Marine with 2nd Low Altitude Air Defense Battalion Counter–Unmanned Aerial Systems Detachment, attached to Special Purpose Marine Air-Ground Task Force Crisis Response–Central Command, conducts functions check on Mine Resistant Ambush Protected vehicle, Southwest Asia, February 17, 2019 (U.S. Marine Corps/Jack C. Howell)

# Clausewitz's Wondrous Yet Paradoxical Trinity

## The Nature of War as a Complex Adaptive System

By Brian Cole

*But in war more than in any other subject we must begin by looking at the nature of the whole; for here more than elsewhere the part and whole must always be thought of together.*

—Carl von Clausewitz

In *On War*, Carl von Clausewitz introduces readers to widely recognized axioms such as how the simplest things become hard in war and how the fog and friction of war transform minor difficulties into major, nearly insurmountable obstacles. Within many of these axioms, Clausewitz describes the nonlinear nature of war. It is, however, the last five paragraphs of his first chapter that holistically describe the nature of war as a nonlinear system. His description and understanding of the social dynamics of war give complex meaning to the interaction of various social elements in war, characterizing it as a complex adaptive system. Political and military leaders and policymakers should be mindful of the nonlinear nature of the social interactions in war. In doing so, they will be more prepared and adaptable to unpredicted yet material developments throughout a conflict.

Brian Cole is the Director of the Joint Warfare Department at the Marine Corps War College.

Clausewitz describes war in holistic terms as a paradoxical trinity comprised of the tendencies of the people, the commander and his army, and the government. In war, the most violent of social interactions—the three elements of the Clausewitz's trinity—interact within and among the other elements to create a pattern of behavior that is understandable yet difficult to predict. Clausewitz warns that while it is hard enough to understand the nature of each of the three elements of war's paradoxical trinity, a "theory that ignores any one of them or seeks to fix an arbitrary relationship between them would conflict with reality to such an extent that for this reason alone it would be totally useless."[1] John Miller and Scott Page echo Clausewitz's sentiments by exclaiming that to understand a complex adaptive system, we must know both the nature of each element and the meaning of their interactions.[2]

Clausewitz uses still-contemporary ideas and terms in his manuscript, but his descriptions of the trinity, its attributes, and its emergent behavior are what complexity theory describes as a *complex adaptive system*. Complexity theory was originally developed for the natural sciences, but social scientists find it useful to understand social systems. Complexity theory provides a framework to help us understand the root causes of phenomena—not replace traditional theories—and to help us understand the nature of war.

Modern military strategists, commanders, and staff officers must be familiar with the abstract conception of war and be willing to release the concrete, tangible tactics for the operators. War must be considered as a whole or, as Michael Handel writes, a *gestalt*, to appreciate the complexity and nonlinear nature of war. Handel argues that "because of its infinite complexity and non-linear nature, war can only be understood as an organic whole, not as a mere compendium of various elements."[3]

This article provides an overview of Clausewitz's wondrous yet paradoxical trinity, complexity theory, and complex adaptive systems. In the end, it revisits Clausewitz's paradoxical trinity and the nonlinear nature of war, explains how his trinity is a complex adaptive system, and illustrates how complexity theory can be applied as a framework to examine his observations of the interactions among chance, politics, and passion in unity.

## Clausewitz's Trinity

Clausewitz argues that war is a phenomenon consisting of three central elements or dominant tendencies. This triad, or trinity, is a paradoxical relationship "composed of primordial violence, hatred, and enmity . . . chance and probability . . . and of its element of subordination, as an instrument of policy."[4] It is paradoxical because while war is an extension of policy—a rational tendency—it is propelled at times by primordial violence and hatred—irrational tendencies—or by chance. Primordial violence is the blind natural force, whereas the subordinated nature of war as a political tool is what makes it subject to pure reason, and chance is always a factor under extremely violent and dangerous conditions.[5] Each of the three elements are "manifested in a corresponding subject within society: respectively, the people, the commander and his army, and the government."[6] Clausewitz's trinity is a compressed concept of a number of central ideas that are integrated by a logic of interacting contrasts.[7] The trinity is a social system that exhibits complex interactions and adaptive, emergent behavior. The system is sensitive to initial conditions, and chance and luck can always alter the system's behavior in unpredictable ways.

## The Nature of War Is Constant

Clausewitz wrote *On War* in a time when wars were interstate conflicts fought by clearly defined armies. War was confined to battlefields and uniformed combatants. The characteristics of war have changed since the 19th century, but its nature has not. It is constructive to challenge the relevance of Clausewitz to modern war, and doing so forces one to revisit his nonlinear theories of war.[8] The first book in *On War* is a conceptual framework created to understand the nature of war, and the wondrous trinity can be used as a methodological starting point to studying post–19th-century war.[9] Ultimately, war is characterized by a combination of the three tendencies of the trinity with varying influences dependent on conditions such as the state of weapons technology and the historical relationships between opponents.[10]

War is an act of violence, of that there is no question, but it is first an extension of policy, a rational and purposeful act of violent means used to forcefully compel one's opponent to its will. The primacy of politics may start as the most influential tendency of war, but the nature of the conflict will be determined by the initial conditions and the subsequent interaction of the trinity's three elements.[11] The combatants' subordination of rational policy may be usurped by chance and luck, or by the primordial tendencies of hatred and enmity.

## Three Levels of the Trinity

Thomas Waldman establishes a typology for the trinity's elements. The typology is defined as the objective, subjective, and contextual levels of the trinity. Passion, chance, and politics constitute the *primary* or objective trinity. The primary trinity is manifested into the societal elements of the people, the commander and his army, and the government, respectively. The societal elements, Waldman explains, make up the *secondary* or subjective trinity, whereas *context* constitutes a third level. Context is not a trinity, but it is the conditions under which the other two levels of the trinity exist and interact. The trinity as a system is highly sensitive to its conditions, and thus context is vital to explaining changes that occur at the secondary level and provides an understanding of the inherent flexibility of the trinity.[12]

The third level, context, influences the system the most. Context provides the setting in which "the three primary tendencies—passion, chance, and politics—are manifested in reality through secondary level subjects."[13] Clausewitz explains context by showing that

historically, societies tend to conduct wars in their own particular ways, using different methods and pursuing different aims than their opponents.[14] He describes context in the opening sentence of his section on the trinity, writing, "War is more than a true chameleon that slightly adapts its characteristics to the given case."[15] Waldman argues that Clausewitz uses the chameleon to demonstrate how war is connected to its surroundings.[16] Justin Kelly and Mike Brennan write that war must be viewed as a complex system that emerges from "infinitely small changes in its environment, truly 'more than a chameleon.'"[17] Initial conditions are too varied to apply a single methodology on which to approach a conflict. The context constructs the initial relationships, acting as a catalytic force of emerging, largely unpredictable behaviors among and between elements of the trinity. The hope, as Kelly and Brennan remind us, is not to achieve absolute control but to influence tendencies toward desirable outcomes and away from undesirable ones.[18]

## A Review of the Inherent Properties of Complex Systems

What makes a system complex and not complicated? Complicated systems may seem complex, but they are not unless they possess certain inherent properties of a complex system. Complex systems come in a wide variety of forms, and at times they can be difficult to recognize or distinguish from complicated systems. A *complex system* is an open system that interacts with its environment, whereas complicated systems are usually closed systems. A *complicated system* is reducible; its parts can be disaggregated, and by understanding the nature of its parts, one can determine the nature of the system in the aggregate. A complex system is irreducible. One cannot determine the nature of the system in the aggregate by understanding its disaggregated parts because the elements of a complex system interact in developing ways that give rise to emergent behavior.[19] Unlike a complicated system, a complex system often exhibits nonlinear characteristics that can lead to positive feedbacks and instability, similar to the economic theory of increasing returns, making it difficult to predict its behavior. The theory of increasing returns relies on a principle of indeterminacy and accounting for random events affecting markets. The properties of complex systems also make them capable of self-organizing and adapting without a central authority.

***Complex Adaptive Systems.*** Complex systems are found in many places. In the natural world, such systems include the brain, immune systems, ecologies, cells, developing embryos, and ant colonies. In the human world, they include cultural, economic, and social systems such as political parties or scientific communities. Complex systems are everywhere in all sorts of contexts, but complex systems that adapt share central properties.[20] A complex adaptive system consists of a network of agents acting in parallel. Agents, depending on the context, can be nerve cells, individuals, firms, or even whole nations. In a complex adaptive system, "Each agent finds itself in an environment produced by its interactions with other agents in the system. An agent is constantly acting and reacting to what the other agents are doing."[21] As a result, nothing in a complex adaptive system is fixed, and control is highly decentralized.[22]

In *Harnessing Complexity*, Robert Axelrod and Michael Cohen describe a complex adaptive system as the interlocking sets of processes that generate productive actions in a world that cannot be fully understood. The three key processes that constitute a complex adaptive system are *variation*, *interaction*, and *selection*. The framework by which Axelrod and Cohen study complex systems is made up of three elements called *agents*, *strategy*, and *population*. An agent interacts with its environment and with other agents. It can respond to what happens around it and can act, to some extent, purposefully. A strategy is the way an agent responds to its surroundings and pursues its goals. Populations are part of an agent's environment.[23] The agent-strategy-population framework is known as the *population approach to complex adaptive systems.*

***Aggregation of Agents.*** A complex adaptive system is an aggregation of agents within a given environment. The modeler decides what to focus on and what to avoid. *Aggregation* is a building block approach in which aggregates act like agents at a higher level, or as meta-agents. Modeling is an art form, and what is aggregated is dependent on what a modeler wishes to examine. Aggregation is also about the actions of a complex adaptive system. In aggregation, a modeler can identify and understand a system's emergent behavior as a whole, which is commonly different than the behavior of the individual agent.

***Tags.*** Boundaries can be defined for specific aggregations of agents or populations. When one defines the boundaries of an aggregation, it is referred to as *tagging*. For example, a flag or guidon is used to unite in effort an army or group of people under a political system. Billiard balls on a table are a population of billiard balls, but adding stripes to half the balls manipulates the symmetry and tags the aggregations into stripes and solids. In the field of complexity theory, tags are used to manipulate symmetries in order to study certain details while ignoring others. Tagging manipulates symmetry by creating boundaries and thus defining the system or a particular aggregation that we seek to observe that might otherwise be hidden.[24] Clausewitz tags the elements of the second level of the trinity by delineating the objective level of passion, chance, and politics to designated aggregates. Those aggregates are the population, the military, and the government. The division is not an arbitrary device; rather, it is meant to isolate and study the interactions both within a particular system and between the systems.

***Flows.*** The concept of flows is important to understanding complex adaptive systems. For example, flow can refer to the movement of goods into or out of an economy, or flow could refer to information or transportation with networks and connectors. Tags can be used to define the system and the networks that connect and direct flows. Two properties can affect flows. The first is the multiplying or multiplier effect, which is common in

Commander Task Force 51 Marine Major General Carl E. Mundy III addresses Sailors and Marines during all-hands call on flight deck of USS *Essex*, Pacific Ocean, February 26, 2015 (U.S. Navy/Jason M. Graham)

economics when discussing circular flows; the second is the recycling effect.

The *multiplier effect* is the overall increase in returns for every unit of currency spent. For example, as John Holland explains, if you were to contract someone to build a house, you would pay the contractor, who in turns pays varying subcontractors. Those subcontractors use part of that money to buy food and other things, and so on. By taking a fraction of the original contract and using that same fraction at each subsequent phase, we can determine the multiplying effect. For instance, if the fraction to be applied to each step in the spending process is r = 80 percent, we can calculate $1 + r + r^2 + r^3 + r^4 + \ldots$ or using the equation $1/(1 - r)$, we get a multiplying effect on the overall system of $1/(1 - 0.8) = 5$.[25] The result in this example is that for every $1 spent, the effect to the overall economy is $5.

The other property of flows is the *recycling effect*. Once again, as Holland points out, it is easiest to understand by using an example. A steel producer sells some fraction of his steel to a car manufacturer. The cars are built, then driven and sold repeatedly to the point that they are no longer useful and finally given up for scrap metal in a junkyard. The junkyard then recycles a portion of the steel used to make the cars and sells it for some other use. In the end, each cycle traps resources to be recycled again and again, creating a multiplying effect on the original resource sold to the car manufacturer.[26] This cycle can occur several times over, depending on the system and resource.

***Variation.*** Variation of a population is an essential attribute of a complex adaptive system. Variation, Axelrod and Cohen write, "provides the raw material for adaptation."[27] There are, however, limits to the extent variation in a population will facilitate adaptation.[28] Those who want to shape the behavior of a complex adaptive system must work to increase or decrease the variety of agents in a population, but not simply by accommodating variety. A population with varying types of agents creates a system that gives rise to events that unfold in often unpredictable ways.

***Interaction.*** Interaction is essential to Axelrod and Cohen's framework because the events of interest within a system come from the interactions of agents with other agents and artifacts. For example, trade occurs when a buyer meets a seller, strategies of bidding and offering take place, and eventually goods change hands. Most complex adaptive systems have distinctive interaction patterns, which are "neither random or completely structured."[29] Axelrod and Cohen provide two examples: asymmetric interaction and uniform interaction. *Asymmetric interaction* occurs, for example, when a leader is able to broadcast messages simultaneously to many who


Marine Corps Communication-Electronics School student racks billiard balls before match during Single Marine Program's weekly pool tournament held at 5th Street Zone, Twentynine Palms, California, July 16, 2015 (U.S. Marine Corps/Levi Schultz)

likely do not have the same capability to broadcast information back to a leader. This type of highly asymmetric interaction is different from symmetric interactions, in which all agents can interact equally with all others. *Uniform interaction* is established when, for example, there is a neighborhood in which there are stores, schools, and churches. In all these places, people are able to meet and develop a network with a strong local bias. People know many others near where they live and very few people, in comparison, who live elsewhere around the globe. Interactions, the authors write, are what make complex adaptive systems come alive. David Earnest describes the complexity of global life as *interaction complexity*, or the condition in which the effect of a factor on a social system is dependent on the state of other factors.[30]

***Selection/Adaptation.*** The properties described so far are necessary for a system to be complex, but for such a system to become adaptive, it must have a mechanism for selection. Axelrod and Cohen use evolutionary biology's concept of natural selection to understand the nature of complex adaptive systems. While not identical to the process of natural selection, complex adaptive systems do operate in a similar way. Natural selection requires a means to retain agents' essential characteristics, a source of variation, and amplification or some change of frequencies of type.[31] Natural selection relies on the selection of the agent, but a more direct method of adaptation is the selection of the strategy. Instead of waiting for agents to reproduce, a good strategy can achieve successful results much faster.

In either the agent or strategy level of selection, to retain effective adaptation reproduction needs to occur. Natural selection occurs in the absence of centralized control and authority. The absence of central authority is what allows a complex system to adapt. However, defining criteria for success is essential to harnessing complexity, as the title of Axelrod and Cohen's book implies. The framework

they present offers a way to "analyze institutions and how they shape—and are shaped by—the actions of individuals."[32] Complex systems are constantly shaped by the interaction of agents. One agent acts as a result of another's action. In other words, actions are informed by other actions, and so on.

Axelrod and Cohen write that a system is complex when there are strong interactions among its elements, such that "current events" heavily influence the probabilities of later events. A change in strategy results from a system's selection process, which leads to an improvement according to some measure of success. Axelrod and Cohen call this process *adaptation*. A complex adaptive system then, is a system that contains agents, or populations, that seek to adapt.

***Nonlinearity.*** The nonlinear characteristic of the relationship among the three tendencies in Clausewitz's trinity is potentially the most significant and dangerous attribute. The nonlinear interaction is analogous to when "a magnet is released over three equidistant and equally powerful magnets, it moves irresolutely to and fro as it darts among the competing points of attraction."[33] Predicting the trajectory of such a magnet is essentially impossible, even though one could anticipate its pattern. Any infinitely small variation in initial conditions can cause significant subsequent variations. Waldman explains that this can occur in war because it is an open system that is sensitive to differences in initial condition and external influences. The magnet model analogy captures the complexity of war. As Waldman notes, such complexity makes it difficult to make "neat" analyses of war. Clausewitz conceived of the trinity with complexity in mind, "a fact that belies its seeming simplicity."[34] No single tendency can be understood in isolation because, as Waldman points out, in war all three tendencies simultaneously interact, creating a nonlinear, unpredictable complex system.

A moderating tendency can create a stable system. This means that a moderating tendency can prevent minor disturbances from amplifying into major disturbances. In other words, a stable system has a dampening property so that the system maintains its essential properties. When the actions of others in a given population influence others, as in the Standing Ovation Problem (described later), a tipping point may occur that could lead to a cascading effect and undermine system stability. When agents do as other agents do, they can become locked into path-dependent behavior. Path dependency can lead to a nonlinear, magnifying effect amounting to a social tipping point.

The model of a steel ball suspended above three equally spaced magnets provides a good visualization of the trinity. When the ball is pushed in one direction, the magnets all act on the steel ball and the ball reacts to the magnets. The path the ball takes is highly dependent on, and sensitive to, its initial conditions, but the path is difficult if not altogether impossible to predict in real life. There are many variables involved in the initial conditions, such as wind, temperature, symmetry of the ball, and strength of the magnets. Once the ball is set in motion, it is unlikely to gain momentum while it gyrates wildly. In this model, friction is one of the moderating forces that acts to stabilize the ball and prevent it from reaching a tipping point. In war, an unmoderated trinity could manifest in irrational acts of large-scale violence. The violence may continue until it expands into new boundaries where there are moderating forces that will dampen and end the violence. It can be difficult to predict under what conditions violence will extend beyond the rational tendency.

## The Trinity as a Complex Adaptive System

Because of the overarching inherent element of danger in war, no other human endeavor is more turbulent, ambiguous, or reliant on luck than war.[35] Human behavior in the face of danger is largely an unpredictable variable across a given population. The subjective nature of courage plays differently among everyone. No matter the extent of mathematical calculations in planning, the roles of luck and chance interject probabilities into the equations, making war most like a game of cards in which chance is as dominant a force as calculation.[36] Acting courageously in war is one aspect of unpredictable human nature; another is the level of indiscriminate violence that people have shown to be capable of committing.

A complicated system, as mentioned, is one whose individual parts (when broken down) can be studied and understood. By understanding all the parts, it is possible to understand and thus predict the behavior of the system in its aggregate. This is possible because the parts are actually independent from each other, even when they are in the aggregate. A piston rod, when connected to the camshaft, does not change the nature of the camshaft itself or the piston attached to the other end. These parts behave as would be predicted given the context in which they function. The tendencies of Clausewitz's trinity cannot be isolated because the boundaries among them are indistinct—all three elements help define the others.[37] In complex social systems like Clausewitz's trinity, the parts or tendencies are interconnected and interdependent.

Clausewitz writes that war is a human social activity. According to him, the fundamental understanding of war is based on the human element. He observes that war is "an activity in which each aspect influences and is influenced by others, and this interrelationship extend[s] to the social and political matrix of war."[38] In war, like life, all parts are interconnected and constitute a whole. Waldman argues that the trinity is not "simply a combination of these elements placed side by side. It is much more than this and is intended to reflect the incredible complexity of war in reality."[39] One cannot reduce the tendencies to individual elements and seek to understand them—the trinity is a unity and must be comprehended as such.

Isolating each tendency is not only an insufficient way to attempt to understand the trinity as a whole, but it is also paradoxically impossible to understand each element in isolation of the others. The scientific approach of reductionism begins to fail "as we move from the realm of complication to complexity, and

reductionism no longer gives us insight into construction."[40] The tendencies do not exist independently; they are in continual tension and interaction with each other. Their interaction is dynamic and continually varying over time. Clausewitz creates an image of two wrestlers to illustrate the interaction of the tendencies. He explains how the actions of one wrestler are dependent on the interaction with the other. Not only would the actions of a wrestler seem odd if not in the context of a match with another; the actions would be impossible, for they rely on the interactive participation of the other. Much like in any complex system, the actions of agents are dependent on, and a result of, the interaction of the other agents.

They are not always in competition with each other; sometimes they are even mutually supportive. The boundaries of each tendency are defined by the others. For instance, policy is thought to be the rational and goal-oriented attribute in war. Yet policy cannot define war in isolation because war as a whole is "pervaded by great chance, uncertainty and friction, while inescapable emotions impact behaviour."[41]

War, Clausewitz writes, is never an isolated act. Opponents are aware of each other. Individuals may be strangers, but they are not abstract entities. Clausewitz points out that war does not spontaneously break out unexpectedly. Each side has an awareness of the others' motives, but an element of uncertainty always exists. This uncertainty, Clausewitz emphasizes, creates a moderating tendency on each side that can prevent a tipping point.[42]

Space and distance affect the interaction between opponents and shape the interaction of the tendencies of the trinity. The Standing Ovation Problem that John Miller and Scott Page created is a general model that can be used to study the effect that proximity has on many social issues, such as drug use, schooling choices, whether to recycle or not, and a variety of other issues. In the example of the piston rod and camshaft, no matter how close the two parts are moved together, there will be no effect on how they behave toward each other; there is no adaptive property that emerges as a result of their proximity. Clearly, when the two parts are attached as designed, they physically act and react in accordance to Newton's laws of motion. But at the macro level, the actions of the parts interact linearly (this example is only considered at the macro level because at the quantum level the interacting elements may, in fact, exhibit complex adaptive characteristics). The Standing Ovation Problem is based on the premise that following a performance, an audience will respond with applause that may lead to a standing ovation. Each audience member can choose whether to applaud standing or remain seated. The social dynamics can lead an audience member to feel pressured to stand and join her immediate neighbors even if she despised the performance, whereas if an audience member was farther away from those standing, the pressure to stand would be diminished as a function of distance.[43] The model can provide interesting insights into how the irrational tendency of primordial violence can predominate actions and reactions in war.

The authors cite Robert Putnam's 1939 writings on social capital as a public good, where social capital is measured by the proximity and activation of agents. Putnam believed that social capital is largely a byproduct of social interaction that creates ties, norms, and trust within a particular network. Interaction within a social network can be measured in terms of proximity and activation factors. Proximity factors determine how agents are likely to interact, and activation factors determine the sequencing of their activity. In addition to physical proximity, many other types of relational networks establish proximity. Activation groups many processes together that affect the timing of agent activity or the temporal structure of events.[44] Social capital, then, is a result of the interaction of the features of social organization, such as networks, norms, and trust, that facilitate coordination and cooperation occurring in both time and space.

Much like the Standing Ovation Problem, proximity of opponents in war can influence which tendency will likely be stronger than the other. Intuitively, the greater the distance between opponents and their respective use of force, the more likely rationality will predominate. When in personal contact with the enemy, the hatred and enmity for each opponent can lead to excessive aggression and carry the violence to levels beyond what are necessary, or legal, to achieve rational political objectives.

Proximity can also lead to groupthink or mob behavior. If the elements of hatred and enmity lie carefully below the surface, bringing them to the surface would not take much effort. If one person or small group is more likely than another to act out primordial violence on another group, it may be enough to encourage another group to act the same way though they are at first reluctant. One act of primordial violence may unleash the hatred and enmity of a population against its opponents. The irrational aspect of base human violence toward another may inspire a neighbor, a friend, or a family member to act in a like manner. The violent actions may spread, the deviation of laws and norms will soon become normalized, and what was once an unthinkable act will become commonplace within the context of the tagged system. Once the violence subsides, and the conflict ends, a society may look back on its actions in disgust and disbelief. Under normal circumstances, they would not have acted like they did, but the interaction and proximity to the violence created perceived social pressures to act in a similar way. This is a hypothetical and theoretical example, yet there are many examples that demonstrate how probable, under the right conditions, such actions can occur.

## Conclusion

The question that should arise while reading Clausewitz's description of the three tendencies regards the extent to which the trinity shapes the outcome of war. Of course, the most obvious answer is, "It depends." While this answer is true, it is not helpful. However, if we understand what Clausewitz defines as the trinity and the tendencies that make it a complex

adaptive system, then by using complexity theory as a framework, we can understand how initial conditions affect the interactions. Efforts to identify the conditions under which events occur is often a frustrating endeavor. The Arab Spring took many by surprise because they did not recognize the conditions that led to the events. Many other conflicts have destabilized entire regions unexpectedly. In 1914, a series of seemingly unrelated events inadvertently sent European powers spiraling to war. David Earnest writes:

*The spiral theory of inadvertent war provides one of the most compelling arguments about emergent phenomena in world politics: micro-decisions produced macro-behaviors that none of the political actors desired. One cannot simply reduce the war to preferences of the tsar, Kaiser, emperor, or king. Thirty-seven million people died.*[45]

World War I resulted from nonlinear and recursive relationships between causes and effects. Nonlinear effects are difficult to predict and limit the ability of individuals to consider the full range of outcomes of their actions.[46] Clausewitz does not assert that the interactions of the elements of the trinity are random but that those elements self-organize and create complexity. Self-organization is a phenomenon that Earnest believes is a largely ignored reality of world politics.[47]

Coming to terms with a turbulent and ambiguous world does not mean giving up on traditional understandings of international relations. It means embracing the nonlinear predilection and unpredictability of international relations.[48] Understanding both the nature of complex adaptive systems and the trinity allows students of international relations to increase their tolerance of ambiguity. James Rosenau advised that in order to understand international relations, one must be concerned with probabilities and distrustful of absolutes. Rosenau, furthermore, stressed the need to be genuinely puzzled by international phenomena and open to being proved wrong. The Clausewitzian trinity is a paradox, and it is wondrous in that it is a puzzle of rational and irrational forces from which unpredictable behavior emerges. In other words, both Clausewitz and Rosenau are stating that to study international relations and war, one must be willing to live in and with change to come to terms with the "turbulence of global life."[49] In the end, the trinity is only an abstract model of the complex social structure of society, designed to help political and military leaders understand and appreciate the decidedly unpredictable, emergent nature of war. JFQ

## Notes

[1] Carl von Clausewitz, *On War*, ed. and trans. Michael E. Howard and Peter Paret (Princeton: Princeton University Press, 1989), 89.

[2] John H. Miller and Scott Page, *Complex Adaptive Systems: An Introduction to Computational Models of Social Life* (Princeton: Princeton University Press, 2007).

[3] Justin Kelly and Mike Brennan, *Alien: How Operational Art Devoured Strategy* (Carlisle Barracks, PA: Strategic Studies Institute, September 2009), 6, available at <https://publications.armywarcollege.edu/pubs/2027.pdf>. The authors reference Michael I. Handel, *Masters of War: Classical Strategic Thought*, 2nd ed. (London: Frank Cass Publishers, 1996), 345.

[4] Clausewitz, *On War*, 89.

[5] Andreas Herberg-Rothe, "Clausewitz's 'Wondrous Trinity' as General Theory of War and Violent Conflict," *Theoria: A Journal of Social and Political Theory* 114 (December 2007), 48–73.

[6] Thomas Waldman, *War, Clausewitz, and the Trinity* (Burlington, VT: Ashgate Publishing, 2013), 6.

[7] Ibid.

[8] Herberg-Rothe, "Clausewitz's 'Wondrous Trinity' as General Theory of War and Violent Conflict," 49.

[9] Ibid., 52.

[10] Ibid., 64.

[11] Ibid., 54.

[12] Waldman, *War, Clausewitz, and the Trinity*, 7.

[13] Ibid., 46.

[14] Ibid., 48.

[15] Clausewitz, *On War*, 89.

[16] Waldman, *War, Clausewitz, and the Trinity*, 53.

[17] Kelly and Brennan, *Alien*, 6.

[18] Ibid.

[19] Colin Wight, "Theorizing International Relations: Emergence, Organized Complexity, and Integrative Pluralism," in *World Politics at the Edge of Chaos: Reflections on Complexity and Global Life*, ed. Emilian Kavalski (Albany: SUNY Press, 2015), 53–77.

[20] M. Mitchell Waldrop, *Complexity: The Emerging Science at the Edge of Order and Chaos* (New York: Simon & Schuster, 1992), 145.

[21] Ibid.

[22] Ibid.

[23] Robert Axelrod and Michael D. Cohen, *Harnessing Complexity: Organizational Implications of a Scientific Frontier* (New York: The Free Press, 2000), 3–5.

[24] John H. Holland, *Hidden Order: How Adpatation Builds Complexity* (New York: Basic Books, 1996), 13.

[25] Ibid., 25.

[26] Ibid., 27.

[27] Axelrod and Cohen, *Harnessing Complexity*, 32.

[28] Ibid.

[29] Ibid, 63.

[30] David C. Earnest, "The Gardner and the Craftsman," in *World Politics at the Edge of Chaos*, 31–51.

[31] Axelrod and Cohen, *Harnessing Complexity*, 117.

[32] Ibid., 159.

[33] Waldman, *War, Clausewitz, and the Trinity*, 70, 176. Waldman references Alan Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," *International Security* 17, no. 33 (Winter 1992), 59–90.

[34] Ibid.

[35] Clausewitz, *On War*, 85.

[36] Ibid., 86.

[37] Waldman, *War, Clausewitz, and the Trinity*, 173.

[38] Ibid.

[39] Ibid., 172.

[40] Miller and Page, *Complex Adaptive Systems*, 117.

[41] Waldman, *War, Clausewitz, and the Trinity*, 174.

[42] Clausewitz, *On War*, 78.

[43] John H. Miller and Scott E. Page, "The Standing Ovation Problem," *Complexity* 9, no. 5 (2004), 8–16.

[44] Axelrod and Cohen, *Harnessing Complexity*, 65–66.

[45] David C. Earnest, *Massively Parallel Globalization: Explorations in Self-Orgainization and World Politics* (Albany: SUNY Press, 2015), 3.

[46] Ibid.

[47] Ibid.

[48] Kavalski, *World Politics at the Edge of Chaos*, 16.

[49] Ibid.