NATIONAL DEFENSE UNIVERSITY

NATIONAL WAR COLLEGE

CHAOS, CLAUSEWITZ, FRICTION and COMMAND

Col Paul R. Manley, USAFR/ Class of 1999
Course 5602

Faculty Seminar Leader
Col Jack McDonald

Faculty Advisor
Col John Zielinski

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
1999		**00-00-1999 to 00-00-1999**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Chaos, Clausewwitz, Friction and Command	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **National War College,300 5th Avenue,Fort Lesley J. McNair,Washington,DC,20319-6000**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
see report

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**		**11**	

Everything in war is very simple, but the simplest thing is difficult. The difficulties accumulate and end by producing a kind of friction that is inconceivable unless one has experienced war.

Carl Von Clausewitz

In his great work ON WAR, Clausewitz struggled with this concept that he called "friction". He used this term to describe things that happen in battle that cannot have been foreseen or planned for and which cause the commander to make decisions about events that he did not anticipate. It called for him to possess something he called *genius* in order to overcome these events. I will argue in this paper that the friction that he describes is intrinsic in the modern mathematical theory of Chaos, that its effects are manifested in war at both the tactical and strategic levels, and that the creative and non-linear thinking leader, the genius, is just as important now, as he was in the 19th century.

CHAOS EXPLAINED

The disorderly behavior of simple systems generated complexity: richly organized patterns, sometimes stable and sometimes unstable, sometimes finite and sometimes infinite, but always with the fascination of living things. That was why scientists played with toys.[1]

James Gleik

A playground swing will, when you use it smoothly as it was intended, exhibit behavior that is quite predictable. However, if you kick it while it's swinging, it begins to exhibit behavior that is not at all predictable This is one of the many traits of Chaos behavior that is not periodic and apparently random. If a system is linear its output is directly related to its input. In nonlinear systems, the output

[1] Glenn E James, 'Chaos Theory", Center For Naval Warfare Studies (Newport, Rhode Island, 1996) p 9

might be related to the square or the cube of the input. All chaotic systems are nonlinear. They are also not periodic because they, like the swing after it has been kicked, do not return regularly to the same conditions and they do not repeat. This is because their future behavior is extremely sensitive to their initial conditions which, because this can never be measured exactly, makes their future behavior impossible to predict. Thus, infinitesimal differences in initial conditions eventually cause large changes later. The importance of this concept is that it explains how a system can be governed by a set of equations and yet still be unpredictable. The earth as it revolves around the sun is not chaotic. A slight change in orbital speed yields a slight change in its path of revolution In contrast, a column of smoke rising into the air is chaotic It rises straight up for a time, then suddenly breaks into turbulent whorls, twists and zigzags that seem to follow no particular pattern. Fortunately there are bounds to the unpredictability of chaotic patterns and there are even tools that predict patterns of system behavior that can define bounds within which the behavior is unpredictable. An intriguing offshoot of Chaos Theory is one known as " self-organized criticality. " It was defined by two of its originators as follows:

Large interactive systems perpetually organize themselves to a critical state in which a minor event starts a chain reaction that can lead to a catastrophe.. Although composite systems produce more minor events than catastrophes, chain reactions of all sizes are an integral part of the dynamics.. Furthermore, composite systems never reach equilibrium but instead evolve from one temporarily stable state to the next.[2]

---

[2] David Nicholls Tudor Tagarev, "What Does Chaos Theory Mean for Warfare?" Air Power Journal (Fall 1994) P 53

IBM researchers are examining this theory using grains of sand in piles. The grains are added one by one to a pile until a critical state is reached in which the next grain of sand added produces an avalanche. After the catastrophic reordering, the system is stable as it builds toward the next collapse. An important point to reemphasize is the disproportionate effects seemingly minor events can provoke. As the German physicist Gerd Eilenberger remarked:

The tiniest deviations at the beginning of a motion can lead to huge differences at later times- in other words; minuscule causes can produce enormous effects after a certain time interval. Of course we know from everyday life that this is occasionally the case; the investigation of dynamical systems has shown us that this is typical of natural processes.[3]

CLAUSEWITZIAN FRICTION AND CHAOS

There are events in war, seemingly insignificant, that can have an effect completely out of proportion too their apparent importance. In discussing Friction, Clausewitz struggled with the concept of why this happened, but he was certainly aware of how often it manifested itself. *The dangers inseparable from war and the physical exertions war demands can aggravate the problem to such an extent that they must be ranked among its principal causes.* He had seen things go suddenly wrong, for the most insignificant and unanticipated events, and the causes always eluded him. The modern theory of Chaos tells us that this is preordained. A system as complex as a modern (or a 19th century) army will inevitably be affected. At the tactical and operational level plans cannot possibly be used for anything other than a way to get started. The requirements for

[3] Glenn E James, "Chaos Theory" Center For Naval Warfare Studies (Newport, Rhode Island, 1996) p 17

genius in the commander, the ability to react to the change in circumstance, will remain paramount. As Clausewitz described it, it consisted of the " harmonious combination of elements" in particular, daring, determination and informed intuition that can ward off the psychological threat of uncertainty. It is what physicist Roger Penrose referred to as " the instantaneous judgments of inspiration " and Clausewitz encapsulated with coup d' oeil: those " glimmerings of the inner light which leads to truth." The need for nonlinear thinking and the concept of chaos was also apparent to Dwight Eisenhower who insisted that his instructors should;

Treat war as the drama that it is rather than constantly reducing it to a science of marching tables and tonnage calculations. I do not decry the necessity for the scientific end of the education, I merely think that too many officers develop their thinking more and more along the lines of mathematical calculations rather than realizing that calculations always go wrong.[4]

I need to look no further than Haig's actions at the Somme to see the disastrous results that can occur if one ignores the perils and continues to adhere, in a linear fashion, to a plan whose " swing has been kicked " by the god I call Chaos, the Romans called Fortuna and Clausewitz called Friction For an example of genius I think of Joshua Chamberlain at Little Round Top; reacting, improvising, creating and adapting to a constantly changing scenario. It is the Chamberlains who we should seek to promote to command, and the Haigs that should be weeded out before they can inflict damage.

---

[4] John Ferris and Michael Handle 'Clausewitz,Intelligence,Uncertainty and the Art of Command In Military Operations" Intelligence and National Security (January 1995) p 44

For want of a nail the shoe is lost,
For want of a shoe the horse is lost,
For want of a horse the rider is lost,
For want of a rider the battle is lost,
For want of the battle the war is lost,
For want of the war the nation is lost,
All for the want of a horseshoe nail.

George Herbert

There are those that dismiss Chaos (if indeed they have considered the theory's implications for war) and lay claim to the use of better intelligence as reducing uncertainty. Nothing could be further from the truth. John Ferris and Michael Handle are disciples of this argument. In their work Clausewitz, Intelligence, Uncertainty and the Art of Command in Military Operations, they maintain that modern intelligence gathering has drastically reduced uncertainty and lessened the requirement for genius.

What once were random actions now often can be predicted and controlled. Armies can foresee far more than before, and execute their intentions far better. Thus, the effect of 'fortune' on war has declined along with its plausibility as an excuse for defeat 'Fortune', so long queen of the battlefield, has been dethroned by a pawn . Indeed, military genius itself may actually be counter-productive in an era of excellent and reliable intelligence. Geniuses . often make a fetish of faith in their intuition.

They fail to grasp that chaos theory teaches us that it is the more complex systems that are most affected by unforeseen events that no amount of intelligence can prepare you for. The complexity of a modern army's C^4I, high-

speed logistics, computer automations and weapons systems integration, relative to 19th century armies, means that the effects of chacs are more prominent now. Perhaps Messrs. Ferris and Handle should consider the situation of the commander of Desert One who, possessed of an almost unsurpassed amount of intelligence, found himself with a useless plan, reacting to the unforeseen effects of grains of sand

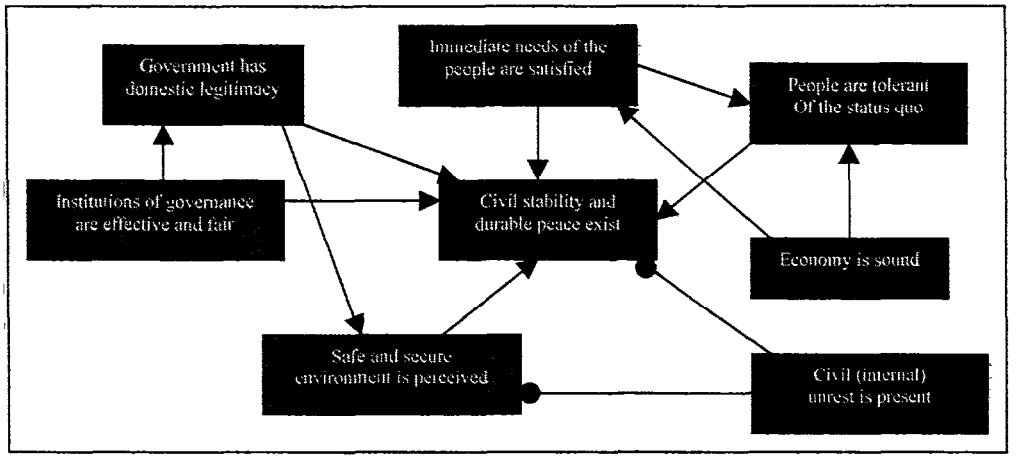
On the subject of computer simulations, Majors David Nicholls and Tudor Tagarev agree that chaos will cause future warfare to remain unpredictable. They find hope in simulations to " contain some nonlinear relationships between system variables so that the computer model is chaotic and thus reflects the chaotic nature of warfare realistic war games would have significant educational and operational advantages." I agree with them as to the use of computers for understanding uncertainty. However, any use of computer simulations to obviate the need for creativity or genius is doomed. One need only think of the recent computer models of Long Term Capital Management Designed by two Nobel Laureates in mathematics, they cost their investors billions in losses and required the intervention of the Federal Reserve to avoid a chain reaction collapse of the largest investment banks in the United States

In the not too distant future, software which incorporates true artificial intelligence will be available to add the dimension of human behavior induced chaos available from intelligent agents. A recent article in The Journal of Electronic Defense quotes Dr. Grisagono of the Australian Land Operations

Division explaining how intelligent agents could be used in place of human decision-makers in a virtual reality war game world

" Presently, it is these human elements that are difficult to test without employing live exercises. The research into intelligent agents should enable these exercises to be carried out in a closed computer world .where those human decision-makers are represented by software agents."

While awaiting developments in AI, it is still possible to induce friction in war game simulations by use of arbitrary outside intervention of an "umpire" A promising tool in this regard is software known as Situational Influence Assessment Module (SIAM) It allows the effect of a change in one parameter or node to cascade though the entire simulation. This allows the umpire to "construct graphic depictions of complex, cause-and-effect relationships involving uncertainty." In the spirit of a " picture is worth a thousand words ", I've included the picture below.



The United States Marine Corps is attempting to address chaos and its effects on commanders in some interesting ways. They are studying chaotic situations

that come close to the reality of war. Trading on the floor of the Chicago Commodities Exchange and firefighters at the scene of large structural fires with trapped inhabitants are two of the scenarios used. They are attempting to understand the intuitive abilities of these individuals as they make quick decisions based on constantly changing intelligence inputs. The pressure of tremendous consequences for loss of life or large sums of capital in the event of a bad decision adds realism. Clearly, these are studies in the attributes of genius. (Note- the author does not intend for the reader to feel that he condones the recruiting of future commanders from the ranks of commodities traders or firefighters.)

Although Clausewitz limited his concept of friction to the operational and tactical levels of war, it is interesting to consider the effects of Chaos Theory at the strategic level. Steven Mann in his essay Chaos Theory and Strategic Thought argues that chaos makes long range strategic predictions difficult. He gives examples of what he calls the " illusion of reordering" such as the League of Nations covenant to establish global collective security, the Kellog-Briand pact to renounce war and the Yalta Conference to shape the post WWII international order

The mechanistic view is too arbitrary and simple for international affairs. We must start from the point that disorder, proceeding to reordering, is an inherent, inescapable feature of complex, interactive systems. We are deluding ourselves if we choose metaphors which suggest that externally-imposed, long-term stability can be a defining feature of the world. The world is destined to be chaotic We can learn to see chaos and reordering as opportunities, and not push for stability as an illusory end in itself. All of this awaits if we can transcend the bonds of the mechanistic framework, which still dominates strategic thought .

There remains much work to be done in analyzing the effects of Chaos Theory at the strategic, operational and tactical level of war. It will remain imperative to avoid dependence on sequential plans, with genius impaired commanders given the task of execution. As Dwight Eisenhower reminds us "planning is essential, but plans are useless." War will remain an art, with the most creative and enterprising commanders able to achieve victory. We would do well to remember Clausewitz's advice on the qualities we should seek for those who lead our armies. " The man responsible for evaluating the whole must bring to his task the quality of intuition that perceives the truth at every point Otherwise a chaos of opinions and considerations would arise, and fatally entangle judgement Everything in war is very simple, but the simplest thing is difficult."

Bibliography

1. Clausewitz, Carl von, trans and ed. Michael Howard and Peter Paret. *On War.* Princeton, Princeton University Press, 1976

2. Ferris, John and Handle, Michael, "Clausewitz,Intelligence,Uncertainty, and the Art of Command in Military Operations". *Intelligence and National Security* (January 1995)

3. James, Glenn E. *Chaos Theory.* Center for Naval Warfare Studies, Newport, Rhode Island, 1996

4. Mann, Steven R "Chaos Theory and Strategic Thought". *Parameters,* (Autumn 1992) pgs 54-69

5. Nicholls, David and Tagarev, Tudor, "What Does Chaos Theory Mean For Warfare?". *Air Power Journal,* (Fall 1994) pgs 48-58

6. River, Brendon, "Australia Studying Intelligent Agents". *Journal of Electronic Defense,* (Sep 1998) pg 20

7. Davidson, Lisa and Hayes,Richard, "Understanding and Using SIAM" *Evidence Based Research,* (Lecture, March 1997)