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Noah J. Komnick, LtCol, USMC

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14. ABSTRACT

Neostrategy: How to Win in the Age of Complexity **makes two bold claims. First, the world is now in the midst of a new age, the Age of Complexity. Second, to survive and win in this Age of Complexity requires a new paradigm: *neostrategy*. The fundamental difference between strategy and neostrategy is the awareness of complexity and its ramifications. Whereas strategy, and strategists, are complexity naïve; neostrategy, and neostrategists, are complexity aware. The difference is significant and revolutionary. As explained herein, the old paradigm of strategy is dangerously insufficient and ineffective when coping with complex systems and complex problems. As such, this research paper introduces a new paradigm—neostrategy—as a necessity to survive and win in the future international security environment. In turn and in time, neostrategy will replace strategy as the new, more effective paradigm for understanding and winning wars in the 21st century.**

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Neostrategy:
How to Win in the Age of Complexity

by

Noah J. Komnick
LtCol, USMC

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of Gravely Naval Research Group. The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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PREFACE

This research paper is the capstone byproduct of applying the lessons of complexity science to the art and science of warfare during my time as a graduate student of the College of Naval Warfare and under the supervision of the Vice Admiral Gravely Advanced Research Program (ARP), Naval War College, Newport, RI. In total, there are three academic papers that applied complexity science to solve contemporary warfighting problems: (1) *Rise of the Neostrategist: A New Paradigm for the Age of Complexity*, which argues that the fundamental assumption of strategy, as currently accepted, is flawed; (2) *Leadership in the Age of Complexity*, which explains why military leaders must understand the ramifications of complexity if they are to survive, lead, and win in war; and, (3) this ARP capstone paper, *Neostrategy: How to Win in the Age of Complexity*, which details some practical lessons for warfighting in an age of accelerating complexity. As a result, the three papers share similarities with interpreting, explaining, and applying complexity science. Furthermore, in addition to the bibliography, the author has borrowed ideas from the Santa Fe Institute (SFI) and the New England Complex Systems Institute (NECSI), as a current and former student of each, respectfully. Any errors or incompleteness are my own.

Additionally, a version of *Rise of the Neostrategist* was submitted to the 2018 International Conference on Complex Systems (ICCS), hosted by NECSI, where the author is scheduled to present his idea of *neostrategy* as an oral presentation to an international audience in July 2018. The sole purpose of *Rise of the Neostrategist* is to prove the bold claim that strategy is inherently flawed, and should not be accepted as either enduring in nature nor ubiquitous in application. For that reason, it is recommended for the interested reader that seeks a better understanding on *why* abstract strategy often fails with complex problems.

Finally, as this paper will conclude, there is still much more work to be done and lessons to learn with respect to fighting and winning in the Age of Complexity. As such, this work is the starting point for seeking a better understanding of human cooperation and competition on local and global scales. Ultimately, the goal of this paper is to show the validity and significance of applying complexity science to solve contemporary military problems in a manner not done so before. Where other attempts to do this have failed to cause substantial change in both U.S. military doctrine and practice, this paper aims to remedy those short comings by using a dialectic as a more effective means of communicating the relevance of this new science to the military arts. Moreover, though the vernacular of complexity science is often esoteric, this paper minimizes the use of terms that may be foreign to the layperson. When in doubt, terms have been defined in footnotes with sources denoted in brackets [SFI, NECSI, etc.].

ABSTRACT

Neostrategy: How to Win in the Age of Complexity makes two bold claims. First, the world is now in the midst of a new age, the Age of Complexity. Second, to survive and win in this Age of Complexity requires a new paradigm: *neostrategy*. The fundamental difference between strategy and neostrategy is the awareness of complexity and its ramifications. Whereas strategy, and strategists, are complexity naïve; neostrategy, and *neostrategists*, are complexity aware. The difference is significant and revolutionary. As explained herein, the old paradigm of strategy is dangerously insufficient and ineffective when coping with complex systems and complex problems. As such, this research paper introduces a new paradigm—neostrategy—as a necessity to survive and win in the future international security environment. In turn and in time, neostrategy will replace strategy as the new, more effective paradigm for understanding and winning wars in the 21st century.

Introduction

"I think the next [21st] century will be the century of complexity."
–Stephen Hawking[1]

There is a better way to train, fight, and win. Yet, that better way is not born of new hardware, more advanced technology, or increased lethality. The better way is about new ideas. As this paper will prove, some fundamental assumptions about war and strategy are inherently flawed. The main problem exposing these flaws is complexity. The world today is increasingly complex due to rapid growth of interdependent relationships between people, cultures, societies, economies, and politics. The amount of connections, and the associated feedback due to each connection, is why our modern world is growing in complexity every day. To cope with this natural fact, to survive in its wake, and to win future conflicts, a new paradigm is needed: complexity science and its derivative, *neostrategy*.

The old paradigm is classical mechanics and its derivative, strategy. Strategy based on classical mechanics is becoming increasingly less effective at solving contemporary problems. When an existing paradigm ceases to adequately function and a new paradigm seeks to replace it, there will surely be doubt, disbelief, and fear by the majority who have accepted the old paradigm as fact. In the beginning, only a minority will accept the new paradigm and argue the failing of the old. In the fourth century BCE, when Aristotle's epistemology of empirical observation and inductive reasoning challenged the more established Theory of Forms by Plato, there were those who opposed the new paradigm. In the 16th century, it was Aristotle's and Claudius Ptolemy's natural philosophy and empiricism that was challenged by Nicolaus Copernicus, Thomas Digges, and Galileo

[1] Stephen Hawking quoted in an interview, "Unified Theory is Getting Closer, Hawking Predicts," San Jose Mercury News, January 23, 2000; found in Geoffrey West, *Scale: The Universal Laws of Growth, Innovation, Sustainability, and the Pace of Like in Organisms, Cities, Economies, and Companies* (New York: Penguin Press, 2017), 20.

Galilei. This was arguably the nascent stages of the Scientific Revolution when the Copernicus system challenged and ultimately replaced the Ptolemaic system. Once again, the transition to a new paradigm was initially not welcomed by the majority. Then, in 1687 Isaac Newton published his *Principia* that established yet another new paradigm based on Newton's laws of motion. Today it is common to refer to that time as the end of the Scientific Revolution and the beginning of classical mechanics. It was also a catalyst for the Age of Enlightenment, a change in how people viewed the world order: natural laws, primacy of reason, individualism, and nationality. Since then, classical mechanics have dominated human thought about causality: man can explain the past and forecast the future using natural laws and ever more precise measurements. However, this paradigm is proving its limitations as well. First, in the early 20th century it was challenged by both relativity and quantum mechanics. Yet, none of these three paradigms outright invalidates another. Instead, they prove each other's inherent limitations for explaining observations. Second, in the late 20th century, complexity and chaos theories emerged to further expose the limitations of our Newtonian intuitions. As a result, the idea of strategy is challenged because it assumes causality can necessarily be observed, either directly or indirectly (i.e., strategy assumes determinism). That is what this paper will address: the limitation of strategy, the complexity revolution, and the rise of complexity science and neostrategy as the new paradigms to understand, survive, and win in the Age of Complexity.

The Complexity Revolution

"The consistency condition which demands that new hypotheses agree with accepted theories is unreasonable because it preserves the older theory, and not the better theory. Hypotheses contradicting well-confirmed theories give us evidence that cannot be obtained in any other way."
–Paul Feyerabend[2]

The complexity revolution has already begun. It is not in the near future or distant future, it is here now overshadowing the evolution of humanity's ideas about society, technology, economy, and government. This revolution is not the discovery of artificial intelligence, it is not the advancement of autonomous agents, it is not the birth of big data, and it is not spawned by a research and development department or a scientific laboratory. There is no one in charge of this revolution. There are no obvious levers to push, strings to pull, or brakes to step on. The only option is learning and co-revolution (of ideas) if survival is one's goal. In other words, the revolution is unstoppable, and the inability or reluctance to adopt the new thinking required will only lead to eventual ruin.

A revolution is different from evolution in that it *overturns* an existing belief, a belief which is fundamental to, or underpins, other understandings about how the world works (otherwise known as a *paradigm*). Thomas Kuhn, in his magnum opus, *The Structure of Scientific Revolutions*, explains that a scientific revolution is "non-cumulative developmental episodes in which an older paradigm is replaced in whole or in part by an incompatible new one…often restricted to a narrow subdivision of the scientific community, that an existing paradigm has ceased to function adequately in the exploration of an aspect of nature to which that paradigm itself had previously led the way."[3] In consideration of Kuhn's definition, there are three key elements needed to identify a revolution. First, a revolution is *non-*

[2] Paul Feyerabend, *Against Method*, 4th ed. (New York: Verso, 2010), xxix.
[3] Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 4th ed. (Chicago: University of Chicago Press, 2014), 92-93.

cumulative. Said differently, a revolution is not sequential accumulation of knowledge; it is instead an unforeseeable and abrupt change in understanding. Second, a revolution is about replacing one paradigm with a new, *incompatible* one. Therefore, the new paradigm must cognitively replace the older paradigm because of incongruence. This is why, as Kuhn further explains in his book, that a revolution is the act of people discarding an old paradigm that has proven inadequate—in explaining a phenomenon—in exchange for a new paradigm. Third, the old paradigm *ceased to function adequately*. That implies that the old paradigm was useful for some time and, as a result, people's trust in that paradigm grew to the extent that *the belief* became *the truth*. This is why revolutions are so disruptive, because it requires doubt (of the old) and courage (to accept the new). It is also why revolutions begin with a minority; a minority that first notices the inadequacy of the old and, in turn, argues for what appears at the time to be radical in thought. With all that explained, is complexity really a revolution?

The earth has always been complex. From the Precambrian Supereon to the current Information Age, the earth and its inhabitants have forever coped with the ramifications of complexity to diverse extents. After all, evolutionary ecology and all its variations, mutations, and adaptions are the result of, and often in response to, complexity. The human body, in fact, is complex. Weather and climate are complex phenomenon. Civilization and its many forms of economic, societal, and political developments are complex. Even the constructs of conflict and cooperation are complex. So, what makes today any different? What is precipitating this *complexity revolution*? There are three related reasons for the complexity revolution.

First, today's civilizations are facing more nonlinear problems than linear problems.[4] As Steven H. Strogatz, a professor of applied mathematics at Cornell University, explains: "Whenever parts of a system interfere, or cooperate, or compete, there are nonlinear interactions going on."[5] The Information Age and globalization have exponentially grown the number of connections (interdependencies) between individual humans, families, communities, schools, businesses, governments, etc., thus nonlinearity is the norm, not the exception. In other words, contemporary problems originate from complex systems much more often than they do from simple, linear systems. As a consequence, common tools of analysis such as reductionism, proportionality, and determinism "cease to function adequately in the exploration" of these pervasive complex systems.[6] In short, the typical problems of today are fundamentally different: they are complex problems, where everything appears to affect everything.

Second, small errors can often lead to systemic problems because of scaling in complex systems. As stated previously, typical contemporary problems are different in that they are complex, yet when errors are made in solving those problems the potential harm grows super-linearly in magnitude.[7] This is often the result of applying solutions at the wrong scale, like top-down management to solve small scale problems. The top-level error cascades throughout a hierarchically controlled system. Additionally, top-level management often confuses volatility at small scale with systemic problems, not realizing that small scale

[4] Linear means that a proportional change of input equals the same proportional change of output (e.g., double the input leads to doubling of the output). Conversely, nonlinear means that changes of input and output are not proportionally equal.
[5] Steven H. Strogatz, *Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering* (Boulder, CO: Westview Press, 2015), 9.
[6] Kuhn, *The Structure of Scientific Revolutions*, 92.
[7] Super-linear and sub-linear growth refer to departures from a linear growth curve. Super-linear growth means "growing faster than linear growth", and sub-linear growth means "growing slower than linear growth." [SFI]

volatility is necessary for innovation, organizational learning, and systemic health. More colloquially, everything affects everything so intervention is rarely localized, cascades throughout the system, and can lead to systemic failure.

Third, there is now a new paradigm, *incompatible* with the old, for coping with complexity and its inherent nonlinearities. Yaneer Bar-Yam, a complex systems scientist and President of the New England Complex Systems Institute, explains that reductionism, statistics, and calculus (the old paradigm) are inadequate tools for the study of complex systems. Those old tools previously led the way in problem diagnosis but fail when addressing problems of complexity. The new paradigm is called complexity science, or complex systems science, and is championed by a minority of people across a plethora of disciplines, including but not limited to the Santa Fe Institute (since 1984), New England Complex Systems Institute (since 1996), and the Real World Risk Institute (since 2015). Some of the tools included in complexity science for problem diagnosis are multiscale analysis, renormalization, pattern recognition, and network analysis. That said, complexity science has really only existed for the past 30 years.[8] Therefore, it is correct to say that complexity and human acknowledgement of it go back several centuries, yet only recently was a new paradigm discovered that can better explain complexity's ramifications. Further, it is true that even Carl von Clausewitz understood the telltale signs of complexity by highlighting such things as chance, uncertainty, friction, and the fog of war. But, only today do we now have a science that dives much deeper than the labelling of complex problems: complexity science adds clarity, precision, and new tools for analysis. Therefore, to summarize, the complexity revolution has begun because: (1) there are more complex

[8] Geoffrey West, *Scale: The Universal Laws of Growth, Innovation, Sustainability, and the Pace of Like in Organisms, Cities, Economies, and Companies*, (New York: Penguin Press, 2017), 24.

problems than simple problems to solve, (2) the consequence of intervention error is more harmful due to growing interdependencies, and (3) there is now a new way, a new paradigm, to better understand the world and its era of complexity.

Learning from Complexity Science: A Dialogue on Competing Ideas

"The first principle is that you must not fool yourself—and you are the easiest person to fool."
– Richard Feynman

Learning from complexity science is not new territory in the study of war, strategy, and operations. As will be explained shortly, there have been numerous attempts by several authors over the last thirty-plus years to do so. However, across the Joint Force, very little change has occurred from their valiant insights, and even some stalwarts of military strategy continue to rebel against the usefulness of studying complex systems.[9] Hence, senior military leadership has not yet incorporated the lessons of this new paradigm into the American way of war. Therefore, a new approach is needed in order to overcome the hindrances of accepting a new paradigm about how the world works and how to win its future wars as a result.

As explained in this author's previous academic papers, this is not the first attempt to apply the lessons of complexity science to solve military or warfighting problems.[10] Colonel John Boyd's *Destruction and Creation* (1976), *Patterns of Conflict* (1986), and *Organic Design for Command and Control* (1987) were likely the first attempts. Later came Alan Beyerchen's "Clausewitz, Nonlinearity and the Unpredictability of War," in *International Security* (1992); Roger Beaumont's *War, Chaos, and History* (1994); Thomas J.

[9] Colin S. Gray concludes, "there is nothing really new about this," in his book, *Strategy for Chaos: Revolutions in Military Affairs* (London: Frank Cass, 2002), 109.
[10] Noah J. Komnick, "Rise of the Neostrategist: A New Paradigm for the Age of Complexity" (research paper, U.S. Naval War College, National Security Affairs Department, Newport, RI, 2018).

Czerwinski's *Coping with the* Bounds (1998); Colin S. Gray's *Strategy for Chaos* (2002); Everett Carl Dolman's *Pure Strategy* (2005); Sean T. Lawson's *Nonlinear Science and Warfare* (2014); and, most recently, General Stanley McChrystal's *Team of Teams* (2015). Yet, today's doctrine, military practice, operational planning, and force design remain largely devoid of the changes needed, as argued by the preceding authors.

There are several reasons for this lack of acceptance. First, as mentioned earlier, complexity science is relatively new. The authors mentioned above borrowed ideas from a discipline that was and is still developing; and as such, many of its lessons were not fully explored yet (like the effects of scaling or fragility in systems) at the time when the select works were written.[11] As a result, some of the translated lessons are incomplete by today's standards in the science. Second and similarly, the ideas and lexicon derived from complexity science are foreign to most outside the emerging discipline. Words such as bifurcations, fractals, emergence, scaling, power-laws, ergodicity, fat tails, chaos, nonlinearity, strange attractors, and countless others are seldom understood by the audience or readers at first attempt. Third, the significance and applicability of complexity science was not communicated strongly enough. That is why this monograph began with describing the revolution caused by a new understanding of complexity. The fact is that linear intuition, fostered by traditional education, is fundamentally ineffective for coping with complex systems. "To change one must begin by asking better questions derived from a pedagogy of complexity science. Said another way, Isaac Newton was not wrong, his theories are just dangerously incomplete for today's interconnected, globalized world."[12] For all those

[11] (Anti)Fragility is how much stress, randomness, volatility, or uncertainty a system can withstand (fragile) or benefit (antifragile) from. [Nassim Taleb]
[12] Noah J. Komnick, "MWCS-38: What We Have Done, What We Have Learned" (Post-command Brief, San Diego: unpublished, 2017).

reasons, the remainder of this monograph will use a dialectic to better convey the applicable lessons of complexity science to the subjects of war, strategy, and operations.

Communicating using a dialectic was used by the likes of Plato, Seneca the Younger, and Galileo Galilei to compare new ideas with old ones. Similarly, the reason for using a dialectic in this case is to increase clarity of difference between the perspectives of strategy and neostrategy, much like Plato, Seneca, and Galileo did in their respective works. Additionally, since the topic of complexity science is relatively esoteric, the dialectic is intentionally written in a conversational tone to mimic a casual yet informed conversation about the fundamentals of neostrategy. That said, the following dialectic is between three participants: the Strategist, the Neostrategist, and the interviewer, Major Sagredo.[13] The Strategist gives the commonly accepted views on problem solving within the context of war, strategy, and operations. In other words, the strategist answers questions using the old paradigm. Conversely, the Neostrategist represents the new paradigm of neostrategy derived from complexity science. Major Sagredo, the interviewer, is the astute observer who is trying to learn how the old paradigm and the new paradigm differ. Major Sagredo represents the reader, or at least as well as this author can imagine him/her to be. More succinctly, **the Strategist is complexity naïve, the Neostrategist is complexity aware**, and Major Sagredo is the curious audience. In the end, this dialectic aims to better explain the lessons of complexity science and how those lessons can help win future battles and wars. The following dialogue addresses common questions concerning war while simultaneously introducing neostrategy in a deliberate yet digestible way. In the end, the goal is to give a clear picture of what the difference is between strategy and neostrategy.

[13] Sagredo is a character in Galileo's *Dialogue Concerning the Two Chief World Systems*.

Major Sagredo: Can both of you please briefly explain what *strategy* and *neostrategy* are? I am not sure I understand the difference?

The Strategist: Simply put, strategy is the reconciliation between the *ends* and *means* in order to determine the *ways*. To quote Colin S. Gray, a military strategist and historian: "The enduring logic holds that strategy is all about the attempted achievement of desired political ENDS, through the choice of suitable strategic WAYS, employing largely the military MEANS then available or accessible."[14] In a more general since, strategy is about judging and selecting a course of action in order to achieve a goal. Of course, there are multiple variations of strategies (e.g., national strategy, grand strategy, military strategy, maritime strategy, deterrence strategy, operational art and design, tactics, etc.) because of different contexts. But, abstractly—without context—strategy is the reconciliation between the *ends* and *means* in order to determine the *ways* to achieve the desired *ends*.

The Neostrategist: Neostrategy is strategy, but with limits. To parlay from the Gray quote: neostrategy does *not* assume an "enduring logic holds." The flaw with strategy as presently understood is the underlying assumption of determinism. This leads to a belief that with "the right" strategy the ends *can* be achieved. With respect to complex systems, one will find that there are many occasions when a complex system becomes stochastic[15] or even chaotic[16]. In those cases, it is impossible to determine "the right" strategy.[17] Said differently, neostrategy

[14] Colin S. Gray, *The Future of Strategy* (Malden, MA: Pality Press, 2015).
[15] A stochastic process is process whose behavior has random or probabilistic components. [SFI]
[16] A system is considered chaotic if it is (1) deterministic, (2) aperiodic (does not repeat), (3) bounded (does not fly off to an infinity), and (4) sensitive to initial conditions. [SFI]
[17] For a detailed proof of this see: Komnick, "Rise of the Neostrategist: A New Paradigm for the Age of Complexity."

is *complexity aware*, whereas strategy is *complexity naïve*. Therefore, there are additional lessons derived from the study of complexity science that further define who a neostrategist is.

Major Sagredo: I see. So, a strategist believes there is *always* a way to fix a problem—we just need to figure out that strategy—and, a neostrategist believes *sometimes* a problem cannot be solved no matter how hard we try. Is that correct?

The Neostrategist: Yes, and I am glad you phrased it that way because the belief is not that there are problems without solutions in our world. Instead, it is a belief that we (humans) cannot see, cannot determine or formulate, those solutions (a strategy). So, a problem will have a solution but sometimes it is impossible for humans to find the solution because it is "hidden" within the complex system. You could also say that the complexity of some systems exceeds our ability to understand it.

The Strategist: That sounds like in some scenarios the neostrategist would just quit and not do anything to address a problem.

The Neostrategist: Yes, because sometimes intervention (executing a strategy) is more probable to cause additional, unforeseen, and/or more severe harm than what is presently occurring.

Major Sagredo: Does this mean that a strategist and neostrategist view war differently? How do each of you define war?

The Strategist: I derive my understanding of war from Carl von Clausewitz. War is a violent clash of wills. It is the continuation of politics by violent means. It includes both physical and moral forces between belligerents. In that sense, Clausewitz used the analogy of the duel to highlight both the will and capacity for killing.

The Neostrategist: I think the strategist's understanding of war is appropriate but insufficient. The violent clash of moral and physical forces of nations and their armies does not resemble a duel, it more accurately resembles *a clash of systems*. This may seem pedantic but it is a crucial point in gaining a better understanding of warfighting. A duel implies that someone or something is always in control of the fighting force, that all behaviors of the enemy and friendly forces can be explained or controlled, at least in theory. This is not true. Complex systems, which include our own Joint Force, often behave in ways we can never predict; it is the result of the interactions between the parts of the system that leads to this unforeseen behavior. In complexity science, this is called emergence. The idea of a duel ignores the fact that some behavior is caused by the system itself, not by any controlling entity.

Major Sagredo: I think I need to understand complexity a little better. We frequently read in literature that the U.S. military must prepare for a very complex security environment. What does that mean to you?

The Strategist: It means we cannot afford to be caught off guard, flat footed, or ill prepared for tomorrow's battlefields. With violent extremist organizations and the added threat of rising state powers, we must do two things: (1) anticipate future challenges earlier and take action to deter aggression and resolve regional disputes before violent conflicts begin, and (2) recapitalize on our readiness and innovate with new and emerging technologies so our potential adversaries do not gain advantages over our forces. Yet, with all that said, if you reflect on previous national security strategies and military strategies, we have faced this kind of challenge before. Those earlier strategies also highlighted the need to anticipate and deter aggression before escalation. Furthermore, even Carl von Clausewitz recognized this complexity in warfighting and preparing for war when he wrote about the characteristic of chance in war. To quote the Army's operating concept for Winning in a Complex World:

> "Complex is defined as an environment that is not only unknown, but unknowable and constantly changing. The Army cannot predict who it will fight, where it will fight, and with what coalition it will fight. To win in a complex world, Army forces must provide the Joint Force with multiple options, integrate the efforts of multiple partners, operate across multiple domains, and present our enemies and adversaries with multiple dilemmas."[18]

The Neostrategist: It is accurate to paint the future as uncertain, complex, and full of risks. However, the first thing that is missing is an understanding about what those three things really mean. Too often *complex* is used to merely convey a degree of difficulty or lack of information. That understanding is not false, it is just dangerously over simplified. Today

[18] U.S. Army, *Win in a Complex World: 2020 – 2040*, TRADOC Pamphlet 525-3-1 (Washington D.C.: Headquarters Department of the Army, 31 October 2014), iii.

we have a much more accurate understanding of complexity, exposing *why* complex problems are difficult and *why* Clausewitz observed things such as chance, friction, and the fog of war. Let me explain further: complexity is the amount of possibilities for a given system—be it a city, a school, an economic market, a political party, or a military force (they are all examples of complex systems). Though, the number of possibilities for a system is not just the result of adding all the parts and connections of a system together. Instead, those possibilities arise largely from the two characteristics of a complex system (some have used the term *complex adaptive system*): (1) interdependencies of the parts and (2) the nonlinear feedback resulting from their interactions. At the local level (think small scale, at the individual part level), it appears that a part has autonomy and it can appreciate most of the details about its local environment. Yet, at a larger scale—say a collection of parts interconnected—you start to observe group behavior that was never conceived by any of its individual parts (i.e., emergence). There is no direct control over emergence. This is essentially what complexity science (or, *complex systems science*) is all about: studying the emergent behavior of complex systems. The science has been around for only about 30 years so it is not surprising that many people are still unfamiliar with it or its lessons.

The Strategist: Okay, fancy terms aside, the solution moving forward is still the same: anticipate and innovate to win future contests of will and capabilities.

The Neostrategist: Not quite. The problem is our conventional wisdom based on a traditional education of cause and effect. This is understandable because since Isaac Newton humans have had the popular notion that if we have enough information about the current

status of things and the right set of rules for a given system (economic, social, political, etc.), then we can predict the future and explain the past. But, this is not the case. In reality, we have very little direct control over emergent behavior of a complex system. To believe that anticipation and innovation is enough to win future wars is to assume that we have enough information (intelligence) *and* that we know all the rules that govern geopolitics, global economies, and social systems. Obviously, that is not the case (hence our continued quest for more intelligence, greater cultural understanding, etc.). Yet, even more profound, is the fact that even if we did know all the rules of a system, the amount and precision of information needed to forecast the future is impossible. This characteristic is called *chaos*. It is true that not all complex systems are chaotic, but when they are chaotic, would we know that or would we mistake it for something else? The point is, the quest for "anticipation" is effective only at the local level or smaller scales of a system. At the larger scales we simply have no idea who is going to do what to whom and when.

The Strategist: It sounds like you are describing Nassim Taleb's Black Swan event. That means we cannot predict anything, and bad events will happen regardless of what we do.

The Neostrategist: No, no, no. That is not what he meant by a black swan event. As brilliant as Taleb may be, unfortunately he is often misunderstood. Be that as it may, let me take a different tact to explain my point. A military planner only has so much time to develop a plan of action (e.g., hours, days, months). Right now, the tendency is to spend the bulk of that time analyzing the environment, studying the enemy, reframing the problem, etc. The aim of doing all this is to find things like critical vulnerabilities and centers of gravity in

an attempt to determine a friendly course of action that will lead to the capitulation of the enemy. Conversely, my point is that the planner should instead spend the bulk of his/her time studying the structure of the friendly forces. It is more fruitful to learn blue (friendly) force strengths and weaknesses than it is to deceive ourselves into believing we know something grand about the enemy. Too often the enemy surprises us; therefore, it is better to learn our weaknesses so we can hide, protect, or fix those.

Major Sagredo: I do not understand. What is a black swan?

The Neostrategist: A black swan event is an unpredictable event that causes significant consequences (good or bad). Consider the international equities market for a minute. If you own shares of an oil company, an outbreak of major war in the Middle East is a black swan event that you may benefit from. Now there is no way for you to know *when* war may breakout but you can predict that it will *eventually* happen (surmised from history). Therefore, the goal should not be to predict when significant events occur (like different methods of enemy attacks), but to assess your *exposure* to such events so that you gain from positive black swans and survive the negative black swans. This idea is also known as *convexity* (a term from finance). One of the reasons Taleb wrote about it is that people too often focus on mitigating or avoiding small, localized risks and/or system volatility, but they do not realize that they are undeniably exposed to systemic risks (i.e., black swans; aka hidden risk).

Major Sagredo: I think I understand now: it is better to spend time assessing your exposure to risks than it is to spend time trying to predict their occurrence.

The Neostrategist: Exactly. Now, to be clear, this is not a binary choice between spending your time studying the enemy and environment versus studying the capabilities and limitations of your friendly forces. The point instead is to not get hung up on gathering every bit of intelligence because the enemy and the environment will always have surprises you cannot predict. Therefore, spend a fair bit of time ensuring your force structure is sustainable and adaptable (i.e., a learning organization) to those surprises if and when they happen.

Major Sagredo: This leads me to another question: what is risk and uncertainity?

The Strategist: That is why I think this talk of complexity and neostrategy is nothing new. We have always dealt with risk and uncertainty. Black swan, white swan, blue swan… it is just another name for risk. The solution is to identify the risks and mitigate them, and then it is up to the military commander on what risks to assume and which ones to avoid. That said, risk has two forms: risk to forces and risk to mission. According to CJCSM 3105.01, the *Joint Risk Analysis* Manual, risk is "the probability and consequence of an event causing harm to something valued." In fact, that publication lists a number of considerations when computing risk (and it includes complexity!):

> "a. Three major challenges to successful risk analysis exist:
>
> (1) Complexity - difficulty in establishing cause and effect relationships and intervening variables

(2) Uncertainty - human knowledge is inherently incomplete and assessments require assumptions

(3) Ambiguity - multiple legitimate interpretations exist and the exact problem or source of risk is not agreed upon by stakeholders.

Thus, the degree of confidence in any risk analysis is based on the availability of relevant data, the number of variables, and assessors' depth of knowledge.

b. The time horizon is another important consideration. It takes into account how to balance risk over time. Decisions to accept, avoid, or mitigate risk today may affect risk exposure in the future. Conversely, making decisions that focus on mitigating potential future risk may cause increased risk in the present or near-term.

c. The challenges explained above (assets, impacts, threats, solutions, planning cycle, complexity, uncertainty, ambiguity, time horizon) are why decision-makers' judgment and experience are critically important within the risk analysis methodology. In a military context, it is the senior leader or commander who can often provide a distinct and broader perspective or apply coup d'oeil (strategic intuition) that helps determine the appropriate risk decision…"

The Neostrategist: Let me address the "nothing new" comment before addressing risk and uncertainty.

There was a time when humans *only* believed that the sun rose and fell every day on the horizon. This understanding was useful for planning rudimentary living of our ancestors. Yet, thanks to Nicolaus Copernicus and Thomas Digges in the 16th century, we now know that the sunrise is the result of the earth's orbit around the sun. That new, 16th century

understanding did not refute the original observation, it just gave a much better understanding of *why* it happens. As a result, the new understanding allowed us to intellectually evolve as a species. Analogously, complexity science gives the underlying reasons for Clausewitz's observation of fog, friction, and chance. Complexity science does not overturn those observations, but it does give us a better understanding that will help us evolve our warfighting methods.

Back to The Strategist's understanding about risk: it is not wrong, it is just dangerously incomplete and not precise enough. Additionally, the quoted material is summarizing the problem but its only solution is for the "senior leader" to make "the appropriate risk decision." There are three fatal assumptions with this understanding: (1) the security environment is largely deterministic, (2) most risks and the severest risks can be identified and mitigated, and (3) a senior leader makes better decisions. These three assumptions often prove false when coping with a complex system.

Major Sagredo: How so?

The Neostategist: First, a complex system is seldom deterministic from the perspective of control or influence (e.g., these so called "shaping" operations or "deterrence" efforts are not so innocent as currently portrayed). To reiterate, we have a tendency to believe they do work because of the long lived philosophical effect of Newton's classical mechanics and the accompanying Scientific Revolution. Before Newton's discoveries in the 17th century, people's belief about the future was dominated by the acts of the Devine. Newton's laws of

motion changed that and showed us that we can indeed predict the future (and thus explain the past) if we understood the laws of nature *and* we knew the position and velocity of objects in question. In other words, this is the birth of causality. However, a little-known fact is that even Newton knew his laws had a significant limitation: the three-body problem. Though Newton could not explain why at the time (that came later in the 19th century from a French scientist named Henri Poincaré), the fact is that the three-body problem proved that chaotic behavior was a frequent trait in nature. Similarly, the Lorenz equations we use today to predict the weather have the same limitation. That limitation is called sensitive dependence to initial conditions (SDIC). It means that even if we understood all the processes or rules involved in a system, we can never measure the position and velocity of the system's parts precisely enough to predict the distant future. As most people are aware, weather forecasts are seldom accurate beyond a few days—that is because of SDIC (aka the butterfly effect). That is one reason why a complex system appears random or stochastic.[19] Other reasons are path dependence, entropy, and cognitive complexity.

The Strategist: Path dependence, entropy, and cognitive complexity? Sounds like more fancy words to overcomplicate things. And, what do they have to do with your other two "fatal assumptions" you mentioned?

The Neostrategist: If you want to learn about new ideas you probably will encounter some new words along the way, correct? Do not let their relative novelty distract from your

[19] A stochastic process is a process whose behavior (i.e., transition from one state of the system to a successor state) has random or probabilistic components. A classic example is a random walk. [SFI]

attention or curiosity. I'll explain each and relate them back to the flawed assumptions I mentioned earlier.

First, think about strategy development for a minute. At the tactical and operational levels of war we tend to use common heuristics like the Joint Planning Process (JPP) to find a strategy. Think of JPP as a means for searching for a solution in a room full of possibilities. The solution is just one of many-many options available. In other words, there are countless possibilities for what a blue force may do in any given situation, and we use JPP to find the right solution to achieve our goal(s). We often call this solution a "course of action" (COA). Now, we know that a COA usually involves sequencing—somethings need to happen before other things in order for us to accomplish our goal or objective. In complexity science, this sequencing requirement is called path dependence, and it makes finding the right COA all the more challenging (i.e., lower probability of success). Next is entropy. Entropy is the amount of hidden information in a system. Said differently, there are COAs hidden by the entropy of a system. They are hidden because of the magnitude of complexity for the system, our time limitation to consider all COAs, and our cognitive complexity. Thirdly, cognitive complexity is our human ability to consider different options in isolation (i.e., without bias or interference). A Joint Planning Group (JPG) can consider more COAs per unit of time than one person because the JPG's cognitive complexity is greater than the individual's. However, even the JPG's cognitive complexity is limited and often less than the complexity of the problem being addressed. According to Ashby's Law of Requisite Variety (from cybernetics), the ratio of control over a system is equal to the ratio of variety (complexity) between the controlling agent and the system. In other words, the JPG cannot consider all

the options available because the complexity of the system exceeds their own cognitive complexity.

All this relates back to risk and uncertainty to prove that (1) the security environment is *not* deterministic, (2) most risks (i.e., bad COAs) and the severest risks *cannot* be identified and mitigated, and (3) a senior leader does not necessarily make better decisions because s/he is constrained by their own cognitive complexity.

The point of all this is not that the JPP, commander decisions, or COA selection are fruitless endeavors. The lesson to be learned is that we more often than not will select the wrong COA.

The Strategist: Again, you make it sound like we are doomed to fail, and that it is better to do nothing.

The Neostrategist: That is not my intent. My point is not that we are doomed to fail; rather it is an admission of limitation in both knowledge and control when planning for war. Instead of the perpetual "can-do" attitude of today's military planning, we need to accept that *sometimes we will not know how to win*—at least with a known level of certainty. As a result, you will hear a neostrategist say things like, "I don't know" and "maybe" much more often than what is culturally accepted in the military today.

Remember that risk is probability of consequence. Too often we deceive ourselves by thinking we know the probably of a consequence before the decision to act is made. A major reason for this error in judgment is mistaking retrospective predictability with prospective predictability. Nassim Taleb explains this fallacy in great detail in his book *Fooled by Randomness: The Hidden Role of Chance in Life and in the Markets*. Historians make this mistake all the time by overfitting past events to prove a narrative (or a sequence of causality). There are two problems with this: (1) it is much easier to see causation retrospectively than it is prospectively, and (2) correlation does not necessarily mean causation.

Whereas the strategist is myopically focused on ensuring success (because that is what is culturally expected), the neostrategist spends a lot of time considering how and why things will go wrong.

The Strategist: Don't we do that already? The plans and strategies I develop include risk assessments and branch plans for when things do not go according to plan.

The Neostrategist: What strategists do now is incomplete because of the traditional understanding of risk, uncertainty, and the very nature of strategy.

Another problem with risk is the space of possibilities. Yaneer Bar-Yam, a complex systems scientist, explains that there are two types of risk in this regard: risks that are within the space of possibilities and risks that expand the space of possibilities. The risks that expand the

space are much more difficult to access because we have no information. Innovation and insurgencies are examples of risk taking that expands the space of possibilities. As a consequence, we see more failures with these types of risk. Additionally, we seldom assess risk or uncertainty with respect to scale, and concomitantly we often suppress volatility. For example, who should decide what the next generation of body armor will be? Should it be the Department of Defense (DOD), the service headquarters, the tactical unit, or the individual service member? Conventional wisdom dictates that the DOD should. That answer is the most efficient solution in the sense of economies of scale, conformity, and interoperability across the force. Notably, those advantages are quantifiable and thus easier to communicate. However, if this innovation (risk that expands the space of possibilities) fails in combat it affects the entire joint force (i.e., a systemic failure to protect the force). Whereas if the innovation efforts were at the tactical level, many more tests can occur simultaneously, and when errors occur the consequences remain local. This latter option is seldom chosen today because it is much less efficient (in process), leading to higher costs and more volatility across the force. But, that volatility is not necessarily bad as long as there is an embedded learning process in the system. In turn, the joint force evolves in a Darwinian sense: mutate > survive or die > replicate the survivors. Said more succinctly, when we suppress volatility in force composition we also suppress and often negate systemic adaptation, thus killing the processes of a learning organization. General Stanley McChrystal explains how he used this way of thinking to lead JSOC operations to combat terrorism in his book, *Team of Teams: New Rules of Engagement for a Complex World*.

Major Sagredo: But, a higher headquarters—whether a corps, service, or agency level—makes those kinds of decisions because they should assume the risk, not the tactical level? In effect, it seems you are challenging our very notion of command and control.

The Neostrategist: Yes, command and control as defined in doctrine today is insufficient. But, before I get to that, let me answer your question about risk.

Remember that risk is about consequence, it is not just the probability in and of itself. Therefore, it is logical to ask who benefits or is harmed by said consequence. In our hypothetical about future body armor, who suffers the harm or gains the benefit of the body armor?

Major Sagredo: The service member wearing it.

The Neostrategist: Exactly. When we use the phrase "assumes the risk," we often really mean who is held accountable financially, legally, or procedurally. Accountability and risk are not the same thing.

Nassim Taleb's most recent book is *Skin in the Game: Hidden Asymmetries in Daily Life*. It is relevant to our conversation about risk and accountability. In the book, Taleb explains that "skin in the game" (SITG) is an inherent, internal function of a complex system. SITG is about the exposure to consequences, both positive and negative, of a decision. People who share in both the potential harm and benefit of a decision are people with SITG.

Accountability, on the other hand, is a bureaucratic process enforced upon a system where SITG is either not present or artificially suppressed. The beauty of SITG is not that it solves problems, rather it maintains systemic health. Those with SITG, who make bad decisions, are harmed. Those with SITG, who make good decisions, are rewarded. In this sense, SITG is the prefect filter for incompetence and it helps the system learn (organizational learning).

Major Sagredo: I think I understand, but what does this mean for command and control. I'm not even sure I know what that really means.

The Strategist: I can explain command and control (C2). It is one of the joint warfighting functions, along with fires, movement and maneuver, protection, intelligence, information, and sustainment.

> "C2 encompasses the exercise of authority and direction by a commander over assigned and attached forces to accomplish the mission… command includes both the authority and responsibility to use resources to accomplish assigned missions. Command at all levels is the art of motivating and directing people and organizations to accomplish missions. The C2 function supports an efficient decision-making process. Timely intelligence enables commanders to make decisions and execute those decisions more rapidly and effectively than the enemy. This decreases risk and allows the commander more control over the timing and tempo of operations."[20]

[20] U.S. Joint Chiefs of Staff, *Joint Operations*, Joint Publication 3-0 (Washington D.C.: Department of Defense, 17 January 2017), III-2 – III-3.

In essence, C2 is about directing and controlling subordinate forces to accomplish a mission. The authority to direct and control resides in the commander, hence the term command (the authority to act).

The Neostrategist: I think Colonel John Boyd had a more complete understanding of C2. He called it "leadership and appreciation," in his brief, "Organic Design for Command and Control." The difference is feedback. In Boyd's concept, *leadership* is about giving direction and influencing change, and *appreciation* is about assessing the consequences (i.e., feedback) of that leadership action. This is how the U.S. Marine Corps understands C2, and, to a lesser degree, is how the Army understands its concept of "mission command." Furthermore, Boyd's leadership and appreciation, the USMC's C2 doctrine, and the Army's mission command account for both implicit and explicit direction. Implicit direction is less perfect and can be ambiguous, but it is much faster because it does not require direct communications (phone calls, e-mails, written orders, etc.). That is why training together as a total force is so important: it builds implicit understanding now, so that we rely less on explicit communications later.

Major Sagredo: How does it build implicit understanding?

The Neostrategist: Think of your closest friends. They know a lot about you and you know a lot about them. Therefore, when you get into a situation you do not have to spend much time talking about how to handle a problem because you already have an understanding about what each person can do, will do, and should do. This understanding is built on trust.

To be clear, trust is not the belief that good things will happen. Instead, trust is the probability of consequence (in this sense, *trust* and *risk* are synonymous terms). That is why implicit understanding takes time to build, through rigorous training—trust increases through repeated, observed consequences. You trust your friends to repay debts to you because you have seen them do it many times before. As a result, when you loan them money you do not have to explain your expectations of repayment because you already have a shared understanding. Moreover, new information flows faster in a C2 relationship built on implicit understanding than explicit. This is because requests for information are seldom needed. Each unit already knows when, what, and who to report new information to.

Major Sagredo: This sounds like a possible solution to our contemporary problem of Command and Control in a Denied or Degraded Environment (C2D2E).

The Neostrategist: It is, and there is nothing new about it. The German Army before World War I trained to this idea, what we now call mission command (delegation of authority and reliance on implicit understanding and commander's intent).

The Strategist: But, we have the most advanced military communication systems in the world today. That is what makes us faster and more agile on the battlefield.

The Neostrategist: That is a misunderstanding. The long-range, high-bandwidth, tactical communication systems today fool us into believing more information is better just because it is more accessible. Right now, the organizational culture of our military is to share more

information with higher, subordinate, and adjacent units. It becomes a game of who can share and gather more information—anyone who has been a staff officer understands this bias. But, that is a bad habit and the perceived benefits are misleading. Modern communication systems are also highly complex, compared to the systems we had just twenty years ago. It is true that our modern systems may lead to increased speed at the tactical level of war, but they *decrease* speed at the operational level of war. The negative impact to operational speed is due to increased time to diagnosis system failures, increased operator training time, increased maintainer training time, and increased dependencies on other supporting systems.

Major Sagredo: So, how do we fix this bad habit of lusting for more information?

The Neostrategist: First, operational commanders must change the game. No longer should the goal be: share more information and gather more information. The game should be: who can survive and win with the least amount of information? The goal will cause our military services to reexamine not only our over-reliance on expensive communication systems, but more importantly reassess how we are organized to train and fight. How we design force structures (remember, a military force is a complex system) will determine information exchange requirements.

Major Sagredo: Are there any other ramifications of complexity science applied to C2?

The Neostrategist: Yes. As a system increases in complexity the less effective one part or one entity can exercise control. This is why the Prussian style staff that we still use today has grown considerably. The complexity of war has increased, the complexity of our fighting force has increased, and the speed of operations has increased. All this has contributed to the growth in staffs from battalion to corps to component to combatant command levels. From a complex systems perspective, the growth in staffs is the result of the mismatch between the complexity of the force (and operating environment) and the respective commander. One human can handle only so much complexity.

One great example is the 2017 America's Cup. Team New Zealand easily defeated the reigning world champions, Team USA, by a score of 7 to 1. The biggest reason for that lopsided championship was the different command and control systems of each team. Team USA decided to centralize all control with the team captain, who had a state-of-the-art control console. The assumption was that if the team captain (possibly the most experienced sailor on the boat) had access to all the feedback information *and* the controls, he could make better and faster decisions. The opposite proved true: Team New Zealand decentralized control, so the Team Captain could focus more on strategic decisions (things that affect the whole boat/crew) and pay greater attention to what was happening outside the boat to take advantage of Team USA's weaknesses and poor tactical decisions.

There are also military historical lessons proving the limits of control in complex systems. During World War I, Moltke the Younger executed his version of the Schlieffen Plan in the Battle of the Frontiers. He even instituted a form of mission command, keeping his

headquarters far from the frontlines and instead relying on vertical communications. However, one reason why the plan failed was because he and the German army neglected the importance of lateral, or horizontal communications. It was more important that his Army commanders could talk to each other, to maintain their offensive line, then it was to talk to Moltke's headquarters. This phenomenon is evidence that control of a complex system is really done by a subset of its parts: otherwise called a team.

The future of C2 and leadership is less individual, and more team. Both General Stanley McChrystal and Yaneer Bar-Yam use the term: "team of teams." Yet, if you reflect on your own military experience, you will notice that the power of teams is already exceeding the effectiveness of the commander. As a staff or company commander, I bet you witnessed countless decisions and actions that had significant affects that were the result of different individuals working together to solve a problem. The commander was seldom aware or even involved.

As one increases in scale (e.g., from platoon to company to battalion, etc.), the amount of complexity any one person can handle stays pretty much the same. Therefore, the individuals in command at large scales should focus on large scale dynamics (i.e., systemic health), and design their force structure to permit self-organization of teams to execute the traditional C2 at respective scales.[21]

[21] Self-organization is a process in which pattern at the global level of a system emerges solely from numerous interactions among the lower-level components of the system. Moreover, the rules specifying interactions among the system's components are executed using local information, without reference to the global pattern. [SFI]

The Strategist: This is *starting* to make sense to me. Can you recommend any books to read to help me understand complex systems better?

The Neostrategist: Absolutely. There are three books that really helped me gain a practical grasp on complex systems: (1) Yaneer Bar-Yam's *Making Things Work: Solving Complex Problems in a Complex World*, (2) Nassim Taleb's *Antifragility*, and (3) Geoffrey West's *Scale: The Universal Laws of Growth, Innovation, Sustainability, and the Pace of Like in Organisms, Cities, Economies, and Companies*. Read Bar-Yam's book first. All of Taleb's books are good, but if you only read one read *Antifragile*. Do not get hung-up on his cynicism, pay attention to his examples. West's book describes the problems of scale that confront our present and future.

Major Sagredo: Thank you, to both of you. I have learned a lot from today's conversion.

The Way Forward

The better way to train, fight, and win is to accept the realities of complexity. Labelling problems as "complex" or "wicked" is not sufficient. We must understand what complexity is so we can more accurately appreciate the limits of our knowledge and our capabilities. Furthermore, if the acme of a military officer is critical thinking (i.e., asking the right questions), then complexity science and neostrategy provide a new set of questions (i.e., a paradigm) to help us better understand the problems of today and tomorrow.

This is only the beginning. Neostrategy is an embryonic idea. Therefore, this author aims to continue building a body of understanding that will help decision-makers understand, prepare for, and ultimately win future wars. More to follow…

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