effectiveness in the face of a threatening input or to capitalize upon an opportunity for growth or value maximization. Others are subconscious or unconscious adaptations. Morale and confidence, for instance, might decrease as efforts to cope with interactions prove futile or, conversely, might increase as those efforts succeed.

A way to appreciate complexity, and its potential in war, is by contrasting it with simple and compound systems. A simple system is linear: the force of a single input will generate a proportional and predictable output. Decision making in simplicity is fairly easy. The combatant must respond to only a single threat. For instance, the presence of a bomber overhead will elicit a predictable "scatter" response from a ground unit: to escape the effects of the bomber, the ground unit disperses.

A compound system, on the other hand, is one in which two or more inputs are present that force a combatant to make choices. Often the choice taken to avoid one threat increases a combatant's vulnerability to another. This time, the ground unit is facing both a bomber and an opposing ground force. The best reaction to the bomber is dispersion, but that choice will make the unit more vulnerable to the opposing ground force. Conversely, the best choice to oppose the ground force is to concentrate the friendly ground forces; doing so, however, makes it more vulnerable to the bomber. The commander is on the horns of a dilemma. The combination of threats in a specific battle or context increases the challenge for the enemy. Compound systems account for interaction at the friendly-versus-enemy level.

A complex system is one in which interactions take place on multiple levels. Combatants interact with more than just the enemy. In war, commanders interact within themselves—their own emotions, goals, biases, and experiences—and with their staffs as they attempt to cope with war's complexity while simultaneously trying to accomplish the war's purpose. Commanders and organizations also interact with friendly forces. At the strategic level, this can be interaction with the people and the government. At the operational and tactical levels, this can mean interaction with adjacent forces or other instruments of national power. The activities of friendly forces shape the context in which our own operations take place. In a similar vein, there is interaction with the external environment. Examples of external forces are, among others, political directives, coalitions, the physical environment, and third-party inputs to the system. The complexity of war, therefore, increases with the number of critical interactions and adaptations affecting the components of the Clausewitzian trinity and triangle.

Warfare is not a single, isolated act. Interactions take place simultaneously on various levels. As long as the system—the individual, the organization, the country—remains resilient, it will attempt to adapt effectively to crises and opportunities. As the system becomes more fragile, its ability to sustain effectiveness erodes. Adaptations aimed at other purposes (such as individual survival) can rise to the fore, atomizing and unraveling the fabric of the combatant.

Evolutionary biology theory lends insight into the unpredictability of complex interaction within Chaotic systems. Although it is possible in hindsight to trace backward the development of a species, predicting its evolution in advance is not possible.[22] Too many singular factors intervene to determine the outcome ahead of time—that is, as in Chaotic systems, the result is deterministic but not predictable.[23] The outcomes of individual interactions, therefore, alter the general situation and affect the choices of others. They shape the nature of future interactions and thus exert successive effects.[24]

When applied to war, the concept of adaptive complexity suggests that the number of possible outcomes increases unpredictably with the number of meaningful inputs.[25] As each side adapts to those inputs, interactions can generate effects and responses that defy prediction and expectation.[26] Looking backward from the outcome, one can readily perceive a logical, understandable unfolding of interactions.[27] From the perspective of the observer in the midst of the process in time and space, however, the result was only one of myriad possibilities.

War Is a "Nonlinear Phenomenon"

The Chaotic nature and adaptive complexity of war render it a nonlinear phenomenon.[28] A linear outcome is one in which the strength of the input yields an output of proportional strength; a nonlinear outcome is one that is not directly proportional to the input.[29] Nonlinear systems, as historian Alan Beyerchen explains, "are those that disobey proportionality or additivity. They may exhibit erratic behavior through disproportionately large or disproportionately small outputs, or they may involve 'synergistic' interactions in which the whole is not equal to the sum of its parts."[30] In a nutshell, a nonlinear outcome is one that defies the logic and science of linearity.

Nonlinear systems are living, animate, and adaptive. They can change over time and by interaction with their contexts.[31] As Chaos and complexity theories suggest, the alterations that result can move the system into a qualitatively different nature or regime of behavior. Nonlinearity helps to explain why even subtle inputs to the system sometimes yield inordinately large outputs and, conversely, why large inputs may have only minor effects. Small changes to initial conditions in a fragile system can lead to outcomes that defy proportionality, while large inputs to a resilient system might simply be absorbed. A given input can yield different outcomes at different times, because the nature of the system at any moment is dependent upon context.[32] As Beyerchen summarizes, "The heart of the matter is that the system's variables cannot be effectively isolated from each other or from their context; linearization is not possible, because dynamic interaction is one of the system's defining characteristics."[33]

To recognize war as a nonlinear phenomenon is to acknowledge that no single formula, equation, methodology, or capability can predict outcomes or guarantee victory. Inputs can cause effects that are disproportionately large or small; they can cause "system perturbations" and unintended consequences, responses to which can lead in turn to successive effects that change the situation fundamentally but could scarcely have been anticipated.[34] Effective adaptation to the unpredictability of warfare remains a fundamental challenge.

War Is the "Realm of Uncertainty"

Warfare, then, is by nature uncertain.[35] Prevailing concepts of uncertainty, however, are inadequate. Uncertainty is commonly understood as a matter of information.[36] If that is the case, the argument that information superiority, or "dominant battlespace knowledge," can "lift the fog of war" is plausible.[37] Uncertainty, however, is not reducible to information. To be sure, simple uncertainties, unknown but attainable pieces of information, can be reduced radically by technology. But simple uncertainties merely scratch the surface of the issue.

An uncertainty not necessarily reducible to existing information concerns the future. According to one influential study, such situations of *future uncertainty* can be grouped into four categories. In the first, a "clear enough future," forecast precisely enough for strategic development, is apparent—though absolute certainty is impossible, the future seems to point inexorably in a single strategic direction. In other cases, "alternate futures," a few discrete outcomes are plausible. In a third category the actual outcome can lie anywhere along a broad (but bounded) continuum: a "range of futures" in which no discrete outcomes are obvious. True "ambiguity" is the last category. In this case there is no basis upon which to forecast the future.[38]

Aside from those that result from gaps in information and those relating to the future, there are several other types of uncertainty that are crucial to an understanding of war.[39] *Intrinsic uncertainty* results from "bounded rationality"—the existence of a gulf between perception and reality. Cognitive biases, emotions, assumptions, experiences, education, and heuristics all shape the meaning people elicit from information. This type of uncertainty accounts for the phenomenon of two people seeing the same things and deriving different conclusions. Particularly in complex, unique, and ambiguous environments, the decisions and actions arising from bounded rationality can be highly unpredictable. *Frictional uncertainty* deals with the inability to predict precisely how the "friction of war" will manifest itself. Equipment failures and performance anomalies form a part, but more importantly, so do poor communication, fear, danger, exhaustion, disobedience, initiative, will, inertia, and other human

factors. These frictions can affect individuals and organizations in ways that defy prediction and expectation.

Dynamic uncertainty is the most problematic, because it results from interaction. The concepts of Chaos, adaptive complexity, and nonlinearity underscore the inherent unpredictability in war that results when forces interact. An input that generates a certain response from one system will likely elicit a much different one from another. Destroying a communications network, for instance, might make one combatant unwilling to continue the war; it might merely stimulate another combatant to increase the intensity of resistance. Such outcomes result from complex interactions that defy precise modeling and forecasting.[40] Intrinsic, frictional, and future uncertainties exacerbate the problem.

Coping with uncertainty has traditionally meant collecting more information. In this approach, the decision maker must have a sense of what is knowable and accessible and what is not. He or she must also understand the cost of additional information and determine whether the effort is worthwhile. The decision maker uses analyses refined on the basis of the new information to develop strategies to shape or adapt to developments and to determine the right "portfolio of actions" in response to them.[41] Uncertainty has been something to be overcome (by information) or something to "bind" (by anticipating the future).

The existence of frictional, intrinsic, and dynamic uncertainties suggests that the old paradigm is incomplete. Chaos, adaptive complexity, and nonlinearity suggest that instability and fragility in the system can lead to highly contingent, disproportionate, and dysfunctional outcomes. Coping in advance with uncertainty requires creating the conditions necessary for resilience. Second, uncertainty demands versatility and flexibility if crises and opportunities are to be responded to in a manner that derives maximum advantage. Last, this broader concept demands an approach to war that focuses on the creation and exploitation of uncertainty in the enemy.

TRANSFORMING HOW WE FIGHT

A combatant who understands the nature of war and can not only cope with but exploit it will have a decided advantage. This perspective can open new and more appropriate pathways toward real transformation. It also can serve as a reference point from which to evaluate the IT-RMA thesis and to suggest alternatives to a myopic focus on technology. Our ability to do so will in many ways determine the effectiveness of our armed forces in both the present and the future; it depends, in turn, on our ability to master four basic conceptual approaches.

Decentralization

A knowledge advantage can be exploited by empowering people at the lowest possible level. The notion that information is essentially dispersed in the extended order of the battlefield, coupled with the fact that shared information does not necessarily imply a shared appreciation as to how to respond to it, leads to fundamental questions regarding how organizations should be commanded and controlled. One part of the issue concerns whether a centralized or decentralized approach is more effective.[42]

The increasing transparency of the battlefield makes the impulse for centralization more difficult to control. The argument is that very senior commanders now have "dominant battlespace knowledge"; that they know everything necessary to make rapid and sound decisions. The interconnectedness of the organization, in this view, enables the commander to transmit those decisions instantaneously to subordinates and monitor precisely how those orders are implemented. The core assumptions of this argument are that shared information leads to shared understanding, that decisions are made most effectively at higher echelons of organization, that organizations consist of "decision entities" controlling "actor entities"—and that networks permit fewer of the former to control more of the latter.

Such centralization of authority, however, would suboptimize the performance of the military and the people who constitute it, because, as studies in the behavioral sciences have shown, bounded rationality is intrinsic to human nature. In a crisis, as we have seen, one person might respond conservatively while another person recognizes a fleeting opportunity worth significant risk.[43] Centralizing authority has the unfortunate consequence of limiting battlefield understanding to a single "decision entity." That might seem safe, in that a senior commander is presumably less likely, by virtue of experience and education, to make a poor decision than a more junior commander. However, the creative tension that results from competing perspectives is lost.[44] Moreover, removing from junior leaders the sense of responsibility, "ownership," and empowerment decreases motivation, retards creative thinking and problem solving, and results generally in less effective execution. The likelihood that decisions will not be executed in the manner intended increases with psychological distance between decision maker and actor.[45]

Empowerment of professionals at the lowest possible levels is the most effective guarantor of excellence. Technology should unleash the power of people rather than handcuff it. Liberating the creative genius of people can create a certain complex order in an operation that no central authority could conceive or direct and that no enemy could fully comprehend or counter. In any case, the

idea that information is essentially dispersed argues for a similar decentralization of authority.[46]

Decentralization, it is important to note, has its limits. Empowering untrained subordinates merely leads to poor decisions made more quickly; dissemination of authority in the absence of direction or guidance can produce disjointed activity that fails to accomplish the purpose of the operation, even impedes it. Leaders must define the creative space in which their subordinates are free to act. Statements of commander's intent, mission, boundaries, rules of engagement, and main effort are traditional methods of bounding that space and providing reference points. A new approach to the same problem is "effects basing"—explaining the effects a commander wants to achieve and how ground, sea, and space forces and other elements of national power interrelate, while allowing subordinate commanders to determine precisely how to achieve those effects. Leaders can also utilize "permissive" rules of engagement, instructions, and control measures designed to accelerate the decision-action cycle.[47]

To be sure, the senior leader must have confidence that a subordinate will make sound decisions. Training, education, and mutual understanding gained through acquaintanceships are natural foundations of mutual trust. Ad hoc organizations, accordingly, have difficulty with decentralization. We need to develop understanding and trust in the necessary depth at the operational level in peacetime so that it can be drawn upon in war. Standing joint task force staffs that train and communicate routinely with the tactical commanders and organizations they are likely to employ in action might prove important. We should also examine institutional impediments that create impulses toward micromanagement: how long officers remain in command positions, the education and training they receive, and how often command teams and staff teams operate together.

Information in the hands of people who cannot act on it is worth little; in the hands of those who can, it creates complex synergies of unimaginable power. We can guarantee suboptimal performance by centralizing authority while placing relatively powerless people in harm's way, or we can create a culture that truly transforms how we operate. Technology is neutral in this regard. A "culture of confidence" requires self-discipline and a relentless passion for excellence. Such a culture likewise relies upon junior professionals to be worthy of trust—an issue, to be sure, that deserves more attention.[48] The ability of commanders to educate and train professional subordinates, give them the authority they need, promote innovative thinking and responsible risk taking, and resist the urge to micromanage is crucial to warfighting effectiveness. Finally, creating the right culture requires institutions and systems that enhance rather than impede decentralization. Technology gives us tools to fight with. The degree to which we

can liberate and focus the creative genius of educated and trained professionals will determine how *well* we fight.

Complexity

A complexity advantage can be achieved by maximizing the number of meaningful interactions with which the enemy must cope simultaneously or nearly so. Complexity increases further if interactions occur at multiple levels. It also rises when response to one interaction creates "system perturbations" to which a combatant must respond as well. The most effective way to gain the complexity advantage is by combining the concept of "effects-based operations" with joint capabilities.[49]

The notion that standoff precision munitions alone can generate the right effects and produce the psychological collapse of the enemy is at odds with the idea of adaptive complexity. A thinking enemy who is determined to win will find ways to mitigate the effects of standoff precision munitions.[50] Despite their destructive power, such weapons, employed in isolation, have limited psychological impact. Their shock value erodes rapidly, and their effects can be countered with relatively few adverse consequences.[51]

"Complex" should not be confused with "complicated"; neither should "simple" be conflated with "simplistic." Simple actions that pose diverse threats, when integrated properly, produce complexity for the enemy. At the tactical level, tasks relatively simple to understand and implement—defend from a battle position; emplace obstacles; employ indirect fires, close air support, and rotary-wing aviation; and counterattack by fire—can create, when integrated into a defensive operation, a very complex challenge for the enemy. Each threat by itself may be easy to deal with; when they are integrated, attempts to evade or defeat one will result in increased vulnerability to others. Threats from multiple directions and in multiple dimensions—sea, air, ground, and space—exacerbate the complexity.

The principle applies similarly at the operational and strategic levels. Balanced, synergistic employment of complementary capabilities to achieve effects along "multiple lines of operation" integrates simple individual tasks into complexity for the enemy.[52] The simultaneous, integrated employment of precision-strike and ground maneuver forces on enemy formations and critical vulnerabilities, coupled with operational fires on second-echelon or reserve forces; special operations forces operations on strategic targets; strikes against the enemy's communications, economy, and infrastructure; public and private diplomacy aimed at coalition partners and third parties; and the use of economic instruments of power are ways to generate complexity at the operational and strategic levels of war. The increased number of options available to a balanced force to employ all

of its elements of power in an integrated manner will complicate further the range of problems with which the enemy must cope.[53]

In addition, bringing to bear a whole array of capabilities can cause "virtual attrition"—the diversion of assets to deal with anticipated threats—which can make our operations even more effective at the points of focus. Faced with such complexity, the enemy becomes more likely to make critical, even self-defeating errors. By making our actions unpredictable enough, we may create such uncertainty for the enemy as to induce cognitive or psychological collapse. A complex operation is far more likely to do so than a simplistic assault by a single capability.

Resilience

Related to complexity is the concept of resilience, by which balance and equilibrium can be sustained in our own force while instability and disorder are created and exploited in the enemy. Chaotic, complex adaptive systems such as combatants at war range in robustness from resilient to fragile. Resilient systems can absorb inputs and yet sustain, or quickly return to, their "normal" regimes of behavior, while fragile systems become disordered and incoherent.[54] Both are inherently nonlinear. We see unpredictable outcomes in war routinely—the small resilient unit withstands and rebuffs an attack despite being vastly outnumbered; another defending unit collapses entirely in the face of an attack by a numerically weaker foe.[55] We cannot predict with certainty such disproportionate outcomes, but we can approach the Chaotic, complex, and nonlinear natures of war from the perspectives of resilience and fragility in order to tilt the outcomes of interaction in our favor.

Clausewitz described the nature of combatant states in terms of the "trinity" and "triangle," and of the strength of armed forces with respect to physical size, moral factors, and the relative genius of their commanders. Although such a framework is not perfect, it does capture significant "points of attraction" that together influence the degree of resilience in the system.[56] Combatants must cultivate and sustain resilience by attending to these points of attraction at the strategic, operational, and tactical levels. It will be critically important to the process of military transformation to develop the factors that influence morale, cohesion, and leadership with the same amount of energy and enthusiasm now devoted to technology.

The opposite side of the coin naturally concerns the enemy's degree of resilience; operations should create and exploit fragility in the enemy in order to induce nonlinear outcomes in our favor. As we have seen, however, a note of caution is in order—we must not assume that any single weapon can bring about the inevitable collapse of the enemy. Some enemies are indeed fragile

enough to be defeated by standoff precision munitions alone, as believed by some theorists. A more resilient enemy, however, will sustain the will to fight. Rather than relying on problematic assumptions of inevitable collapse after precision-guided missile (PGM) attacks, the U.S. military needs to focus instead on creating the conditions in which the will to fight becomes increasingly difficult to sustain. By maximizing the level of complexity and exploiting fragility we inflict the greatest possible pressure on the enemy's will. The complexity generated by a properly employed, balanced, joint force will create the conditions necessary for successful military operations whether the enemy's will is strong or weak. Understanding the nature of combatants and the relationships between complexity and resilience is the basis of a sounder approach to warfighting.

Tempo

The concept of tempo—sustaining an intensity of operations with which the enemy cannot cope—integrates decentralization, complexity, and resilience. A combatant's will to resist is rarely broken by single spikes in the intensity of operations; in the respites that follow during periods of transition, the enemy recovers, adapts, and resumes the fight.[57] Instead, intense, complex interactions need to be created and maintained over an extended period of time. Operations that integrate effects, generating the most possible at each level of war, and do so unrelentingly have the most potential to break the enemy's will.

Organizations require considerable structural resilience and balance to mount such operations at high sustained tempo without exceeding the limits of their own capability or endurance.[58] To dominate transitions we need to eliminate the operational pauses that result from too little numerical strength to sustain tempo or from improperly assembled forces that cannot overcome the effects of terrain and weather.

Studies of combat psychiatry and nonlinear dynamics indicate that disproportionate negative outcomes—cognitive or psychological collapse—occur when systems, whether organizations or individual humans, do not have time to recover their equilibrium.[59] The ability, then, to sustain constant pressure against the enemy's points of leverage becomes crucial—to deny the enemy periods of rest in our transitions between offense and defense or between our successive offensive or defensive operations. Constant pressure requires not only a balanced force but one able to win the initial fight and then to commit fresh units to maintain pressure while the previously engaged units recover.[60] The nature of the enemy determines whether and when cognitive or psychological collapse will be achieved, but we can stretch his moral factors to the limit by "nesting" significant effects at the tactical, operational, and strategic levels and

by dominating transitions so as to deny the enemy any chance to recover equilibrium.

RELEASING CREATIVE GENIUS

Technological improvement is important but, pursued in isolation, will lead us only so far.[61] We must simultaneously examine desired operational capabilities and cultural and intellectual concepts that express how we want to fight. The synergistic interaction of analysis and synthesis among broad categories leads to innovation that is greater than any single approach can contribute on its own. We will fail if we focus exclusively on technology.

One of the problems with technological evolution and revolutions in military affairs is that the first organizations to experience such changes do not necessarily come to grips with them most effectively.[62] Technological and conceptual change must be integrated in a manner consistent with the enduring nature of war.

Information technology, of course, can radically improve the speed at which orders are transmitted; create forums for dialogue between commanders struggling to interpret reality on the basis of what they see on the ground and on their computer screens; enable commanders to apply combat power quickly to exploit fleeting opportunities; and permit an order-of-magnitude increase in the tempo of operations. A technology-based common operating picture can help commanders unleash the creative energies of their subordinates while ensuring that their actions and decisions remain within the framework of their own intent.[63] However, the true magic of high-performing organizations is that professionals, given the authority and autonomy they need within the parameters of their seniors' vision, creatively employ their interdependent efforts in a manner that leads to the success of the whole organization. Information technology should, in the hands of mature and thoughtful leaders, result in empowerment and initiative rather than rigidity and overmanagement.[64]

True transformation will be measured not by the speed of microchips but by the effectiveness of soldiers, leaders, and organizations in the next war. We need to stimulate and release the creative genius of our people. We must develop leaders who possess intellectual courage, who understand the theory and history—the art and science—of their profession, who can combine education and experience into wisdom, and who can cope with the enduring nature of war and turn it to their advantage. We need to develop resilient organizations that are cohesive, trained, confident, and ready to fight and win. Implementing warfighting concepts and doctrines that promote resilience and agility while generating higher complexity and operational tempo than the enemy can handle will ensure dominance even if an enemy can match or mitigate our technological

advantages. A balanced, truly joint force armed with effective leaders, versatile commands, and sound warfighting concepts and doctrines will be the foundation of a truly dominant military in the twenty-first century.

NOTES

1. In more sophisticated terms: information superiority leads to "dominant battlespace knowledge" that will "lift the fog of war" and assure victory. For examples of the IT-RMA thesis see William A. Owens [Adm., USN, Ret.], *Lifting the Fog of War* (New York: Farrar, Straus and Giroux, 2000); David S. Alberts, John J. Garstka, and Frederick P. Stein, *Network Centric Warfare* (Washington, D.C.: Command and Control Research Program, Office of the Assistant Secretary of Defense [C3I] [hereafter CCRP], 1999); Stuart E. Johnson and Martin C. Libicki, *Dominant Battlespace Knowledge* (Washington, D.C.: National Defense Univ. Press, 1996); David A. Deptula, *Firing for Effect: Change in the Nature of Warfare*, Defense and Airpower Series (Arlington, Va.: Aerospace Education Foundation, 1995); Fareed Zakaria, "Face the Facts: Bombing Works," *Newsweek* (3 December 2001); John A. Warden [Col., USAF], "Employing Air Power in the Twenty-first Century," in *The Future of Air Power in the Aftermath of the Gulf War*, ed. Richard H. Shultz, Jr., and Robert L. Pfaltzgraff, Jr. (Montgomery, Ala.: Maxwell Air Force Base, Air Univ. Press, 1992); Thomas L. Mahnken, "War in the Information Age," *Joint Force Quarterly*, Winter 1995–96, pp. 39–43.
2. Eliot Cohen, "A Revolution in Warfare," *Foreign Affairs*, Spring 1996, pp. 48–50.
3. See the very interesting article on the effects of live video feeds to higher headquarters on tactical decision makers engaged on the ground, by Thomas E. Ricks, "Beaming the Battlefield Home: Live Video of Afghan Fighting Had Questionable Effect," *Washington Post*, 26 March 2002.
4. Rowan Scarborough, "Size of Force on Ground Key in Plan for Iraq War," *Washington Times*, 26 April 2002. The specific claim, whether accurate or not, does reveal an ongoing debate over the best way to take advantage of the American military's technological superiority.
5. See, for instance, Paul Van Riper and Robert H. Scales, "Preparing for War in the 21st Century," *Parameters*, Autumn 1997, pp. 5, 14. The article, however, is more of a critique of the IT-RMA thesis than a discussion of how to apply new technologies to enhance warfighting effectiveness.
6. Donald H. Rumsfeld, "Transforming the Military," *Foreign Affairs*, May–June 2002, p. 29.
7. See the U.S. Defense Dept., *Quadrennial Defense Review Report* (Washington, D.C.: U.S. Government Printing Office, 30 September 2001), pp. iv–v.
8. The term "expensive irrelevance" comes from Riper and Scales, p. 14.
9. See "In Praise of Hayek," *The Economist*, 28 March 1992, p. 75. Quoted in Barry D. Watts, "Clausewitzian Friction and Future War," McNair Paper 52 (Washington, D.C.: Institute for National Strategic Studies, National Defense University, 1996), p. 70.
10. F. A. Hayek, *The Collected Works of F. A. Hayek*, ed W. W. Bartley III, vol. 1, *The Fatal Conceit: The Errors of Socialism* (Chicago: Univ. of Chicago Press, 1989), p. 14. Cited in Watts, p. 70.
11. For discussions of bounded rationality see Robert Axelrod, "Schema Theory: An Information Processing Model of Perception and Cognition," *American Political Science Review*, December 1973, pp. 1248–66, and *Structure of Decision: The Cognitive Maps of Political Elites* (Princeton, N.J.: Princeton Univ. Press, 1976); Richard Heuer, "Cognitive Factors in Deception and Counterdeception," in *Strategic Military Deception*, ed. Donald Daniel and Katherine Herbig (New York: Pergamon, 1982); Daniel Kahneman, Paul Slovic, and Amos Tversky, *Judgment under Uncertainty: Heuristics and Biases*

(Cambridge, U.K.: Cambridge Univ. Press, 1987). Discussions of bounded rationality emerge in ancient Greece. Plato's Myth of the Cave is an example of bounded rationality. According to Plato, we do not see things as they really are. As individuals bound by chains in a cave with our backs to the light, we see only images and shadows of things represented on the wall of the cave. Plato did suggest, however, that a philosopher could break the chains of perception and turn around, climb out of the cave, and reach the light. From there, he could see things as they really are. See Book VII in Allan Bloom, *The Republic of Plato*, 2d ed. (New York: Basic Books, 1991). See also Aeschylus, *Prometheus Bound*, trans. H. Weir Smith (Cambridge, Mass.: Harvard Univ. Press, Loeb Classical Library, 1988).

12. Watts, p. 76. John Boyd argued that the "orientation" process of the OODA loop is shaped by genetic heritage, cultural tradition, previous experiences, and unfolding circumstances. I have subsumed these issues and more under the rubrics of cognitive maps and perceptual lenses.

13. In this article a capital C is used when referring to Chaos as a science; the lower case is used when referring generically to disorder. For excellent introductions to Chaos theory see James Gleick, *Chaos: Making a New Science* (New York: Viking, 1988), and Glenn E. James, *Chaos Theory: The Essentials for Military Applications*, Newport Paper 10 (Newport, R.I.: Naval War College Press, 1996).

14. Weather patterns are examples. We know that temperatures are higher in the summer than in the winter, we know when hurricane and monsoon seasons begin and end, we know when snowfall is likely and when it is not. Within those large parameters, however, we cannot predict with certainty exactly when a hurricane will hit and where, the temperature on a specific day a month in advance, or how many inches of snow will fall on a given ski resort on a given day two weeks from now. See Gleick, p. 48.

15. A military organization with low morale and capability, for instance, can collapse completely when attacked by a more effective force. Likewise, a change in leadership can alter the morale of an organization radically.

16. Every input and interaction affects the system. Some are absorbed and the system returns to normal, some alter the system permanently. A robust, or resilient, system is stable; it retains its character in the face of input. A fragile system is unstable—it alters fundamentally due to input.

17. The Chaotic nature of human systems is due, in part, to the complexity of the individuals that constitute it, the complexity of interactions among individuals, the inputs external to the organization, and the responses and adaptations, individually and collectively, to those inputs and interactions.

18. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton Univ. Press, 1984), p. 89.

19. As historian Alan Beyerchen observes, "But when a pendulum is released over three equidistant and equally powerful magnets, it moves irresolutely to and fro as it darts among the competing points of attraction, sometimes kicking out high to acquire added momentum that allows it to keep gyrating in a startlingly long and intricate pattern. . . . The probability is vanishingly small that an attempt to repeat the process would produce the exact same pattern." (Alan Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," *Parameters*, Winter 1992, pp. 69–70). Clausewitz was an avid observer of science, and it is quite possible, according to biographer Peter Paret, that he witnessed such a demonstration and decided to include it as a metaphor in *On War*. See Peter Paret, *Clausewitz and the State: The Man, His Theories and His Times* (Princeton, N.J.: Princeton Univ. Press, 1983), p. 310.

20. According to Clausewitz, "An irreconcilable conflict exists between this type of theory and actual practice. . . . [Those theories] aim at fixed values; but in war everything is uncertain, and calculations have to be made with variable quantities. They direct the inquiry exclusively toward physical quantities, whereas all military action is entwined with psychological forces and effects. They consider only unilateral action, whereas war consists of continuous interaction of opposites" (Clausewitz, 134, 136).

21. The best discussions of complex, adaptive systems are Robert Jervis, *System Effects:*

Complexity in Political and Social Life (Princeton, N.J.: Princeton Univ. Press, 1999), and "From Complex Systems: The Role of Interactions," in *Coping with the Bounds: Speculations on Nonlinearity in Human Affairs*, ed. Tom Czerwinski (Washington, D.C.: CCRP, 1998).

22. Darwin's central thesis of evolution is that the rich diversity of species comes about "chiefly through the natural selection of numerous successive, slight, favorable variations; aided in an important manner by the inherited effects of the use and disuse of parts; and in an unimportant manner, that is in relation to adaptive structures, whether past or present, by the direct action of external conditions, and by variations which seem to us in our ignorance to arise spontaneously." Cited in Watts, p. 80. Charles Darwin, *Origin of the Species by Means of Natural Selection*, Great Books of the Western World, vol. 49, series ed. Robert Maynard Hutchins (Chicago: Encyclopaedia Britannica, 1952), p. 239; see also Ernst Mayr, *The Growth of Biological Thought: Diversity, Evolution, and Inheritance* (Cambridge, Mass.: Belknap Press, 1982), pp. 394–534.

23. Darwin's theory of natural selection is not without its flaws, but as one observer notes, the core thesis is the only empirical theory that is capable "of solving that most difficult of problems posed by life anywhere in the universe, namely, the problem of the existence of adaptive complexity." Cited in Watts, p. 81. Richard Dawkins, "Darwin Triumphant: Darwinism as a Universal Truth," in *Man and Beast Revisited*, ed. Michael H. Robinson and Lionel Tiger (Washington, D.C.: Smithsonian Institution Press, 1991), p. 38; Richard Dawkins, *The Blind Watchmaker: Why the Evidence of Evolution Reveals a Universe without Design* (New York: W. W. Norton, 1987), p. 317.

24. For a similar analysis of friction see Stephen J. Cimbala, *Clausewitz and Chaos: Friction in War and Military Policy* (Westport, Conn.: Praeger, 2000), pp. 200–201.

25. By "meaningful inputs" I mean inputs to the system that require decisions from leaders and actions from organizations. The level of importance of the inputs is determined by the degree to which they affect the combatants.

26. See Watts, p. 79.

27. See, for instance, Fred Charles Iklé, *Every War Must End* (New York: Columbia Univ. Press, 1971): "The final outcome of wars depends on a much wider range of factors, many of them highly elusive—such as the war's impact on domestic politics or the degree to which the outside powers will intervene" (pp. 1–2).

28. Nonlinear dynamics is a branch of science that seeks to explain why systems in the real world routinely do not respond as predicted by classical mathematics and Newtonian physics. For discussions of nonlinearity see Czerwinski.

29. Linda P. Beckerman, "The Non-Linear Dynamics of War," *Science Applications International Corporation*, 1999, www.belisarius.com/modern_business_strategy/beckerman/non_linear.htm, p. 2.

30. Beyerchen, p. 62.

31. Military organizations often exhibit nonlinearity. The quality of leadership, for instance, can have a significant impact on the combat effectiveness of an organization. As the quality of leadership changes over time, the organization's effectiveness can vary widely. Combat stress on a unit can also become transformational. What is a superb outfit after two weeks in combat can become a dysfunctional one after two months at the front.

32. See also James G. Roche and Barry D. Watts, "Choosing Analytic Measures," *Journal of Strategic Studies*, June 1991, pp. 165–209, and Watts, p. 194.

33. Beyerchen, p. 66.

34. One powerful example of nonlinear behavior comes from Samuel Huntington's *Clash of Civilizations*: "More generally, even small amounts of violence between people of different civilizations have ramifications and consequences which civilizational violence lacks. When Sunni gunmen killed eighteen Shi'ite worshippers in a mosque in Karachi in February 1995, they further disrupted the peace in the city and created a problem for Pakistan. When exactly a year earlier, a Jewish settler killed twenty-nine Muslims praying in the Cave of the Patriarchs in Hebron, he disrupted the Middle Eastern peace process and created a problem for the world." In this case,

context was absolutely crucial in generating nonlinear behavior that disrupted the already fragile peace process in the Middle East. Samuel P. Huntington, *Clash of Civilizations and the Remaking of World Order* (New York: Simon and Schuster, 1996), p. 254.

35. For an in-depth examination of uncertainty in war see Christopher D. Kolenda, *Uncertainty in War: Exploring the Nature of Combat and Conflict* (Advanced Research Project, Naval War College, Newport, R.I., 2002).

36. For instance, Frank M. Snyder, "Command and Control and Uncertainty," *Naval War College Review*, March–April 1979, Owens, pp. 14–15. Robert Leonhard seems to argue along similar lines in asserting an inverse proportionality between "knowledge" and "ignorance." See his *Principles of War for the Information Age* (Novato, Calif.: Presidio, 1998), p. 251.

37. For further discussion see Owens; Johnson and Libicki, eds.

38. Hugh Courtney, Jane Kirkland, and Patrick Viguerie, "Strategy under Uncertainty," *Harvard Business Review*, November–December 1997, repr. *Strategy and Force Planning*, 3d ed. (Newport, R.I.: Naval War College, 2000), pp. 37–41. Vision is another part of uncertainty about the future, not addressed in the above study, that must be added to the construct. Vision is an attempt to create an image of the future and then to develop plans, policies, and programs to achieve it. Imbedded is a degree of doubt, conscious or otherwise, over whether the vision is the correct or best one. The enemy attempts to achieve vision as well, and these competing visions and implementation schemes can undermine existing plans, create unforeseen opportunities and crises, and even make an existing vision absolutely untenable.

39. See Kolenda, *Uncertainty in War*, pp. 47–58.

40. The interactions and counteractions and the resulting changes and adaptations that take place create such complexity that the interacting systems defy modeling by anything less complex than themselves.

41. Courtney et al., pp. 43–51. The authors suggest three strategic postures (shape the future, adapt to the future, and reserve the right to play) and three payoff profiles in a portfolio of action (no-regrets moves, options, and big bets).

42. For discussions of centralization versus decentralization see Christopher D. Kolenda, "Discipline: Creating the Foundation for an Initiative-Based Organization," in *Leadership: The Warrior's Art* (Carlisle, Penna.: Army War College Foundation Press, 2001), and Dandridge M. Malone, "The Integration of Internal Operating Systems: An Application of Systems Leadership," in *Strategic Leadership: A Multi-Organizational Perspective*, ed. Robert L. Philips and James G. Hunt (Westport, Conn.: Quorum Books, 1992). Another part deals with the question of organizational structure. Should we "flatten the hierarchy" and develop "networked" organizations, or is the current structure still useful? Due to the increased capacity for control afforded by network-centric organizations, the organizational structure can be flattened to remove unnecessary and redundant layers of commanders and staff. In light of the war on terror, as one argument posits, the only way to defeat a networked organization is with a networked organization. See John Arquilla, David F. Ronfeldt, and Michele Zanini, "Networks, Netwar, and Information-Age Terrorism," in *Countering the New Terrorism*, ed. Ian O. Lesser et al. (Santa Monica, Calif.: RAND, 1999). So-called networked organizations, however, seem to thrive when operating in a negative integration paradigm. They are good at nihilistic destruction but have difficulty building cohering platforms for action. Nationalist organizations, for instance, while effective in undermining existing governments or fighting foreign forces, have traditionally experienced severe difficulties in attempting to build for the future. Hence, we should exercise caution prior to assuming that a networked organization is intrinsically more effective than a well-functioning hierarchical system. For further study on nationalism and nationalist organizations, see John Hutchinson and Anthony D. Smith, eds., *Nationalism* (New York: Oxford Univ. Press, 1994).

43. One famous example is the dispute between General Heinz Guderian and his superiors about how best to exploit the Sedan breakthrough in May 1940. Guderian wanted to continue his attack to the west, while his superiors wanted to consolidate south of the

bridgehead, defeat an impending French counterattack, and only then resume the attack toward the Channel coast. Guderian eventually had his way through a combination of obfuscation and downright disobedience. Had the more "prudent" approach prevailed, the outcome of the campaign in France might have altered significantly. For more development see Robert Allan Doughty, *The Breaking Point: Sedan and the Fall of France, May 1940* (Hamden, Conn.: Archon Books, 1990), pp. 218–38, and Heinz Guderian, *Panzer Leader* (New York: Da Capo Press, 1996), pp. 97–106.

44. The fear of subordinate leaders making suboptimal decisions can be addressed through training and education; see Kolenda, "Discipline."

45. "Distance" in this case can be viewed as psychological distance between leader and subordinate. As the psychological distance grows, the subordinate might feel less responsible for successful implementation of a decision or plan. The stronger the identity of actors with decisions, the more likely they will have a sense of ownership and desire to see the decisions implemented properly.

46. Empowered professional individuals and leaders throughout an organization will make decisions and take actions designed to maximize the contributions of themselves and their organizations toward achieving the commander's intent. When coupled with the levels of excellence created by ownership and sense of responsibility, this complex order increases the effectiveness of operations by an order of magnitude.

47. A "free-fire area" is an example of a permissive control measure. Although restrictive in that it prevents friendly forces from entering, it is permissive in that enemy forces within the area can be struck immediately without cumbersome clearance-of-fire procedures.

48. Much ink and emotion have been spent recently about the increasing penchant for oversupervision. A dispassionate analysis would undoubtedly reveal that lack of confidence in the competence and judgment of subordinates, whether justified or not, is an important part of the cause. Recent conflicts may have left senior leaders with relatively little to do other than micromanage affairs, but a conflict of greater complexity might come along that demands attention at senior levels and faith in junior leaders to perform without direct and overwhelming supervision. The direction taken during transformation with respect to centralization versus decentralization of authority might make the difference between winning and losing. The term "culture of confidence" is used effectively by Kevin Farrell in his discussion of the German army in the Second World War; see "Culture of Confidence: Tactical Excellence of the German Army in the Second World War," in *Leadership*, ed. Kolenda.

49. For discussions of effects-based operations see Arthur Cebrowski [Vice Adm., USN], "President's Forum" (pp. 5–14), and Edward A. Smith, Jr., "Network-centric Warfare: What's the Point?" (pp. 59–75), *Naval War College Review* 54, no. 1 (Winter 2001). Theorists of maneuver warfare and network-centric warfare acknowledge the Chaotic nature of war. They call for operations aimed at generating effects upon the enemy's will to create paralysis, shock, and dislocation rather than merely focusing on the physical destruction of the enemy's forces. They recognize implicitly that interactions that create dysfunctional instability in the enemy's system can result in the loss of will to fight. Nesting effects on the enemy's command and control structures, on the morale of enemy armed forces, and on a combatant's economic infrastructure are examples of such methods. The degree to which such operations are successful, however, depends upon the ability to generate the destabilizing inputs and upon the resilience of the enemy. For articles on the necessity of balance in force structure see Robert Scales, *Future Warfare Anthology* (Carlisle, Penna.: Strategic Studies Institute, 1999).

50. Placing air defense sites, command and control facilities, and other critical assets next to hospitals, places of worship, and highly populated areas are adaptations designed to take advantage of American aversion to civilian casualties and collateral damage. Dispersing and hiding armored forces, using decoys, and relying more heavily on small-unit infantry operations are some ways to limit the effectiveness of precision munitions. Multirole chemical factories that can make

pharmaceuticals and baby formula as well as chemical and biological weapons are also adaptations.

51. The campaign in Kosovo, Operation ALLIED FORCE, is used by IT-RMA enthusiasts and strategic bombing advocates as an example, par excellence, of the notion that airpower alone can win war on the cheap and should usher in a new American way of war. The reality is a bit more complicated. Recent scholarship over the past year had added much needed substance to the debate on all sides. See Andrew J. Bacevich and Eliot A. Cohen, *War over Kosovo* (New York: Columbia Univ. Press, 2001); Benjamin S. Lambeth, *NATO's Air War for Kosovo* (Santa Monica, Calif.: RAND, 2001); and Stephen T. Hosmer, *Why Milošević Decided to Settle When He Did* (Santa Monica, Calif.: RAND, 2001). For an incisive analysis of the three books see Stephen Biddle, "The New Way of War? Debating the Kosovo Model," *Foreign Affairs* (May–June 2002), pp. 138–44.

52. "Lines of operation" is a term General Tommy R. Franks used in an address to the Naval War College in Newport, Rhode Island, on 23 May 2002 to describe the different avenues he was employing in Operation ENDURING FREEDOM.

53. Employing ground forces does increase the potential for U.S. casualties, and therefore, critics argue, might undermine the war effort in a casualty-averse society. A number of problems exist with this argument. First, casualty aversion seems to have far more to do with the stakes of the war than a reflexive impulse to avoid putting Americans in harm's way. Second, as we learned in Kosovo, taking ground troops "off the table" simplified the conflict for the Serbians and led to a belief that they could endure the bombing while completing the ethnic cleansing of the province. Such myopic rationality on the part of NATO to avoid casualties by taking away the ground force option highlights a third problem: making adaptations easier by simplifying the war for the enemy can prolong the conflict, thereby actually increasing the total number of casualties and amount of destruction. For relevant polling data for the war on terrorism see CNN/USA Today/Gallup, ABC News/Washington Post, and CBS News, 12 September 2001; Washington Post/ABC News, 8 November 2001, and contrast with polls concerning U.S. forces deploying to Bosnia in CNN/USA Today, 15–18 December 1995.

54. It is also possible for inputs to strengthen or weaken a system. For instance, a change to better leadership, a battlefield victory, and refitting can make an organization more resilient, whereas a change to poor leadership, a series of defeats, and lack of logistical support can erode resilience and make an organization more fragile.

55. For further discussion see Kolenda, *Uncertainty in War*.

56. While physical size is important, for instance, a large force with poor morale and incompetent leadership is far more fragile than a smaller force with high morale and superb leadership.

57. Transitions are characterized by pauses in war as each side prepares for a subsequent operation. The period between initial deployment and the conduct of offensive or defensive operations is a transition. The pause that results when an offensive operation culminates and the unit prepares to defend or resume the offensive is another type of transition. Likewise, the period between conducting a defensive operation and a subsequent offensive operation is a transition. These transition periods, and others like them, are typically times when an organization can recover and restore equilibrium.

58. See Watts, pp. 82–89.

59. See Czerwinski; Beyerchen; and Kolenda, *Uncertainty in War*.

60. There seems to exist, therefore, an organizational threshold for the management of transitions. Below a certain number of robust subordinate units, the organization cannot dominate both fights. The U.S. Army, for instance, can employ cavalry forces to dominate transitions in war. These forces are traditionally organized and equipped to operate autonomously in a geographically dispersed manner to cover the entire battlespace of their parent unit. Intelligently employed, cavalry organizations give army divisions and corps the capability to dominate transitions and thus set the conditions to induce adverse nonlinear effects on the enemy.

61. John Boyd's "conceptual spiral" provides important insight into the transformation and future of the military. See John Boyd, "Conceptual Spiral," lecture, Naval War College, Newport, Rhode Island, August 1990. For further discussion of Boyd see Grant Tedrick Hammond, *The Mind of War: John Boyd and American Security* (Washington, D.C.: Smithsonian Institute Press, 2001).

62. It was not the British and the French, the technological leaders in mechanized systems during the interwar period, who implemented the concepts of "blitzkrieg" or "Deep Battle." In May 1940 the side with the technologically superior tanks lost to the side that employed inferior and fewer machines more effectively. While the Germans and Soviets were conceptualizing the power of deep penetrations by mechanized formations supported by artillery and aviation, the British and French focused on using "penny packets" of tanks to plug holes in defensive positions. See Robert Allan Doughty, *The Breaking Point, Sedan and the Fall of France, 1940* (Hamden, Conn.: Archon Books, 1990), pp. 7–32, and *The Seeds of Disaster: The Development of French Army Doctrine, 1919–1939* (Hamden, Conn.: Archon Books, 1985); and Frederick W. Kagan, "Soviet Operational Art: Theory and Practice of Initiative, 1917–1945," in *Leadership*, ed. Kolenda.

63. The Marine Corps has captured these ideas most effectively. See U.S. Navy Dept., *Warfighting*, Fleet Marine Field Manual 1 (Washington D.C.: U.S. Government Printing Office, 1997); U.S. House, Procurement Subcommittee and Research and Development Subcommittee of the House National Security Committee, testimony of Lt. Gen. Paul Van Riper, USMC, 20 March 2001; and H. T. Hayden ed., *Warfighting: Maneuver Warfare in the U.S. Marine Corps* (London: Greenhill Books, 1995).

64. See Kolenda, "Discipline."