

# ***Complex Systems and Military Transformation***

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Military theory has long recognised the enduring themes of uncertainty, complexity and organisation in conflict. However, it could be argued that until recently, the response of professional armed forces to these themes has been to exercise hierarchical control during operations, and generate large scale capability using production line thinking. The former limits adaptivity, the latter limits variety, and both share the assumption that complex problems can be reduced by decomposition. Substantial transformation in military thinking has coincided with the development of rigorous techniques for the treatment of uncertainty, complexity and organisation within the interdiscipline of complex systems. Some of the central concepts behind military transformation have explicit roots within complex systems, while others make sense only once a complex systems perspective is adopted. By a complex systems perspective, we refer to an understanding of the dynamics of self-organisation and emergence over multiple scales, always considering a system in the context of its environment. In this essay, we trace the impact of complex systems on military theory. We show how complex systems has changed the way operations are managed; forces are structured; capability is developed; and conflicts are analysed.

## **Structure**

### Strategic context

- 9/11 and the Long War

- Asymmetric Warfare

- Symptoms that conventional forces cannot cope with complexity

### Military transformation

- Dollars spent and operational experiences

- The theory

  - Network Centric Warfare

  - Effects Based Operations

  - The Three Bloc War and Complex Warfighting

- Links to complex systems and network theory

  - Self-synchronisation

  - Mission Command and semi-autonomous combined arms teams

  - Modular force packages

  - Systemic Operational Design

### Capability development

- The Industrial Age approach

- Example of Complex Systems Engineering: the Air Operations Center

### Analysing Combat

- Lanchester equations

- Agent based models and the fractal attrition meta-model

### Concluding Remarks

## **Quotes on complexity of war**

“In the tumult and uproar the battle seems chaotic, but there is no disorder; the troops appear to be milling about in circles but cannot be defeated. An apparent confusion is a product of good order... Order or disorder depends on organization.”  
Sun Tzu, The Art of War, 500 B.C.

Karl von Clausewitz:

War is not an exercise of the will directed at an inanimate matter.

I shall proceed from the simple to the complex. 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 the whole must always be thought of together.

Everything is very simple in war, but the simplest thing is difficult. These difficulties accumulate and produce a friction which no man can imagine exactly who has not seen war.

War is the province of chance. In no other sphere of human activity must such a margin be left for this intruder. It increases the uncertainty of every circumstance and deranges the course of events."