Complex Systems and Classical Military Theory

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Abstract War has always been an emergent phenomenon, comprised of countless, constantly interacting physical and cognitive elements of individuals, groups, societies, and nation states competing violently for power, influence, and access to resources. If war is the sum total of these multiple levels of competition, can war be any less complex than any of the phenomena that play a part in it? Schools of military theorists have largely followed the same tensions that schools of science have followed between "positivist" schools of thought born during the Enlightenment who believed that the world is inherently ordered and controllable via by formal scientific description and method, and those "romantics" who suspected that randomness played a much greater role in the universe than our scientific tools and reason could handle on their own. Various military writers throughout the centuries have sought to offer prescriptive principles that can be used to make warfare more predictable and manageable. But modern understandings of complex systems can help us better understand the true degrees of efficacy we can hope to achieve through our calculations of war, and help us to avoid coming to false conclusions about what we can hope to achieve through the force of arms alone.

Keywords Complex systems · Military · Theory

1 First Section

War has always been an emergent phenomenon, comprised of countless, constantly interacting physical and cognitive elements of individuals, groups, societies, and nation states competing violently for power, influence, and access to resources. If war is the sum total of these multiple levels of competition, can war be any less complex than any of the phenomena that play a part in it?

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Any new theory should not only replicate the success of the old ones, but should also explain things that the previous theories could not account for, and also do it in a more elegant manner, a concept described as "Occam's Razor" [1]. Claims that any new theory will "change the nature of war" should rightfully be looked upon with suspicion. But complex systems theory makes no such promises, complex systems theory gives us a better way to look at the nature of war that has always existed, with the nature defined as the basic interaction rules of human systems that don't change, and character defining the interactions themselves which can change. Complex systems theory explains many of the key insights of the classical military theories, and also offers new ways to both expand on their original insights and correct some of their deficiencies. Using complex systems concepts as the foundation of military theory is nothing new, but our dawning recognition of this currently constitutes the leading edge in military thought.

1.1 The Ancient Military Classics

Thucydides' History of the Peloponnesian War and Sun Tzu's The Art of War, both written approximately 2400 years ago, are ancient classics of military strategy that have maintained their relevance in modern times. Among Thucydides' most famous contributions is his proposition that the actions of individuals, groups, societies, and states can be understood in the context of an attempt to simultaneously balance the prioritized social forces of fear, honor, and interest [2]. In complex systems terms, these are the powerful psychological attractors that guide all basic individual decisions, with fear being the primary motivator geared toward physical survival, honor being focused on the survival of one's sense of identity within the contexts of groups, and interest guiding decisions when the previous two imperatives are satisfied. While an understanding of these attractors cannot guarantee accurate prediction of individual decisions in specific instances, they can often be used to describe and predict what psychological behaviors will drive human behavior from the bottom up in aggregate, as well as in the long term. This serves as the foundation for prediction that all sound strategy relies on.

The story of Athens and Sparta itself is a classic case of two complex adaptive systems competing against each other within the larger complex adaptive system of the Ancient Mediterranean and Persian worlds. For decades, the sea power Athens and land power Sparta two sides clashed with futility, neither side being able to overcome the strengths of each other, in what students of military strategy describe as "elephant vs. whale" stalemate. Then, both sides began the process of adaptation, each adopting the means of the other in order to break through the defenses of the other, and ending ironically when the land power, Sparta, defeated the sea power, Athens, in a decisive naval engagement, after they allied with their traditional enemies, the Persians. But in winning, Sparta illustrated another key takeaway from complex systems theory: in complex adaptive systems, you can "never do merely one thing." [3]. In making an alliance with Persia to defeat Athens, Sparta weakened the entire alliance of Greek

city states that had traditionally banded together to defend the region from foreign invasion. Only decades later, after even more Greek internecine warfare, all of the weakened Greek city states eventually fell separately to Phillip of Macedon and his son Alexander the Great. Thus, the real admonition of Thucydides in writing is book may be his warning echoed by the most important principle of complex systems. If your own definition of the system is too narrow, as was both the Athenian and Spartan definitions of victory, your solution set will be to narrow, and if you fail to understand how competition and cooperation work at various levels of scale, you cannot hope to adapt successfully within the context of the larger system.

Sun Tzu (or the group of scholars represented by him) is very possibly the earliest known advocate for systems thinking in warfare, as a holistic understanding of the system and the environment in which a military commander competes is crucial to success according to his theory. If the acme of skill is to win without fighting—by first defeating the enemy's strategy, as Sun Tzu suggests—then one must not only be able to adapt oneself to the situation and the enemy, but also be able to predict how the enemy is adapting, and factor that into your own model for adaptation [4]. Sun Tzu seeks to use knowledge of the potentialities inherent within the total system in his favor, using deception to maneuver the enemy into positions of geographic and material disadvantage that can then be exploited with minimal effort and risk, a concept described by Francois Julien as seeking "efficacy." [5]. Successful generals recognize the fundamental nature of the system and the environment, and pattern their actions (or inaction) to take advantage of three different potentials: moral potential, topographic potential, and potential of adaptation. It is the third of these aspects of potential that the maneuver of military forces can influence. The potential of the situation cannot be anticipated, as it "proceeds from continuous adaptation…" [6].

1.2 Theories of War During the Enlightenment

Schools of military theorists have largely followed the same tensions that schools of science have followed between "positivist" schools of thought born during the Enlightenment who believed that the world is inherently ordered and controllable via by formal scientific description and method, and those "romantics" who suspected that randomness played a much greater role in the universe than our scientific tools and reason could handle on their own. Various military writers throughout the centuries have sought to offer prescriptive principles that can be used to make warfare more predictable and manageable. In the emerging "scientific" theories of war, some even believed that "Bellona, the furious goddess of war, was to be rendered tractable, tamed like a kitten on the hearth."

Theorist after theorist designed systems of war built upon principles that if followed, would practically ensure victory for those who had the diligence to study and master them. This school of thought was a natural follow-on from the era of "cabinet wars" in which fortification had dominated the character of war, and was represented by a geometric style of calculation best represented by the theoretical

works of Sébastien Le Prestre de Vauban, Maurice De Saxe, Louis Pierre de Chastenet, comte de Puységur, Count Turpin de Crisse, Paul Gideon Joly de Maizeroy, and Dietrich Heinrich Von Bulow. This positivist school described by Gerhard Ritter in The Sword and the Scepter, "Many people hoped that war would ultimately eliminate itself, having become a pure, universal science by means of mathematical equations that ruled out chance and the fortunes of war." And perhaps the most famous of the positivists, Baron Antoine Jomini advocated prescriptive theories based on principles of war that would help you recognize "decisive points" that have a greater impact on the system than others, and should therefore be the focus of one's efforts in warfare [7].

But others were not so sure. Carl Von Clausewitz—would write in his magnum opus On War that "…all military action is intertwined with psychological forces and effects", and elsewhere that "One might say that the physical seem little more than the wooden hilt, while the moral factors are the precious metal, the real weapon, the finely honed blade." Those unquantifiable moral factors "will not yield to academic wisdom. They cannot be classified or counted. They have to be seen or felt." [8]. While Clausewitz did acknowledge the usefulness of principles of war and the study of history to search a for a useful general theory, he was firmly against the idea that war could ever be subjugated or controlled mathematically, as Clausewitz described war's main driving forces as psychological passion that drove the combatants to conflict, irreducible chance that creates both challenge and opportunity for military leaders, and the attempt to subordinate war to reason and rationality by those directing the war [9].

1.3 A Modern Diagnosis of the Old Debates

The deeper insight Clausewitz and the others above intuited on—the core issue of misapplied scientific philosophy driven by positivist thinking—can today be described as technical rationalism, a variant of the positivism that fueled the French Enlightenment, the sense that the world was inherently ordered and would eventually be brought under control by a combination of good science and deliberate effort. As described by MIT's Donald Schön, Technical Rationality is the "dominant epistemology of practice," an "instrumental problem solving made rigorous by the application of scientific theory and technique", a scientific philosophy that is "implicit in the institutionalized relations of research and practice, and in the normative curricula of professional education." Under this positivist paradigm, "real knowledge lies in the theories and techniques of basic and applied science." [10]. But what if those scientific theories and techniques imply a degree of order or stability of outcomes that don't exist in real world?

Technical rationalism falls far short when it comes to evaluating competing moral factors, or evaluating the tradeoffs between competing value-laden options or balancing irreducible ethical dilemmas. These are the intangible and often capricious social dynamics that describe the difference between knowledge and wisdom,

a distinction that cannot be described in formal or universal logical functions minus specific contexts, but must be fit to the unique contexts of specific situations. Technical rationalism offers a seductive but false sense of certainty when applied to problems of strategy, and despite several near misses and certain disasters in the recent past caused by its application in war, technical rationalism continues to ensnare senior leaders who fail to understand its obvious inadequacies above the level of tactics, as it did with Robert McNamara's quantitatively focused "Whiz Kids" in Vietnam, who later confessed that "I had always been confident that every problem could be solved, but now I found myself confronting one – involving national pride and human life – that could not." [11].

Technical rationalism continues to seduce those not steeped in the realities of complex systems, as was demonstrated in the 1990s with the overreaches of Network Centric Warfare and Effects Based Operations which sought to make war tamable by digitized, algorithmic logic run by increasingly powerful computer and communications systems [12]. More recently, the "Third Offset", led by former Deputy Secretary of Defense Robert Work sought to describe war as a series of grids, hearkening back to the technical rationalists of the French Enlightenment [13]. Taken metaphorically, these descriptions are valuable, but too many continue to literally believe that war can be reduced to formal logic, and "gonculated" via algorithm, neglecting the true difficulties of formally describing the connected, contingent, and ever changing human value functions that accompany real social intercourse—the same point Clausewitz made in the early 1800s. This "chessmaster" tactical focus has been commented on repeatedly, and can perhaps be summed up by the following observation on the US military by the late éminence grise of strategic studies, Dr. Colin Gray: "The problem, to repeat, is that the United States has a severe strategy deficit. It is, and has long been, guilty of what is known as the "tacticization" of strategy. US military power does tactics well and tends to expect success at that level to translate automatically into strategic victory." [14].

The good news is that complex systems theory does indeed help to bolster the military theories that have resonated with generations of military thinkers, giving us new insights into why these ideas indeed seem to be timeless. As more and more military thinkers become familiar with complex systems concepts, and relate the new ideas to the old ones, there is a much better chance of larger organizational acceptance of intellectual models that better approximate war as it really is, reducing surprise even when it cannot eliminate uncertainty. But it's extremely critical that we adopt the conceptual frameworks of complex systems to complement those classical scientific rationalist approaches that work we with well-structured problems—if we fail to discern the difference between complicated and complex tasks, we'll apply the wrong types of tools to the wrong types of problems, and risk creating "Weapons of Math Destruction" that will force us to learn the lessons of complex systems far too late to achieve our intended goals.

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