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The Application of a System of Systems Analysis to Assessments of National Power

George T. Hodermarsky
Old Dominion University

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ASSESSMENTS OF NATIONAL POWER

by

George T. Hodermarsky
A.B. June 1970, Ohio University
M.S. May 1976, The George Washington University
M.S. July 1990, The U.S. Naval War College
M.S. August 1992, Old Dominion University

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Approved by:

Kurt Taylor Gaubatz (Director)

Steven A. Yetiv (Member)

David Dryer (Member)

ABSTRACT

THE APPLICATION OF A SYSTEM OF SYSTEMS ANALYSIS TO ASSESSMENTS OF NATIONAL POWER

George T. Hodermarsky
Old Dominion University, 2005
Director: Dr. Kurt Taylor Gaubatz

This dissertation proposes an approach and methodology for the utilization of the fundamentals of systems theory as an aid to national security decision-making. At its core is an examination of the elements of nations' or non-state actor's power resources. The product of the analysis is the compilation of a set of nodes, and the relationships between these, upon which actions may be taken to achieve desired effects. Since the boundaries between the subsystems of power resources are flexible and permeable, and there will be interactions between elements in different subsystems, a *system of systems* approach is essential so that the functioning of the system may be better understood and the secondary consequences of actions considered. The premise is that changes cannot occur in isolation, and that alterations in one component will result in modifications (intended or unintended) to related elements. The goal of the approach is not precise prediction of the effects of actions, but rather to provide for understanding of the relationships between elements of national power that will lead to expectations of the consequences of those actions. The hypothesis is: If national power is characterized as nonlinear and complex; *and*, if approaches recently developed in mathematics and the physical sciences provide a means of enhanced understanding of nonlinear systems; *then*, utilization of such an approach may provide a metaphor or model for increased understanding of the system and the secondary effects of coercive actions taken to achieve objectives. This

dissertation will attempt to confirm the existence of the first two conditions, and will provide arguments and a design for accomplishment of the third. An ex post analysis of three conflicts where coercion by military means was the primary strategy—Somalia, 1992-1995; Kosovo, 1999; and, Afghanistan, 2001—will be used as case studies. These examples will provide illustration of the utilization of the principles of the system of systems construct and exposition of the potential of this methodology to enhance the understanding of the effects of coercive actions.

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Coincident with my formal coursework in the Graduate Program in International

Studies at Old Dominion University, I served as a senior analyst supporting the

transformational activities of the U.S. Joint Forces Command (USJFCOM). In August

2001, I led a small team that evolved into the System of Systems Analysis (SoSA) Cell,

building the knowledge base for the embryonic Operational Net Assessment. This

dissertation is the result of nearly three years of my own academic research and writing,

but much of the sources of the methodology emerged from our work for USJFCOM. It is

impossible to determine the original individual sources of all the ideas that combined to

form the basis of the process; consequently, I must recognize the team as a whole.

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project on the numerous occasions when completion appeared to be beyond reach.

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ABBREVIATIONS

ACT	Allied Command Transformation
BDA	Bomb Damage Assessment; Battle Damage Assessment
C2	Command and Control
CAS	Complex Adaptive System
CIA	U.S. Central Intelligence Agency
DOD	U.S. Department of Defense
EU	European Union
FRY	Federal Republic of Yugoslavia
GDP	Gross Domestic Product
IAD	Integrated Air Defense
ISI	Inter-Services Intelligence Directorate
JSOTF	Joint Special Operations Task Force
JUL	Yugoslav United Left
KLA	Kosovo Liberation Army
KVM	Kosovo Verification Mission
LPK	Levizja Popullare e Kosoves
MUP	Ministerstvo Unuprasnif Poslava
NATO	North Atlantic Treaty Organization
NCW	Network Centric Warfare
NSC	National Security Council
ONA	Operational Net Assessment
OSCE	Organization for Security and Cooperation in Europe
PDPA	People's Democratic Party of Afghanistan
PEMS	Political, Economic, Military, Social
POL	Petroleum, Oil, Lubricants
PVO	Private Volunteer Organization
RMA	Revolution in Military Affairs
ROE	Rules of Engagement
RTS	Radiotelevizija Srbije
SACEUR	Supreme Allied Commander Europe
SIC	Sensitivity to Initial Conditions
SNM	Somali National Movement
SNP	Serbian Radical Party
SPPM	Socialist People's Party of Montenegro.
SPS	Socialist Party of Serbia
SRC	Supreme Revolutionary Council
SVM	Alliance of Vojvodina Hungarians
UCK	Ushtria Clirimtare E Kosoves
UN	United Nations
UNITAF	Unified Task Force
UNOSOM	United Nations Mission in Somalia
UNSC	United Nations Security Council

UNSCR	United Nations Security Council Resolution
USAF	United States Air Force
USC	United Somali Congress
USJFCOM	United States Joint Forces Command
VJ	Vojska Jugoslavskaya

CHAPTER I

INTRODUCTION

Among the most critical components of the relations between sovereign states in an anarchic international system are the efforts of nations to influence the behavior of others. This endeavor is often described in terms of the application of some aspect of national power with the objective of coercing a change in the conduct, or deterring actions of another state. While a variety of methods may be employed, military force historically has been the primary instrument of national coercive power. The successful employment of a nation's influence to this end requires, *inter alia*, a capability for examination and understanding of the power capabilities of other nations.

If power is thought of in purely military terms, such assessments become relatively simple. Force on force analysis is relatively linear, and is amenable to modeling and simulation. Hence, in many cases an assessment may be accomplished through relatively uncomplicated means such as a numerical summation of capabilities. Among the many examples is the naval arms race between Germany and Great Britain resulting from the launching of the *Dreadnought* battleships in the early days of the twentieth century. Later, in the nuclear era, assessments of relative power during the Soviet-U.S. cold war often gravitated toward the counting of launchers, warheads, and deliverable megatonnage.

However, in a complex international environment, where the elements of national power are multifaceted and interrelated, the task of accurate assessment becomes

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The format for this dissertation follows current style requirements of the *Chicago Manual of Style*, 15th ed. (Chicago: University of Chicago Press, 2003).

exceptionally difficult, and the tools available for analysis are more limited. Determination of the relationship between cause and effect remains problematic. This is particularly true in the anticipation and comprehension of the secondary effects of actions that are designed to achieve national or coalition objectives. Consequently, a process or methodology that can assist decision-makers in the formulation and execution of coercive actions is a worthwhile aspiration.

Rationale for the Study

Throughout history, nations have attempted to influence the behavior of other states. If coercive actions by nations have been routine, the question emerges as to why a new appraisal and fresh approach to assessments is necessary. The reasons are centered principally on the altered nature of the milieu in which the systems of power exist. These include a geo-political security environment where the contention for global military supremacy has, at least for the present time, been generally accepted. Coincident with this relatively stable security situation is steadily increased globalization and interdependence between nations, and consequently the emergence of interrelated and networked societies.[1]

The former condition means that conflict and the occasions of coercion are likely to be short of battles for national survival and will focus instead on limited scale operations such as peacekeeping and military operations other than war. The latter

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1. Globalization is more than the existence of increased interrelationships between societies and has been described as "a state of the world involving networks or interdependence at multicontinental distances." Robert O. Keohane, *Power and Governance in a Partially Globalized World* (New York: Routledge, 2002), 193. He emphasizes that globalization refers to networks of connections rather than simple linkages. For an extensive analysis of the changing environment see Gregory F. Treverton, "Emerging Threats to National Security: Testimony Presented to the House of Representatives Permanent Select Committee on Intelligence on 2 February 2005," http://rand.org/pubs/testimonies/2005/RAND_CT234.pdf (accessed 5 April 2005).

situation suggests that operations with multiple objectives, including humanitarian relief and nation building, will be relatively unconstrained by political or geographic boundaries.

These connections are an immensely extended consequence of the economic dependencies that emerged in the mercantile and colonial era, which expanded in the industrial age and became a defining characteristic of international relations in the twentieth century. More recently, the advent of an information age where knowledge itself becomes a commodity has changed the environment. While the extent and future impact of the effects of this globalization are contentious, the existence of increased interconnections and dependencies that transcend national boundaries is irrefutable. When considered together, the result is an international climate that is increasingly complex and substantially unlike that of the cold war era. Recognition of this radically changed situation has been a primary rationale for political realignments and military transformation efforts among nations across the globe.[2]

Regardless of the nature and character of these transformations, the essential purpose remains the same, i.e., the ability to influence the behavior of other actors in the international environment. Just as in earlier endeavors, an understanding of system of power of the nation being acted upon is critical to effective achievement of this objective.

Power is applied by one nation to affect the systems of another. Hence, a calculus that considers the political, economic, military, and social systems as interrelated

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2. In the military context, this transformation is sometimes referred to as a *Revolution in Military Affairs* (RMA). The RMA is principally a U.S. Department of Defense concept and described as "a major change in the nature of warfare" that involves changes to application of technologies, doctrine, and concepts that "fundamentally alters the character and conduct of operations." Chris C. Demchak, "Complexity and Theory of Networked Militaries," in *The Sources of Military Change*, ed. Theo Farrell and Terry Terriff (Boulder, CO: Lynne Reinner Publishers, 2002).

elements of an overall system of power, which is different from the sum of the parts, is critical to the assessment. Therefore, a construct that can provide enhanced understanding of the functioning of that system can contribute to more effective and efficient attainment of objectives. However, an effective utilization of such an approach requires an understanding of the systems to be acted upon, especially in the interrelationships between elements within and across the systems.

Most past and extant net assessments have considered the elements of political, economic, military, and social power; however, these were often treated as separate and distinct entities, and consequently did not adequately present the holistic view. This results in a less than optimum level of analysis. This shortfall produces, at minimum, inefficient applications of power and increased potential for failure to achieve the stated objectives.

A segmented and linear view of the adversary can lead to an inability to anticipate secondary effects that occur beyond system boundaries. Incomplete assessments can produce unnecessary levels of violence, increased destruction of human life and the means to support it, and a worsening of the situation that the operation was intended to alleviate. The deleterious effects of the lack of an adequate level of understanding are evident; tools to assist the decision-maker in dealing with them are less abundant. In an attempt to reduce that shortfall, this dissertation proposes a methodology that approaches assessments of national power from a systems perspective. This construct is a logical progression from, and synthesis of, previous work.

This study uses the *complex adaptive systems* (CAS) as a paradigm for national power. With the publication in 1979 of Kenneth Waltz's seminal *Theory of International*

Politics, consideration of dealings between nations from a systems approach became a much discussed and debated concept.[3] Hence, use of the term *system* is not without precedent in the field of international relations. Additionally, there is little debate that nations are *adaptive*, that is, they react to external as well as internal stimuli. Hence, a portrayal of nations as complex adaptive systems is not a radical departure from mainstream concepts. Despite the relative lack of contentiousness of these suppositions, acceptance has not provided significant practical advantages to those who desire to influence those complex adaptive systems.

Robert Jervis presents the key challenge to the selection of the optimum alternatives when confronting a complex system. "To alter the state of a system, it is necessary to understand the interaction of the elements that make up the system. It is impossible to change one element of the system without affecting the remaining elements."[4] This condition presents to decision-makers a virtually universal problem that lacks satisfactory solutions. This is the dilemma that this dissertation seeks to address. The approach is to look beyond the traditional methods of power assessment and to explore the potential for incorporation of processes that have proven useful in a wide range of intellectual disciplines.

In the 1970's and 1980's, a quantity of popular literature associated with certain scientific communities, notably the fields of mathematics, biology, and physics, displayed an increased attention to, and an advocacy for, a shift from linear to non-linear paradigms. The emergence of complexity and chaos theories into the parlance of

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3. Kenneth N. Waltz, *Theory of International Politics* (Reading, MA: Addison-Wesley Publishing Company, 1979). Waltz focuses on an international system, vice the system of systems of individual nations that are the core of this study.

4. Robert Jervis, "Complexity and the Analysis of Political and Social Life," *Political Science Quarterly* 112, no. 4 (Winter 1997-1998): 582.

educated observers outside of those previously identified academic fields best exemplifies this trend. Interest in these approaches expanded beyond the realm of technical scientific journals and entered the popular domain with publication of James Gleick's *Chaos: Making of a New Science* in 1987.[5]

Concurrently, researchers and scholars in the social sciences, most notably in Behavioral Psychology, attempted to apply these concepts. Interest was slower to build within the social sciences. However, a review of academic journals from the 1990's did reveal some limited exploration into the potential for application of chaos and complexity theory into this arena.[6] These initial searches for relevancy were intellectually appealing, but interest waned, due at least in part to the inability to extract useful insights or practical methodologies from the analysis.

While these theories, in their purest sense, never became integral parts of research and writing in the field, few would disagree with the description of the international political system and relations between sovereign but increasingly interdependent nations as *complex*. Despite the lack of controversy on this depiction, acceptance of this characteristic of national power has not proven to be particularly useful. Perceived by some as little more than stating the obvious, moving beyond agreement presents the

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5. James Gleick, *Chaos: Making a New Science* (New York: Viking Penguin Inc, 1987). This work, which made several bestseller lists, was followed by a related Public Broadcasting Service presentation. Subsequent chapters will expand on chaos and complexity.

6. Very limited examination of Chaos Theory emerged and most of these were in the fields of Public Administration and Management. Among these are David Levy, "Chaos Theory and Strategy: Theory, Application and Managerial Implications," *Strategic Management Journal* 15, Special Issue: Strategy: Search for New Paradigms (Summer 1994); and, E. Sam Overman, "The New Sciences of Administration: Chaos and Quantum Theory," *Public Administration Review* 56, no. 5 (September - October 1996). Complexity was addressed only slightly more often. Examples include Michael D. Wallace and Peter Suedfeld, "Leadership in Crisis: The Longevity-Complexity Link," *International Studies Quarterly* 32, no. 4 (December 1988); George Modelski, "Evolutionary Paradigm for World Politics," *International Studies Quarterly* 40, no. 3 (September 1996); and, Karen Guttier, Michael D. Wallace, and Peter Suedfeld, "The Integrative Complexity of American Decision Makers in the Cuban Missile Crisis," *The Journal of Conflict Resolution* 39, no. 4 (December 1995). Additional contributions will be cited in Chapter III.

important question, "so what?" The important issue remains whether or not this recognition of nations as complex adaptive systems presents any practical applications. Even if the models are accurate, an important question emerges. Can utilization of the components of these theories provide any realistic assistance to those who must make foreign policy decisions in such an environment? If so, are examples extant that can provide additional insights into the potential value of the consideration of these theories? Satisfactory answers to these questions are far less evident.

There are many opportunities for further study and progress in this area. Literature focused on complex adaptive systems is not abundant, and a systems approach to the study of the relative power of nations has not generated sizeable interest. In *System Effects*, an examination of a systems approach to international relations, the renowned and respected scholar, Robert Jervis, candidly provides that "several private foundations and public funding agencies declined to support this research."[7]

Perhaps terms such as complex adaptive systems and the technical nature of most of the previous examinations of chaos and complexity theory are viewed as too remote and too difficult to apply to international studies. Alternatively, many scholars in this field of study may perceive this approach as being outside of their academic comfort zone. The paucity of previous work in this area suggests that it resides beyond the mainstream, and some may consider it to be threatening to current postulations. As Lars-Eric Cederman observes, "the CAS approach generates surprising and counterintuitive insights about existing theories."[8]

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7. Robert Jervis, *System Effects* (Princeton, NJ: Princeton University Press, 1997), Acknowledgements.
8. Lars-Eric Cederman, *Emergent Actors in World Politics* (Princeton, NJ: Princeton University Press, 1997), 7.

While acknowledging that use of a systems approach in examinations of the relations between states is not without precedent, efforts aimed at practical application of the relevant principles of a systems methodology are less abundant. Hence, this inquiry views national power from a systems perspective, and attempts to fill the existing gap in the literature. It addresses the inadequacy of tools available to policy makers by proposing a methodology for application of these principles. However, further exploration requires a common understanding of terminology and a foundation in the use of systems in the context of this study.

Why a Systems Approach?

A system may be described as a "regularly interacting or interdependent group of items forming a unified whole...under the influence of related forces."[9] Most of the essential components of modern and technologically advanced societies may be depicted as systems, and these often have been developed as the result of systems analysis. Sophisticated communications, transportation infrastructure, information management, manufacturing, distribution of resources, and health systems are but a few examples. However, such a breakdown into component parts is not adequate for successful analysis.

While categorization is useful for descriptive purposes, such systems do not operate independently. Due to the size and complexity of the total structure and processes of a nation's capabilities, depiction as a *system of systems* would enhance understanding. The inherent complexity and interactions make this holistic system of systems different from merely an arithmetic sum of the subsystems. Hence, the challenge facing those who

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9. *Webster's New Collegiate Dictionary*, 8th ed., s.v. "system." All subsequent citations are to this edition.

would utilize a systems approach becomes more problematic. Nevertheless, some intellectual energy has been expended in this arena.

Although most commonly connected with the physical sciences and engineering spheres, a multiplicity of academic disciplines now employ an analysis of systems. Observing this inclusion across many fields of study, Jervis noted, "The fact that congruent patterns can be found across such different domains testifies to the prevalence and power of the dynamics that systems display."[10] While exceptionally useful in mathematics and the technical scientific disciplines, concepts in the social sciences have not included the systems perspective extensively or productively. In the field of international relations, the systems approach has been limited to examinations of the anarchical international political system, and most focus on the theoretical aspects. Prescriptions for the pragmatic application of systems theory have been less abundant.

A systems approach has been applied in the domains of political science and international security studies to a larger extent; however, employment has been more often aimed at defense planning, and the development of offensive and defensive military systems, not specifically the analysis of the systems of potential adversaries. Among the areas where a systems approach has been proposed and utilized is in the concept of Network Centric Warfare (NCW). Strategists and analysts within the U.S. defense establishment continually examine, discuss, and debate the merits of NCW.[11] There is

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10. Robert Jervis, "Complex Systems: The Role of Interactions," in *Complexity, Global Politics, and National Security*, ed. David S. Alberts and Thomas J. Czerwinski (Washington, DC: National Defense University, 1997). *Systems Analysis* is an academic discipline in its own right with a set of conventions and standards. This study will use analysis of systems in a more generic sense, extended to any examination of the interacting components of the unified whole.

11. NCW is normally considered in the context of design of military command and control systems. James Moffat, *Complexity Theory and Network Centric Warfare* (Washington, DC: DOD Command and Control Research Program, 2003), 45, describes NCW as "an emerging theory of war based on the concepts

less evidence of efforts aimed at applying these concepts to examinations of the individual and collective elements that comprise the set of a nation's assets and capabilities. One reason for this reluctance to adopt a systems-based style include the daunting task of explaining and understanding the complex nature of national systems of power, and the absence of practical tools and approaches for such analysis. What are the possible explanations for this paucity of potential solutions?

Unlike many physical structures, national and international systems are nonlinear, complex, and at times, chaotic; and the relationships between nations are complicated, and not readily explained or fully understood. There is no calculus, and there are no universal laws of relations between states that can precisely equate cause to effect. Further complicating the analysis, these systems are dynamic and reactive. In the physical world, if the force applied to an object is changed, the laws of motion lead us to expect a commensurate alteration in the resultant velocity of the object.

The effect of a standard cue ball, traveling at a certain velocity, impacting a grouping of solid and striped balls of known mass, at a specific angle of incidence, may be determined with some degree of accuracy if the environmental factors, e.g., wind velocity, temperature, humidity, etc, are known. Moreover, the effects of the secondary collisions are calculable. However, there is no equivalent equation to predict with much confidence the consequences of state actions. The law of unintended effects, i.e., there will be more than one consequence of an action, remains in force.

If a government increases the level of efforts of its actions, e.g., tightens an economic embargo against another regime, there is not a precise means of determining if

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of nonlinearity, complexity and chaos." Investigations into the use of airpower as a means of military coercion also address systems.

the resultant impact will increase proportionately, or even if there will be a variation at all. Additionally, the secondary or unintended effects of the action may work counter to the embargoing nation's objectives, such as strengthening, rather than weakening domestic support for the regime in the targeted nation. Hence, the methods of analysis that utilize a linear Newtonian approach in subjects such as mathematics and physics, have had a more limited application to description and prediction in social sciences, and particularly in international relations. However, examinations of the seemingly linear character of physical systems now include a different perspective.

Systems previously described as simple, with linear relationships between elements, are now attributed with complex nonlinear components. Investigations into chaos and complexity theories since the 1970's have resulted in nonlinear approaches in multiple scientific disciplines. While many of these are still in an embryonic stage, these advances may provide some useful application to the task of analysis in areas previously believed to be too dissimilar for useful application.

While the recognition of nonlinearity is centuries old, and the scientific community has made continuous attempts to understand and deal with this phenomenon, it is the recent advances in information systems and computer technology that are largely responsible for this increased ability to recognize nonlinear relationships. As Alan Beyerchen observed, "What is new is that computers have allowed us to attack nonlinear problems numerically, in the process highlighting patterns of instability that have captured scientific and popular imagination alike."[12] Consequently, new approaches and advances in the physical sciences may provide insights for other academic disciplines.

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12. Alan Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," *International Security* 17 (Winter 1992-93): 65.

There are benefits to a cross-disciplinary approach. As Gleick argues, "Often a revolution [in science] has an interdisciplinary character—its central discoveries often come from people straying outside the normal bounds of their specialties."[13] This excursion beyond the normal limits of foreign policy analysis is an attempt to capture and apply these central discoveries to an examination of national systems of power, specifically the consequences of actions taken by one nation against another.

I undertake this study due to the recognition that a successful employment of national, coalition or alliance power requires a holistic knowledge of the systems of power of the nation upon which the coercive actions are taken.[14] Accepting this premise, I propose an approach that uses a system of systems analysis of a nation's sources of power as the basis for assessments.

The Hypothesis and Proposition

Fundamental questions emerge in appraisals of the application of elements of systems theory, particularly the recent advances in understanding nonlinear systems, to analysis of national power. Can the process and capabilities through which a nation operates be properly described as a complex and nonlinear system? If so, do the principles of nonlinearity in other systems apply to national systems of power? If national systems of power are nonlinear; and, if fresh scientific approaches, such as chaos and complexity theories, provide aids to understanding nonlinear physical systems; can the application of the principles derived from chaos and complexity studies contribute to the

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13. Gleick, *Chaos*, 37.
14. While I will describe the approach with an individual nation as the normal target of the coercive power, the construct applies to certain non-state actors as well. I will expand on that supposition in later chapters.

understanding of national systems of power?" Stated differently: If elements of national power are nonlinear and complex; *and*, if approaches recently developed in mathematics and the physical sciences provide a means of enhanced understanding of nonlinear systems; *then*, utilization of such an approach may provide a metaphor or model for increased understanding of the system and the secondary effects of actions taken. This dissertation first will attempt to confirm the existence of the first two conditions—systems of national power are complex and nonlinear, and existing scientific approaches may be relevant to assessments of national power. Subsequently, I will provide a design for the product—a model for development of an understanding of the systems and for anticipation of secondary effects.

A fundamental assumption for the utilization of a system of systems analysis in this context is that the elements of national power are interrelated, i.e., an action upon a node (nexus, junction, leverage point) in one system is likely to have an impact on other nodes in other systems. Awareness of these interactions represents the critical output of the system of systems process. The proposition is that improved comprehension of the elements of national power, and the interactions within and between these, can provide a broader knowledge of the whole system, which may contribute to more informed decisions regarding actions designed to influence those systems.

The foundation of this premise is that a system of systems analysis of a nation's elements of national power can provide enhanced understanding of the functioning of that system. This understanding will allow for improved comprehension of the linkages between units of the system and could contribute to better awareness of secondary effects of actions. This awareness can be a useful tool for those who must consider the

alternatives in selection of the actions and resources applied to achieve desired effects. This task is not new or unique to the geopolitical environment of the early twenty-first century. Consideration of the secondary effects of actions has been an element of relations between nations throughout recorded history.

There is a need for this approach now due to the dramatically changed environment in which nations will employ coercive power. The evolving nature of conflict and the perceived decreased likelihood of symmetrical force-on-force confrontations give this study an increased relevance. Historically, wars have involved direct conflict between military forces. Hence, assessments that focused on primarily military aspects were adequate. However, the wars of the second half of the twentieth century involved more than exclusively military engagements.[15] That phenomenon is likely to continue into the twenty-first. Therefore, assessments must consider all aspects of national power.

During the Second World War, in discussions following criticism from the Vatican of Soviet actions, Joseph Stalin reportedly asked, "How many divisions does the Pope have?" While that rhetorical question may have been appropriate in large-scale wars of national survival, it was less relevant to the successors of Stalin who learned that the soft power of the Pontiff could be a powerful force. Hence, assessments must extend beyond numbers of divisions, tanks, and aircraft.

Vietnam and Afghanistan provide the models where overwhelming military force was not sufficient to achieve the respective national objectives of the United States and the Soviet Union. The economic, political, and social structures have become as

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15. Certainly, there are multiple exceptions to this trend. Korea, Falklands/Malvinas, and the 1991 Gulf War were primarily military conflicts. The Israeli military victories of 1967 and 1973 have not yet produced their primary objectives of peace and stability in the region.

important as the military correlation of forces. Conflicts that are more recent have reinforced this need to consider all elements of national power. To be effective, those who employ coercive actions must consider the entire system of power of the adversary. However, assessments still focus on the military, and examinations treat the other components of power as separate entities. There is no adequate means of developing an understanding of the system as a whole, and as a result, the ability to anticipate the effects of actions is limited. Hence, decision-makers need better models and processes.[16]

Recognition of the requirement for such tools is not new; the best strategists have always sought a comprehensive understanding of the adversary. This approach to improving the level of understanding is possible now due to the merging of new approaches to complexity and systems analysis with advances in computer processing and information technology capabilities. This synthesis of evolving concepts and information processing tools may overcome obstacles that made earlier attempts at grasping the nature of secondary effects ineffectual.

Enhanced understanding is the product of the process described in the chapters that follow. While seemingly modest, this goal is of great potential value to the decision-maker whose arsenal of analysis tools is currently limited. The inability to provide precise predictions of secondary effects does not connote that the effort is not potentially important. "Some problems are just too complicated for rational, logical solutions. They

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16. The National Military Strategy of the United States declares, "Our experiences in Afghanistan and Iraq highlight the need for a comprehensive strategy to achieve longer-term national goals and objectives. It also provides, "commanders must expect and plan for the possibility that their operations will produce unintended 2nd- and 3rd-order effects." U.S. Department of Defense, "The National Military Strategy of the United States of America," http://www/oft.osd.mil/library/library_files/document.297_MT_.Strategy/Doc.pdf, 33 (accessed 5 April 2005).

admit *insights*, not *answers*."[17] The objective of this methodology is the development of the former, as a tool to provide the latter.

The proposition does not represent a grand unification of chaos, complexity, and international relations theories that will provide a panacea of previously unattainable capabilities. It is not a "Theory of Everything" and it will not always produce lucid and unambiguous explanations of how the elements of systems interact or how the total system operates. Nor will it enable precise predictions of future events or the specific effects resulting from an action. The methodology is not an attempt to make linear, systems that are nonlinear. It is not a means of directly applying the mathematical equations developed by practitioners of chaos theory to the international relations discipline. Most importantly, it is not a repackaging of reductionist approaches hidden under the banner of chaos, complexity or other more contemporary theories.

New or improved concepts and methodologies are important to decision-makers, as well as the analysts who support them, not solely because of the perceived increased complexity of national systems, but also due to the acknowledged need to improve the ability to understand the secondary effects of actions. Recent applications of American power in Somalia, Yugoslavia, and Afghanistan provide examples where actions designed to achieve effects in support of objectives also resulted in secondary (unintended, unanticipated, undesired) effects, which may or may not have supported these overall national objectives. While not a universal remedy for this problem of contending with secondary effects of actions, this methodology may at least provide an awareness of possible secondary effects that could help mitigate their deleterious impact.

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17. A. B. Cambel, *Applied Chaos Theory: A Paradigm for Complexity* (Washington, DC: Academic Press, Inc., 1993), vi. Emphasis added. Attributed to President Emeritus of MIT, Jerome B. Weisner.

The justification for this study and proposed methodology is the need for a rudimentary tool for decision-makers to contend with the consequences of actions when dealing with complex systems of national power. This investigation into the relationship between elements of national power, and the potential for benefits of such an analysis will consider three key questions:

1. Can the sources of national power be examined and better understood through utilization of a systems approach?

2. Can the interaction between elements within a system be determined using a system of systems model?

3. Can knowledge of these interactions provide insight into the consequences of actions, including the secondary effects?

An examination of coercive power and the basic elements of systems theory will provide the response to the first question. A methodology based on a system of systems approach will address the second proposition through illustrations of the model. The response to the third question must rely on case studies to demonstrate the potential of the approach.

The answers are important to foreign policy decision-makers who must operate in an increasingly complex and interdependent geo-political environment. Actions taken to produce desired effects may also generate outcomes that are damaging to overall objectives. Therefore, identification of alternative actions is a valuable product. While the methodology can only provide estimates of general patterns of behavior, any tool or process that can provide insight into these interrelationships is useful, and the potential for exploitation is worthy of examination.

Organization of the Dissertation

I have organized this dissertation into nine chapters. Chapter II begins with an examination of what *power* means within the context of this study and how that power may be used to achieve objectives. It includes the theoretical foundations and components of power and a presentation of the relevant terminology. The focus is on coercion as the central strategy to goal attainment. The limitations of current models provide the rationale and justification for this analysis. Chapter III examines nonlinear approaches, including complexity and chaos theories, and provides an evaluation of their applicability to assessments of national power. Chapter IV describes the foundations of a systems approach and the advantages its application may contribute to assessments of national power. It also supports the contention that national systems of power are nonlinear complex adaptive systems; and, examines the impact of nonlinearity on assessments of national power.

Building upon the insights provided in the previous sections, Chapter V describes the system of systems approach and presents a methodology for its utilization in assessments of national power. Chapters VI through VIII utilize case studies to examine three distinctive episodes where elements of a system of systems approach were used (although not necessarily overtly) with varying degrees of success. An ex post determination of the effects attained, and how these supported the declared objectives, provides the foundation for the analysis contained in these sections. The final chapter synthesizes the insights from the case studies and summarizes the contention that a system of systems analysis may be useful in the understanding of secondary effects. With the rationale for the study presented, the systems approach introduced, the hypothesis

stated, and the structure outlined, I will now commence with the first essential task—an

examination of the concept of power.

CHAPTER II

THE EFFECTS OF THE APPLICATION OF COERCIVE POWER

Nations apply coercive power in order to produce effects that support objectives. While they may achieve success in the generation of the primary effects, the same actions may also be the cause of secondary consequences. Although there is wide acknowledgement of the problem presented by the phenomenon of secondary effects, there currently are no practical models available to decision-makers that focus on the unintended, unexpected, or undesired effects resulting from actions intended to influence the behavior of other actors. Accepting this premise, a reasonable conclusion becomes that an enhanced method and tool set for this task could be useful.

If adequate instruments were available to the decision-maker that could provide some level of understanding of both the primary intended, as well as the secondary effects, there would be little justification for this analysis and proposition. However, a review of the existing literature suggests that this is not the case and that the ability to do so is at best limited; or at worst, non-existent. Therefore, a vital initial objective is to provide evidence that demonstrates that currently available tools and processes are not sufficient for a comprehension of the effects of actions. It is not possible to accomplish this task without a preliminary examination of the theoretical foundations of the application of coercive power, the rationale for its use, and the factors that make the calculus regarding effects nonlinear and complex.

Since the primary utility of the proposed methodology is within the context of the use of power to influence behavior, this chapter will begin with a brief examination of the

sources of national power, identifying key elements and providing basic definitions upon which to base the discussions that follow. This includes a description of how national power is comprised of a set of interrelated components. Because power is such an expansive concept, this coverage will be rather cursory and will provide only the essentials necessary for subsequent discussion of the points upon which I base the construct of the proposition. The focus will be on the application of power to influence the behavior of other actors.

Coercion best describes the type of power application central to this study, and I will examine it in some detail in the second section of the chapter. This concentration is necessary, since coercive actions are the major source of the effects for which this inquiry hopes to provide some level of increased understanding. If coercion is the chosen strategy, then currently available methodologies are not adequate for envisaging the inevitable secondary effects resulting from coercive actions. This segment includes an overview of the decision-making process related to the selection of coercive actions. Again, this is a vast area for consideration, crossing multiple academic disciplines, and I address it in a level of depth only sufficient to support the proposition.

Subsequently, I will provide an examination of the impact of linkages, along with illustrations of why current methodologies are insufficient, since they do not provide the requisite holistic knowledge of the relationship between elements within the larger system. A primary cause of this comprehension deficit is often the result of attempts to apply linear concepts, models, and thinking to nonlinear systems. This assertion requires an introduction to linearity and consideration of arguments as to why it is an inappropriate approach to understanding the effects of actions. That supposition will

segue into an examination of nonlinearity and the consequent complications to development of any practical predictive capability. This leads to the conclusion that linear approaches are inadequate for the task, and provides the prologue for the investigation into the benefits of nonlinear approaches that I present in Chapter III.

Concepts of Power

An analysis of power first requires some agreement on a definition of the term. Reduced to a simple statement, power is the ability of A to get B to do something B would not otherwise do at a reasonable cost to A. Hence, power is the ability to change behavior. In a variety of permutations, this concept of power is central to debates in international relations theory.

Power is a fundamental, and some argue the most important, factor in the relations between states. Not surprisingly, the concept of power has been the subject of an immense amount of study, analysis, and contention, and has generated an enormous amount of academic discourse. There is no intention to capture the entirety of that trove of data here, or to provide a treatise on contemporary political theory regarding the interactions between nations. However, development of a theoretical foundation upon which to base the proposition contained herein is important to providing an understanding of the proposed methodology.

Traditional realist thought explains the international system primarily in terms of the distribution of power. This relative power relationship, derived from assessments of capabilities, represents a key factor in policy decisions and the determination of outcomes. Hans Morgenthau and Kenneth Thompson assume that political leaders think

and act in terms of interest defined as power, which they define as, "man's control over

the minds and actions of other men."[1] They distinguish power from the application of

force, useable from unusable power, legitimate from illegitimate power, and hence, the

differences between political and military power. Additionally, they identify the

"elements of national power," which are distinguished by those that are relatively stable,

such as geography and natural resources, and those which are subject to change,

including national morale and the quality of government and of diplomacy.[2]

While he disagrees with many tenets of the traditional realist approach, Joseph

Nye offers a definition similar to its advocates. He argues, "Power is the ability to

achieve one's purposes or goals:" and contends, "Power is often equated with resources

and requires an ability to convert this potential power into realized power (the ability to

change the behavior of others)."[3]

David Baldwin also equates power with the ability to influence or control, but

contends that the essential element in any discussion of power must be scope and

domain.[4] He believes it important to distinguish between *power* and *capabilities*. Baldwin

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1. Hans J. Morgenthau and Kenneth W. Thompson, *Politics among Nations*, 6th ed. (New York: Alfred A. Knopf, 1985), 32. Presenting a realist perspective, the authors justify their approach to the definition of power in the relationships between nations. "The concept of interest defined as power imposes intellectual discipline on the observer, infuses rational order into the subject matter of politics, and makes the theoretical understanding of politics possible" (ibid., 5).

2. Ibid., 27-169. Among the subsets of natural resources are food and raw materials. It is the contribution of these, along with geography and industrial capacity, to another factor, military preparedness, that provides their importance to national power.

3. Joseph S. Nye, Jr., "The Changing Nature of World Power," *Political Science Quarterly* 105, no. 2 (Fall 1990): 177-78. He contends that power "is easier to experience than to define or measure," but nevertheless proposes, "the ability to do things or to control others." He also offers Robert Dahl's "the ability to get others to do what they would not otherwise do." In a later work, Nye defines power as "the ability to produce the outcomes you want." Joseph S. Nye, Jr., "The Velvet Hegemon," *Foreign Policy* May-June 2003, 74. He elaborates, "Soft power is the ability to secure those outcomes through attraction rather than coercion."

4. David A. Baldwin, *Neorealism, Neoliberalism, the Contemporary Debate* (New York: Columbia University Press, 1993), 15. He provides additional views on the "troublesome" term "power," including Robert Gilpin's 1975 observation that "the number and variety of definitions should be an embarrassment to political scientists."

also observes that a user of the latter term must consider the "capability to get whom to do what?"[5] Similarly, Robert Keohane views Morgenthau's definition as "murky" in that it fails "to distinguish power as a resource (based on tangible as well as intangible assets) and power as the ability to influence others' behavior."[6]

In the neorealist viewpoint of Kenneth Waltz, "To use power is to apply one's capabilities in an attempt to change someone else's behavior in certain ways." To define 'power' as 'cause' confuses process with outcome."[7] The important factor to Waltz is relative, not absolute power. Gains and declines in power are important only in their relationship to those of other actors.

Moving beyond neorealism, Stefano Guzzini examines the concept of structural power, which he describes as "indirect institutional power."[8] This widening of traditional concepts of power to include features such as indirect institutional and unintended effects is important to this study since an understanding of these types of effects is a major rationale for the conduct of a system of systems analysis.

To those within the liberal or *institutionalist* camp, power remains an essential element in international relations. They contend, however, that power in its purest sense may not be the most critical factor. Rejecting the realist model, they contend that other factors, such as the impact of information, domestic institutions, and international

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5. Ibid., 17.

6. Robert O. Keohane, *Neorealism and Its Critics* (New York: Columbia University Press, 1986), 11. He also observes, "Theories based solely on definable power capabilities have proven to be notoriously poor at accounting for political outcomes." He later advocates, "When trying to explain a set of outcomes in world politics, always consider the hypothesis that the outcomes reflect underlying power resources, without being limited to it" (ibid., 185).

7. Waltz, *Theory of International Politics*, 191. In his analysis, "The first concern of states is not to maximize power but to maintain their positions in the system." Hence, "power is a means and not an end" (ibid., 126). He adds "To define 'power' as 'cause' confuses process with outcome" (ibid., 191).

8. Stefan Guzzini, "Structural Power: The Limits of Neorealist Power Analysis," *International Organization* 47, no. 3 (Summer 1993): 451. These notions of structural power contain varied categorizations of power. Among these are indirect *institutional power, nonintentional power*, and *impersonal empowering* (ibid., 450).

regimes, provide an improved underpinning for understanding. A third, but less developed *epistemic* paradigm, focuses on the impact of collectives, ideas, roles, and beliefs.[9]

While this pithy theoretical discourse regarding the concept of power provides a necessary foundation for further analysis, its inclusion does not represent a primary objective of this study. The key factors in this examination are the components of power, and the essential question becomes, what factors comprise a nation's overall system of power?

Across the theoretic spectrum, most analysts essentially agree that assessment of power resources is not as straightforward or as palpable as the counting of ships, tanks, and aircraft. This type of analysis is relatively simple, has been attempted before, and has proven to be of only partial value. The overall system of power may include more hidden and nebulous factors.

John Mearsheimer differentiates between military and latent power, the latter referring to the socio-economic ingredients that go into building military power.[10] Keohane, Nye, et al, contend that power goes beyond Mearsheimer's limited view of military power as the principal indicator of overall power. They identify multiple

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9. Jeffrey W. Legro and Andrew Moravczisik, "Is Anybody Still a Realist?" *International Security* 24, no. 2 (Fall 1999): 10. Along with the epistemic model, they identify another two paradigmatic alternatives to realism: (1) institutionalist, which "contains theories and explanations that stress the role of international institutions," and (2) liberal, whose theories "stress the role of the exogenous variation in underlying state preferences." Although, as the title would indicate, the authors are particularly critical of the realist model, this article represents one of the best available sources for comparison of the most prominent theories of international relations.

10. John Mearsheimer, *The Tragedy of Great Power Politics* (New York: W.W. Norton and Company, Inc., 2000), 55-56. The basis of power is the particular material capabilities that a state possesses. See discussion on wealth and power, 55-82. Both latent and military power will be considered elements in the broader characterization of national power used in this study, since it is these socio-economic elements, along with the more commonly explored political-military power, that comprise the system of national power.

additional components and dispute his view that socio-economic factors are important only in the degree to which they support or enhance military power.

Regardless of their theoretical persuasion, most investigators into the nature of power describe it as a multifaceted issue, i.e., not based on a single source. Power may have tangible and intangible manifestations. It is possible to readily identify and enumerate some of these, such as the components of a highly developed electrical power distribution network. Others, such as moral and cultural influence, are more esoteric and difficult to quantify. The debate is largely over degree of importance, not over whether less concrete factors, such as ideas and beliefs, are part of the power equation. Hence, for the purposes of this constrained analysis, the differences between the views of Mearsheimer, Waltz, Nye, and Keohane provided earlier are not considerable.

This brief excursion into concepts of power produced three tenets that are important to this analysis: (1) power includes the ability to change behavior; (2) while theoretical divides exist, power is a major element in relations between states; and, (3) power is comprised of multiple elements, and these elements may be physical or intangible. Further discussion and confirmation of the limitations of current models and tools requires an examination of the components of national power.

Elements of Power

Having established that national power is multifaceted, it is worth some effort to identify a few of the elements that contribute to it. As addressed earlier, national power most often equates with military might. Ancient Greece extended its influence through its skilled use of the phalanx and trireme; the British Empire through sea power; and the

Post-World War II United States by its nuclear arsenal supplemented by potent

conventional forces. Although, as Nye and others insightfully point out, the total

influence of Greece, Britain, and the United States extended beyond raw military power.

Military conquest may be ephemeral. The culture of ancient Greece permeates the

western world; while little remains of the Mongol martial victories.

Despite a general acknowledgement of power as a multifaceted concept, there is

little agreement as to the number of categories or to their respective boundaries. In the

literature discussed in earlier paragraphs, military power was included in nearly every

theoretical viewpoint. Mearsheimer assigns socio-economic power to the role of

supporting elements of military power. Waltz allows for some basic decomposition and

includes military, economic, and political potential as components in power assessments.

Nye has offered *soft power* to the discussion.

While the specific means of acquiring and applying this power may have varied,

historically the major manifestations of national power have been military might,

supported by economic capacity. Certainly, military power is itself comprised of multiple

capabilities and resources such as population, degree of industrial or technological

development, natural resources, etc.[11] These assets are often regarded as sub-elements of

economic power.

Klaus Knorr observes, "We distinguish between military power, economic power

and political penetrative power."[12] This distinction becomes germane and helpful in

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11. Joseph S. Nye, Jr., "Soft Power," *Foreign Policy*, Fall 1990, 153-71. Because the ability to control others is often associated with the possession of certain resources, politicians and diplomats commonly define power as the possession of population, territory, natural resources, economic size, military forces, and political stability." He adds, "The factors of technology, education, and economic growth are becoming more significant in international power" (ibid., 154).

12. Klaus Knorr, *The Power of Nations* (New York: Basic Books, Inc., 1975), 6. In the last category, he includes propaganda and other information-centric actions.

discussions regarding interconnectedness and interdependence of activities. In an examination of the structure of international trade, Steven Krasner observes this wide range of power and proposes a classification of elements: "At least four major state interests affected by the structure of international trade can be identified. They are political power, aggregate national income, economic growth, and social stability."[13]

Historically, most categorizations of power have included groupings under military, economic, and political elements. However, Nye sees three sources of power: military, economic, and soft. He has written extensively on the concept of soft power, which he attributes with the ability to influence without coercion. Resources such as technology, culture, ideology, and education all contribute to the calculation of a nation's soft power. Nye views both military and economic power as examples of hard power that could induce others to alter their behavior or positions. Although hard power may be exercised through inducements or threats, "soft power co-opts rather than coerces."[14] In the context of this study, I will consider both hard and soft power in the assessment of national power.

While inclusion of political, military, and economic elements of power is not particularly contentious, visualizations that are more recent describe power in additional terms. This has necessitated the broad category of *social,* which can have cultural, ethnic, religious, and informational components. Adding to the confusion, Guzzini introduces the

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13. Steven D. Krasner, "State Power and the Structure of International Trade," in *International Politics,* ed. Robert J. Art and Robert Jervis (Glenview, IL: Scott Foresman and Company, 1985), 341. Krasner views power as the possession of control over resources. He expands on this concept of power as being also a source of influence in Steven D. Krasner, "Regimes and the Limits of Realism: Regimes as Autonomous Variables," *International Organization* 36 no. 2 (Spring 1982): 497-510.

14. Joseph S. Nye, Jr., *The Paradox of American Power* (New York: Oxford University Press, 2002), 9. Following on to previous writings, Nye explains that soft power is "not the same as influence, though it is one source of influence," and in an interesting comparison, contends that soft power "like love is hard to measure and to handle" (ibid., 12).

concept of "indirect institutional power." Hence, there are no universally accepted criteria for categorization or description of the elements of power.

While perhaps professionally discouraging, this condition does not render this analysis unachievable. It is the interaction of the elements, not the broad categorizations, which is critical to the proposition. Therefore, an arbitrary segregation into broad groupings for analysis is justified. For purposes of the discussion of the interactions to follow, I consign the elements that comprise the overall system of power into four major categories: political, economic, military, and social.[15]

Specific elements or sources of power are easier to identify than they are to assign to a particular category. For example, most would probably consider a nuclear powered aircraft carrier an element of military power. However, others are less obvious. Should a religious leader in a theocracy be classified as a political, social, or economic node? One could make compelling arguments for inclusion in any one, or in all three categories. Chapter V outlines a methodology that offers some practical means of overcoming this dilemma, but for purposes of the discussion contained here, I defer that issue, and a preliminary examination of interrelationships between elements will be undertaken first.

Relationship between Elements of Power

While the elements of economic and military power are mutually supporting, the temporal order of acquisition is not universally consistent. Historically, military power was a means to attain economic assets. The Mongols, Huns, and Vikings all used military power to achieve economic resources. More recently, economic prosperity enabled the

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15. I present this initial categorization of the subsystems now in order to facilitate understanding of the issues addressed in this chapter. I will be define and develop in the chapters that follow the criteria for inclusion of specific elements, as well as the scope and boundaries of these categories.

acquisition of modern weaponry. The economic assets gained from sixteenth century Spain's American colonies allowed her to mount a challenge to British sea power. In a modern example of economic power enabling military power, the sophisticated weapon systems possessed by many middle-eastern nations is a direct result of their oil wealth. In many cases, these factors are so closely interrelated that any discussion of what came first—economic or military strength—becomes irrelevant.

External to the categorization issue is the interrelationship of elements within and across the arbitrary boundaries established earlier. Waltz contends, "The economic, military, and political components of the capabilities of nations cannot be sectored or separately weighed."[16] However, acceptance of this argument does not connote that the separate parts are exchangeable. If power is a combination of capabilities provided by the various elements, the question emerges as to whether these elements or types of power may be interchanged. For example, can economic power be a substitute for military power? If soft power is a viable concept, then is its utilization possible instead of the more aggressive manifestations of hard power?

David Baldwin looks at the issue of fungibility as the ability to transfer power, or, "the ease with which capabilities in one issue-area can be used in other issue-areas."[17] He argues that power is not always fungible. Instead, multidimensional is a more accurate depiction. The common perception of power in the social sciences is, "a type of causal relationship in which the power wielder affects the behavior, attitudes, beliefs, or

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16. Waltz, *Theory of International Politics*, 31.
17. Baldwin, *Neorealism, Neoliberalism, the Contemporary Debate*, 20. The high-fungibility assumption is more useful in the longer the period. In his view, "In politics as well as in economics, more things are fungible in the long term than in the short."

Manifestations of attempts by nations to influence the behavior of others are frequent, reoccurring, and varied. Actions may deny an opponent some vital commodity; punishment may be the primary intent of others. The objective may be to maintain the status quo, i.e., at least one opponent is convinced not to take actions that are counter to the interests of another. In other instances, the goal may be to get the adversary to take actions that they would not undertake without the threat or application of power. Making the cost of resisting appear to be greater than the costs of complying is a means of accomplishing both goals. Therefore, the objective just as well may be to influence an adversary not to do something, as it may be to induce an action. Attempts to prevent actions that have not yet materialized may be categorized as *deterrence*, while those intended to reverse an action or alter the status quo normally are considered *compellence*.

The U.S Department of Defense defines deterrence as "The prevention from action by fear of the consequences intended to prevent an action."[19] Two potential adversaries, currently at peace, making efforts to persuade the other not to embark upon courses of action normally characterize deterrence. Compellence is similar, in that the basis of the concept is convincing the adversary that the costs exceed the payback. In the case of compellence, however, the objective is for the opponent to elect to undertake an action because it evaluates the benefits of doing so to outweigh the consequences of not taking the action. Compellence and deterrence combined may be regarded as subsets of coercion.[20]

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19. *U.S. Department of Defense*, "DOD Dictionary," http://www.dtic.mil/doctrine/jel/doddict/ data/d/01641.html (accessed 27 September 2004). Expanding on this concept and addressing the multifaceted nature of power, the dictionary defines *deterrent options* as "a course of action, developed on the best economic, diplomatic, political and military judgment, designed to dissuade an adversary from a current course of actions or contemplate operations."

20. Deterrence itself has many faces, and may be categorized into general deterrence and immediate deterrence. Immediate deterrence is the type germane to this study. See discussion in Daniel Byman,

Arguments over characterization can result over whether deterrence actually represents a change in behavior, and if strategies that employ denial and punishment are in themselves types of coercion. Avoiding that semantic trap, this project will focus on the more active means of eliciting behavioral change. While the proposed methodology is applicable in other schemes, it is most relevant to the use of coercion and the subsequent case studies will focus on this method. Therefore, further analysis warrants an inclusive inquiry into the concept of coercion.

Coercion

As with much terminology in the social sciences, there is no universal agreement on the definition of coercion, or on its scope and boundaries. Acknowledging that condition, further investigation requires acceptance of definitions that are harmonious with typical, albeit not all, understandings, and that are satisfactory for presentation of the methodology to follow in later chapters.

Dictionary entries include defining *coerce* as, "to enforce or bring about by force or threat."[21] Karl Mueller provides a broad definition in describing coercion as, "a matter of changing the adversary's expectations to make compliance with the coercer's demands appear more attractive than resisting them."[22] The definition is independent of the means used to achieve this coercion. Methods range from the application of overt military force, to economic sanctions or political initiatives, and these may take the form of carrots

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Matthew C. Waxman, and Eric V. Larson, *Air Power as a Coercive Instrument* (Santa Monica, CA: RAND, 1999), 9-13.

21. Webster's New Collegiate Dictionary, s.v. "coerce." To add to the confusion in commonly utilized terms, another offering is "to compel to an act or a choice."

22. Karl Mueller, "The Essence of Coercive Air Power: A Primer for Military Strategists," *Air and Space Power Chronicles.* September 2001, 5. He includes in his definition both *deterrence* (making the adversary not do something) and *compellence* (making an actor take an action that he normally would not). Much coercion lies in the gray area between these.

(promise of rewards) or sticks (threats of punishment). Importantly, Mueller stresses that the choices are relative vice absolute. Successful coercion only must make the coercer's preferred action to be more appealing to the adversary than the action it would take in the absence of the coercive effort.

Thomas Schelling makes the important distinction that while the use of military force may at times be an instrument of coercion, its employment does not connote that coercion has occurred. Coercion has as its goal a change of behavior. It requires "finding a bargain," that is, arranging for the adversary to believe himself to be better off by doing what the coercer wants; worse off if he does not.[23] If sufficient military force is available, a nation may not have to take any purely coercive actions. Based on this disparity, it can simply take or do what it wants.

A RAND study offers, "Coercion is the use of threatened force, including the limited use of actual force to back up a threat, to induce an adversary to behave differently than it otherwise would."[24] This view stresses the advantages of displays of force as threats, over what Schelling describes as the employment of military capabilities as brute force. Compellence is exceptionally difficult to distinguish from deterrence and in practice, "they tend to blur."[25]

Robert Pape offers, "'Coercion' means efforts to change the behavior of a state by manipulating costs and benefits."[26] He does not consider deterrence to be a subset of

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23. Thomas C Schelling, "The Diplomacy of Violence," in *International Politics*, ed. Robert J. Art and Robert Jervis (Glenview, IL: Scott Foresman and Company, 1985), 173. Some actions may do both. He uses the example of the Soviet crushing of the Budapest uprising in 1956. This application of power solved the immediate Hungarian problem for them, but also had a coercive effect on other Warsaw Pact nations, especially Poland.
24. Byman, *Air Power as a Coercive Instrument*, 9.
25. Ibid., 11.
26. Robert Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca, NY: Cornell University Press, 1996), 4. Here he differs from Mueller by equating coercion with compellence.

coercion. In his view, coercion differs from deterrence only in that the intent of the former is to alter the behavior of an adversary while the latter seeks to maintain the status quo. He concurs with Mueller's observation that non-military means may be used in coercive efforts, but contends that military actions deserve special attention because they represent the most common applications.

Alexander George provides a different perspective in his examination of coercive diplomacy, the central task of which is, "To create in the opponent the expectation of costs of sufficient magnitude to erode his motivation to continue what he is doing." He provides two major types of coercion, offensive and defensive. The former is described as blackmail and is the expectation that the opponent will give up something without resistance. The aim of the latter is convincing the opponent to stop an action or undo those already accomplished. Force is to be used in an exemplary manner—to persuade, rather than to bludgeon. Through coercive diplomacy force becomes, "a much more flexible, psychological instrument of policy."[27]

Pape segregates theories of coercion into four broad groupings: (1) Balance of resolve—the state with the greater resolve prevails; (2) balance of interests—the edge goes to the protagonist with the largest stake in the outcome; (3) vulnerability of the civilian population to air attack; and, (4) balance of forces—ability to strike an adversary's military targets. He believes these theories to be incomplete and possessing

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27. Alexander L George, David K. Hall, and William E. Simmons, *The Limits of Coercive Diplomacy: Laos, Cuba, Vietnam* (Boston: Little, Brown and Company, 1971), 18. This strategy focuses on affecting the opponent's will rather than capabilities. Force goes beyond being merely an instrument of military strategy; it becomes subordinated to a political-diplomatic strategy. See also Alexander L. George, *Forceful Persuasion: Coercive Diplomacy as an Alternative to War* (Washington, DC: United States Institute of Peace, 1991), 5. Here he contends that both blackmail and coercive diplomacy would be included in Schelling's definition of compellence. George prefers to distinguish between the two in order to "emphasize the possibility of a more flexible diplomacy that can employ non-coercive persuasion and accommodation as well as coercive threats."

limited explanatory power, since they often represent single factor explanations.[28]

Additionally, he contends it is not the intentions or the behavior of the coercing state that is most critical to defining coercion, rather it is the, "nature of the decisions faced by the potential target states."[29] In his view, success or failure of coercion is in the final analysis a function of the target state's decision process. Consequentially, knowledge about the nature of this process is critical to the planning and execution of coercive actions.

In the evaluation of coercive threats, nations commonly use three factors: credibility, capability, and communication. Is the threat credible? Does the target believe that the coercive action will actually be carried out? Capability: Does the coercer actually have the ability to fulfill the threat? Communication: Is the signal and intent clear, and is the message transmitted the same as the message received? Applying examples from 1961 Cuban Missile Crisis: Did the Soviets believe that the U.S. would go to war over Cuba? Did they believe that the U.S. had the military power to destroy the missiles in Cuba or to launch a strike against the Soviet homeland? Was Kennedy's threat clearly communicated to Khrushchev? Without attempting to reproduce or even to summarize

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28. Pape, *Bombing to Win*, 4-7. Pape considers air power as a principal, but not the sole manifestation of effective coercion. He also contends, "Coercion is generally assumed to operate according to the same principles as deterrence" (ibid., 6). He views these as distinctly different activities, with coercion being more difficult.

29. Ibid., 12. He argues that the target states must decide to make concessions or accede to demands. This is more important to success of coercion than the nature of the threats. He has developed an equation to display the logic of coercion:

R	$= B\,p(B) - C\,p(C)$, where
R	= value of resistance
B	= potential benefits of resistance
p(B)	= probability of attaining benefits by continued resistance
C	= potential costs of resistance
P(C)	= probability of suffering losses

the volumes dedicated to this event, analysts and historians generally agree that the answer to all three questions would be yes, and that the coercion was successful.[30]

This section provided a brief examination of coercion and concluded: (1) definitions and categorization can vary, but Pape's "efforts to change the behavior of a state by manipulating costs and benefits" is appropriate for purposes of this study; (2) coercion may be employed through multiple methods; and, (3) affecting the expectation and perceptions of the adversary is the critical element in coercion. This last observation is the most significant aspect of the application of power.

With this examination of coercion complete, the next step is to develop an understanding of the factors that will cause an adversary to select one course over another, i.e. what actions will cause the opponent to conform to the objectives of the coercive power? This requires an examination of the components and processes of decision-making.

Selection of Alternatives

Thus far, this chapter has looked at the specific applications of power rather than at power in a broader sense. While the overall equation of relative power is important, it is not the primary consideration here. The relative power of adversaries is not the most important factor to this endeavor. Rather, it is the quality and utility of the knowledge base that supports decisions to take actions that are intended to coerce behavior. Regardless of how systems of power are organized and how the components interact, at

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30. Mueller, "The Essence of Coercive Air Power," 4, proposes the categories of threats, and notes, "coercion is a matter of the adversary's perceptions, it depends upon a set of subjective factors." A variety of interpretations of the crisis exists. The degree of employment of these criteria for coercion and the degree to which they were successful remains a topic for debate.

some point an explicit decision concerning possible actions must be made. Those decisions rely on knowledge.

Within the context of this study, the consideration of secondary effects is part of the decision calculus. That decision-making process is important whether the understanding of potential secondary effects is deep and exhaustive, or thin and cursory. Hence, a brief discussion of decision-making in the selection of alternatives for the use of coercive power is germane to this discussion.[31]

The debate over the rules that lead to decisions is animated and wide-ranging. Extending beyond the traditional political science and international relations fields, psychology and sociology have contributed to the debate. While other explanatory alternatives exist, the rational actor and cognitive psychology schools contribute the most models, and the relative merits of these have provided the largest amount of discourse and contention.[32]

Tracing its antecedents back to the 1940's, the rational school assumes that utility and optimization of results are the primary goals of the decision-maker. Simply put, the premise is that the actors will operate in their own self-interest. In its most basic sense, the process includes determining the possible results of a decision, evaluating the probability of the outcomes, and selecting the alternative that provides the best

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31. Ryan Beasley, "Collective Interpretations: How Problem Representations Aggregate in Foreign Policy Groups," in *Problem Representation in Foreign Policy Decision Making*, ed. Donald A. Sylvan and James F. Voss (Cambridge: Cambridge University Press, 1998), 109. He contends that many analysts believe that policymaking is more than simply making decisions. He advocates the use of the term *foreign policy problem solving*, which he believes to describe more appropriately, what is accomplished when a decision is made.

32. The plural must be emphasized; there is no single "rational' model, and many cognitive models of choice exist.

potential.[33] Mueller contends that coercion theory, "does assume a minimal amount of rationality in the target state's behavior," but believes that it is more accurate to require only that the "adversary state not behave *ir*rationally."[34]

Proponents of the cognitive (or psychological) model do not fully agree with the basic premise of actors' striving to maximize utility. In their view, choices normally are made for reasons that cannot be explained by a utility calculus. Those on the cognitive side of the debate tend to focus on filters through which people process information and which can lead to "conflicting expectations about judgment and behavior."[35] Critics of cognitive models point out that the psychological approach does not provide additional explanatory power. However, they often will concur with the contention that the rational approach has inherent limitations and does not provide a total explanation for decision-making. While this debate is useful in analyses of the decision-making process, for the purpose of this proposition it is sufficient to recognize that choices may not always be understood or completely explained. This would apply to coercive actions taken to influence the behavior of others.

Alex Mintz contends, "people/leaders/decisionmakers use a mixture of choice strategies (analytic, cybernetic, cognitive) on route to a decision."[36] That conclusion is fitting and adequate for the purpose of this endeavor, which focuses on enhancing the

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33. Alex Mintz, "Foreign Policy Decisionmaking: Bridging the Gap between the Cognitive Psychology and Rational Actor Schools," in *Decisionmaking in War and Peace*, ed. Nehemia Geva and Alex Mintz (Boulder, CO: Lynne Reinner Publishers, 1997), 11-30. This collection provides an in-depth analysis of the debate and includes chapters on Prospect Theory and Poliheuristic Theory. I will not consider these approaches further.

34. Mueller, "The Essence of Coercive Air Power," 5. Italics in original.

35. Janice Gross Stein and David A. Welch, "Rational and Psychological Approaches to the Study of International Conflict: Comparative Strengths and Weaknesses," in *Decisionmaking in War and Peace*, ed. Nehemia Geva and Alex Mintz (Boulder, CO: Lynne Reinner Publishers, 1997), 5. The authors do not view cognitive psychology as a "true competitor to rational choice," but believe it to be useful in determining why deviations from the rational ideal take place" (ibid., 54).

36. Mintz, "Foreign Policy Decisionmaking," 215. The consensus of the contributors to this collection is that these approaches are not competing, but rather are complementary.

knowledge upon which decisions are made, not the mental processes that are used to formulate them. While examination of the latter issue is an important effort, I leave it to others.

Having selected appropriate understandings of power and coercion, and having concluded that decision-making is not an entirely rational process; the discussion may now consider how these theoretical constructs apply to the existing international environment. I will examine the systems approach in some detail in Chapter IV. However, for the sake of clarity in this discussion related to linkages, broad elements of power, i.e., political, economic, military, and social, I will refer to as systems. This perspective provides a basis upon which to develop further the suppositions that provide the foundation of this proposition.

I base this proposition on a primary assumption of the existence of connections between elements of national power. The elements are interrelated but are not universally substitutable. That is, although economic power may not be metamorphosed directly into political power, they both contain interconnected and interrelated elements of the same overall system of power. Therefore, by extension, an influence applied upon one of these interconnected elements is likely to produce a secondary effect on the other, as well upon any nodes or elements connected further within the network.

While this premise will be developed further in subsequent chapters, a brief departure is warranted in order to describe the environment where these assumptions would be applied. The identification of interrelated sources of power is not a new revelation. There is no major epiphany in that realization. The more important question is

whether this recognition of interrelated elements is transformable into a practical model for decision-makers. The issue of linkages, therefore, becomes the next topic to consider.

The Impact of Linkages

Earlier sections contain the contention that elements of power within a holistic system are interrelated. The existence of linkages between elements of national power is not often contested. However, transformation of this recognition into an understanding of how this condition can influence applications of coercive power is not abundant. Linkages are the critical element in this analysis, since they provide an indicator of where and when secondary effects of actions may occur.

Linkages vary greatly in type of relationship and intensity. Mere geographic proximity provides one type of linkage. Tribal or ethnic identity, political allegiance, religious sect membership, and economic dependencies also provide some type of connection. Evaluation of linkages includes an awareness of the general nature of the relations and interactions that exist between entities. J. David Singer considers these linkages to be in the horizontal plane (among entities is the same subsystem) and vertical and diagonal planes (linking entities across different sub-system classes).[37] Hence, multiple economic entities, e.g., mines, factories, banks, etc., may be related. However, each of these also may link to a political leader, foreign supplier, or transportation facility.

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37. J. David Singer, "The Global System and Its Sub-Systems: A Developmental View," in *Linkage Politics*, ed. James N. Rosenau (New York: The Free Press, 1969), 35. Singer observes the "operational substitutability of *interaction* and *interdependence*, but believes these to be conceptually distinct. That distinction is not important to this discussion and both types of relationships will be included as indicators of linkages. Additionally, he does not "consider it useful or necessary to define the boundaries among social, economic, or political phenomena" (ibid., 24). "It makes little sense to differentiate between polity, economy, and society, intertwined as they are, unless one is trapped in a 'functionalist' matrix" (ibid., 30).

Figure 1 provides a simplified illustration. It depicts three subsystems: economic, political, and social. Each box represents an entity within one of those subsystems. The lines indicate that a relationship exists between the connected elements.
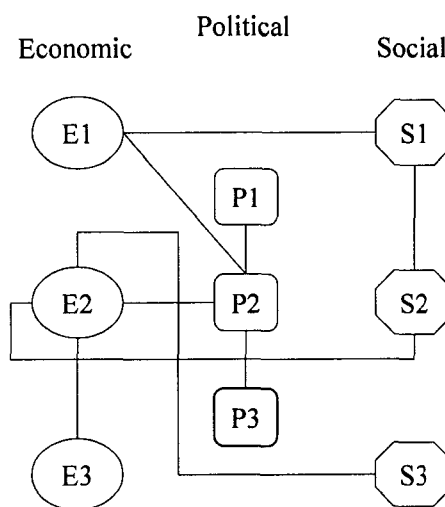
Figure 1. Linkages within and across Subsystems

Economic entity E2 is interrelated with another economic node (E3). It also relates to an entity within the political subsystem (P2), as well as a social node (S2). For example, E2 could be a major industrial facility. It links to P2, for example, because the factory owner is a political supporter of the prime minister. E2 also connects to S2, which could be an ethnic group that comprises the majority of the factory's workforce. Hence, an action taken with the intent of influencing E2 may also produce a second order effect on E3, P2, and S2; and third order effects on the elements connected to those entities, e.g., P3 and P1.

This simple illustration appears to provide no major intellectual challenges. Reasonable estimates of where secondary effects can occur may be readily determined. However, because some entities have multiple linkages, the results of an action upon one of these, e.g., E2, produces results that are indeterminate. This exacerbates the analytical challenge further in actual applications since even the least industrially and technologically advanced nations have a number of entities and linkages that defy precise analysis. Thus, an understanding of the impact of linkages is no simple task.

In 1969 Rousenau observed, "political science as an intellectual discipline has yet to develop theoretical constructs for explaining the relations between the units it investigates and their environments."[38] He defines linkage, "as any recurrent sequence of behavior that originates in one system and is reacted to in another."[39] Nearly thirty years later, Robert Jervis opined, "In politics, connections are often more idiosyncratic, but their existence guarantees that here too most actions, no matter how well targeted, will have multiple effects."[40] The existence of multiple effects resulting from the linkages between elements justifies the conclusion that reductionist approaches and methods that employ a linear analysis are not suitable for the determination of secondary effects of actions. Before assessing currently available tools as inadequate, it is important to define the uses for which they are lacking.

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38. James N. Rosenau, *Linkage Politics*, ed. James N. Rosenau (New York: The Free Press, 1969), 4. Advocating more work in this arena, he argues, "The need for linkage theory is multidimensional." The examples suggest that political analysis would be "greatly facilitated if propositions that link the stability, functioning, institutions, and goals of national political systems to variables in their external environments could be systematically developed (ibid., 7).

39. Ibid., 45. He distinguishes between outputs, which are conventionally called a nation's foreign policy, with inputs, or the reaction in the other system. In this *reactive process*, the behavior of the latter is a response to the actions of the former.

40. Jervis, "Complexity and the Analysis of Political and Social Life," 571. He cautions against the inappropriate use of reductionism and rejects the reductionist claim that "the system is 'nothing' but individual behaviors" (ibid., 573).

Utilization of coercive power with the objective of changing behavior through manipulating perceptions of costs and benefits requires knowledge of the adversary's system of power. The decision as to what course to undertake requires determination of a cause and effect relationship, i.e., what action will produce the desired effect? In the simple physical world, this relationship may be readily determined. In a vacuum, application of a force will result in a predictable effect. However, when environmental conditions are considered, such predictions become more problematic. When we add multiple actions to the equation, then the foreknowledge of results becomes even more imprecise. Since these conditions exist in the world in which the decision-maker must operate, the process is complicated and simple solutions are impracticable.

At the outermost limits of the range of options are two radically diverse alternatives. The first is to declare the quandary to be too challenging, and to abandon the idea of ever being able to develop practical models and methods that can aid the policy maker. The other extreme is to inappropriately oversimplify the situation, ignore the complicating factors, and assume the absence of nonlinear conditions. The former course involves surrender to complexity, and does not provide much opportunity for further productive analysis. However, an exploration into the common errors associated with the attempts at the latter course, including the peril inherent in ignoring the impact of complex conditions, is worthy of additional consideration and will be examined next.

Complexity and Linear Analysis

Determination of any compatibility between complexity and linear analysis first requires a common understanding of the terms. Simple cause and effect relationships,

where an action taken upon A produces a constant influence on B are considered to be linear. Such relationships are readily understood and present uncomplicated solutions. In those situations, the use of linear methods to predict outcomes of actions is apposite. However, when we add a third variable to the equation the relationships become complex and such applications are no longer valid. Nevertheless, there is temptation to ignore these complicating factors and to apply linear analysis processes even when conditions of linearity do not exist. This incongruity between linear methods and complex systems is the focus of this section.

A primary objective of this chapter is to respond to the first question in the hypothesis statement, i.e., to determine if systems of national power are nonlinear and complex. Atkins describes the international system as "a complex political, military, economic, and social structure of both power and interdependence."[41] Further complicating the analysis, a complex system is dynamic, i.e., the condition of the system is time dependent. Although the interactions between components are complex, the constituent parts are not the most important factors. Rather the system as a whole and how the parts interact with each other, are most significant. The central contention of this section is that complexity does not hold up to linear analysis. Hence, more readily comprehensible linear approaches fall short in providing an understanding of how systems function. Support of this argument warrants a brief discussion of linearity and its limitations.

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41. G. Pope Atkins, *Latin America in the International Political System* (Boulder, CO: Westview Press, 1995), 4. He later provides justification for this assessment: "Capability analysis, which is crucial to foreign policy formulation at several stages of the process, is partly an inventory of relative strengths and weaknesses as measured by a state's military, economic, political and other resources " (ibid., 11).

A *prima facie* characteristic of a linear system is that the whole is merely the sum

of its parts. In mathematical terms, a linear system is one in which all observations of a

given variable plot as a straight line (hence, linear) against the observations of a second

variable. No variable is raised to a power other than one.[42] Beyerchen succinctly provides

two requirements for a system to be linear: *proportionality* and *additivity*.[43] The

proportionality aspect means that the effect of actions upon dependent variables directly

relates to the change in the independent variable. Replication may be possible, and the

linkage between cause and effect may be established. Behaviors may be understood and

predicted. Solutions to linear equations are known.[44]

While neat, clear, and relatively easily understood, the use of linear analysis has

limited use in the complex world characterized by systems with multiple components and

interactions. Herein resides the danger to the analysis. John Casti discerns that many

inherently nonlinear processes are treated like linear phenomena until some type of

catastrophic event forces acknowledgement of the "effect of the nonlinear structure on

the system behavior."[45]

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42. Garnett P. Williams, *Chaos Theory Tamed* (Washington, DC: Joseph Henry Press, 1997), 458. The equation: $Y = a + bX$; where b gives the amount of change in Y when X increases by one unit, most simply expresses linearity. See David Byrne, *Complexity Theory and the Social Sciences* (New York: Routledge, 1998), 18-20, for a clear expansion of the relationship, and its limitations in the examination of complex systems.

43. Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," 62. "If the behavior of a system can appropriately be broken into parts that can be compartmentalized it may be classified as linear, even if it is described by a complicated equation with many terms." He also offers, "linear systems are often restrictive narrow and brittle" and "seldom very adaptive under significant changes in their environment." Alan Beyerchen "Clausewitz, Nonlinearity, and the Importance of Imagery," in *Complexity, Global Politics, and National Security*, ed. David S. Alberts and Thomas J. Czerwinski (Washington, DC: National Defense University, 1997). 162.

44. For readable elaborations on the impact of nonlinearity on the analysis of systems, see Glenn E. James, *Chaos Theory: The Essentials for Military Applications* (Newport, RI: Naval War College, Center for Naval Warfare Studies, 1996).

45. John Casti, *Nonlinear System Theory* (Orlando, FL: Academic Press, Inc., 1985), 1. He notes that the tools of linear analysis are quite well developed, while those for nonlinear phenomena have until recently been "feeble and fragmentary at best." His text focuses on the mathematical tools for describing

In the assessment of the systems of power, the interaction of the component

elements makes the system nonlinear, not their size or numbers. National systems of

power—ranging from the largest, most populous, and industrialized nations, to those

furthest away on the developmental spectrum—may display complexity.

Regardless of the number of the categories selected for analysis, all nations have

some type of political, economic, and social components. Although the interactions

between these elements can vary greatly in scope, intensity, and frequency, every nation

possesses these, and therefore their system of power may be regarded as complex. Eve

Mitleton-Kelly recognizes this relationship between interactive components and linearity,

and she offers, "Complex behavior arises from the inter-relationship, interaction, and

inter-connectivity of elements within a system and its environment."[46] Therefore,

complex systems are not linear. That conclusion requires additional evidence and further

development of the condition of nonlinearity.

Nonlinearity

Simply stated, nonlinearity is the antithesis of linearity, i.e., that which is not

linear. The determination of that situation is of critical importance to the decision-maker.

In conditions of nonlinearity, we cannot extrapolate, change scale, or project; and we

cannot disassemble and combine the elements together again to provide a view of the

whole. Nonlinear conditions require differential equations; most differential equations are

not amenable to solution. Most importantly, an action taken to affect a nonlinear system

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and understanding nonlinear relationships, and can provide additional detail for those with sufficient background to comprehend the equations.

46. Eve Mitleton-Kelly, *Complex Systems and Evolutionary Perspectives on Systems*, ed. Eve Mitleton-Kelly (Oxford, UK: Elsevier Science LTD, 2003), 26.

becomes a part of that system. As Glieck observes, "Nonlinearity means that the act of playing the game has a way of changing the rules."[47]

Nonlinear does not mean random. Nor are nonlinear systems always disorderly. There may be order in the whole event although the components appear to be in disorder. I will discuss this order embedded in apparently chaotic systems further in Chapter III.

W. Mitchell Waldrop observes that methods that reduce the world to a simple system, where two or three laws explain a complicated environment, use Newtonian physics as a model and have been the foundation of scientific endeavors up until the twentieth century. However, while potentially useful in the analysis of linear systems, this reductionist, or Cartesian approach, possesses significant limitations when examining nonlinear phenomena.

Diana Richards observes that nonlinear relationships imply that an independent variable does not have a constant effect on the dependent variable. Manifestations of nonlinear relations are, "lack of closed-form solutions, complex and varying dynamics, sensitivity to initial conditions, and the possibility of multiple outcomes or dynamic patterns."[48] David Bearce adds, "Nonlinearity also means that the direction of the relationship between two or more variables may not be the same across all cases."[49]

Chapter I introduced the proposition that a holistic approach to assessments of national power can provide an organized means for analysis. However, if incorrectly applied, even an appropriate methodology can result in erroneous or even

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47. Gleick, *Chaos*, 15.
48. Diana Richards, *Political Complexity: Nonlinear Models of Politics*, ed. Diana Richards (Ann Arbor: The University of Michigan Press, 2000), 1.
49. David H. Bearce, "Economic Sanctions and Neural Networks: Forecasting Effectiveness and Reconsidering Cooperation," in *Political Complexity: Nonlinear Models of Politics*, ed. Diana Richards (Ann Arbor: The University of Michigan Press, 2000), 270. He also observes, "Nonlinearity means that an independent variable, such as the ambition of the sender's goal, should not be expected to have a 'constant' effect on sanctions effectiveness (the dependent variable) over time."

counterproductive results. The most common errors are adoption of a reductionist

approach, application of linear methods to nonlinear problem, and expectations of the

ability to predict phenomena that are beyond the capabilities of the available tools. I will

consider each of these in turn.

Limitations of the Reductionist Approach

This condition of nonlinearity has denied political scientists the ability to provide

useful explanations or, to a lesser extent, predictions of the effects of actions. In the

physical sciences, one method aimed at an understanding of complex systems is

deconstructing the elements parts of these into smaller, more manageable pieces.

Consequently, examination of the characteristics of its parts and their interactions results

in understanding of the whole. This typically describes a *reductionist* approach; reducing

the unwieldy whole to its component parts in order to enable analysis. However, the use

of a similar scheme when dealing with complex nonlinear systems is inappropriate and

subject to significant limitations.

Waltz argues, "If we follow the reductionist route, we can deal only with pieces of

problems."[50] Similarly, Jervis contends, "seeking to understand the system by looking

only at the units and their relations to each other is not appropriate." [51] Supporting this

viewpoint and providing a historical perspective, Beyerchen adds "Traditional analysis

that is aimed at breaking the system into simpler parts fails now just as surely as it did in

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50. Waltz, *Theory of International Politics*, 4. While reductionism historically has been a major component of scientific exploration, he contends that its effectiveness "rests on nothing more than faith."
51. Jervis, "Complexity and the Analysis of Political and Social Life," 573. He also cautions, "Because of the prevalence of inter-connections, we cannot understand systems by summing the characteristics of the parts or the bilateral relations between pairs of them." See also Jervis, *System Effects*, 51.

Clausewitz's time, and for the same reasons."[52] A leading proponent in the development

of complexity theory, Murray Gell-Mann, also cautions, "It is not sufficient to think of

the system in terms of parts or aspects identified in advance, then to analyze those parts

or aspects separately, and finally to combine those analyses in an attempt to describe the

entire system."[53] It is helpful to consider some historical illustrations.

Examples where the sum of the parts was different from the whole abound within

the context of assessments of national power. An appraisal of the relative economic and

military strengths of the seventeenth century Spain provides but one. The gold obtained

from its conquests in the western hemisphere made Spain a major economic power.

However, this wealth was of little value if the transshipment was vulnerable to British

privateers. Their economic power allowed Spain to build a powerful Armada. The naval

power it represented in turn allowed her to protect the gold shipments and enabled further

exploitation of American resources. Hence, the components of economic power

(characterized by gold and silver bullion) and military power (manifested by naval

frigates and ships of the line) were mutually supporting. It is not possible to develop an

accurate assessment of the overall national power of Spain through mere addition of the

components.

As observed earlier, the economic and military components of a nation's power

are intertwined, interactive, and interdependent. Unless there is a benefactor or sponsor

nation that will provide the instruments of military power, the ability to develop, man,

and equip a robust military force is dependent upon economic assets. Similarly, a nation

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52. Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," 82. The reasons for this failure are "interconnectedness and context, interaction, chance, complexity, indistinct boundaries feedback on effects and so on, all leading to analytical unpredictability."

53. Murray Gell-Mann, "The Simple and the Complex," in *Complexity, Global Politics, and National Security*, ed. David S. Alberts and Thomas J. Czerwinski (Washington, DC: National Defense University, 1997), 19.

that cannot protect its economic wealth from military threats will not possess these for very long, as was the case of Spain's American colonies. Therefore, the relationship is synergistic, i.e., the mutually supporting nature of the components makes the whole different from the sum of the parts. As a result, analysts must undertake any decomposition into smaller units with great care and discipline.

Decomposition efforts must utilize a firm grasp of the potential contributions, as well as what it can and cannot offer. Beyerchen articulates this concern: "The purpose of theory is to untangle confusion by creating distinctions, but to do so in order to understand the whole better, not for the sake of pedantic analytical compartmentalization."[54] Despite these limitations, the reductionist approach continues to be applied, even if not explicitly, to attempts to understand complex systems. Although several explanations exist, among the most plausible is the natural desire for simplicity. This emerges because, as Langdon Winner observes, "The systems in which we live are far too complicated as yet for our intellectual powers and technology to understand."[55]

The decomposition of large systems into more manageable sub-elements need not be a binary, yes or no,. In some instances, reductionist techniques may be advantageous. Ian King sees a role for some use of reductionism and cautions against "Throwing out the baby of micro-level analysis with the bathwater of a rigidly reductionist mechanism."[56]

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54. Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War." 59-90. Although he allows for some use of compartmentalization for analysis, he warns of its dangers, p. 82. He adds, "Theorists must not be seduced into formulating analytically deductive, prescriptive sets of doctrines that offer poor hope and worse guidance" (ibid., 87).

55. Langdon Winner, *Organized Social Complexity*, ed. Todd R. La Porte (Princeton, NJ: Princeton University Press, 1975), 40. Attributed to C. West Churchman. Although human intellectual powers remain relatively constant, unarguably there have been significant advances in technology since that time that reduce the impact of this observation.

56. Ian T. King, *Social Science and Complexity* (Huntington, NY: Nova Science Publishers, Inc., 2000), xii. He argues against the Newtonian-positivist-behaviorist worldview and a "horizon-narrowing, rigidifying mechanistic reductionism," which he defines in terms of a worldview. "The universe is essentially mechanistic, processes in the universe and relations between entities are reductionistic, the

Waltz, Beyerchen, Jervis, Gel-Mann, et al, have clearly articulated the dangers inherent with the use of a reductionist approach. These are not to be discounted. Therefore, the methodology presented in Chapter V seriously considers this aspect of reductionism. While inappropriate for many purposes, decomposition into components is a worthwhile analytical tool, as long as one acknowledges its limits. With this examination of reductionism complete, it is now time to move on to the next common error and threat to effective analysis.

Inappropriate Uses of Linear Analysis

If systems of power are complex, and complex systems are typically nonlinear, it does not necessarily follow that no aspects of the system include some linearity. The danger to the analysis is not the result of the use of linear techniques; rather, it is their *inappropriate* utilization. Linear solutions at times are applied to nonlinear situations. The result has been incomplete, inaccurate, and unsupportable analysis and the inability to explain the effects of actions. This condition is particularly problematic in assessment of national power. Recognizing this, Beyerchen contributes, "Linearity is excellent for the systems we design to behave predictably, but offers a narrow window on most natural and social systems."[57] Despite these limitations, the use of the linear approach is not universally discredited, and there may be cases where its employment is appropriate.

When utilized correctly, and with effective measurement criteria, linear analysis provides part of, but not all of the solution. Any analysis of national power that did not include tangible and quantifiable factors would revert to entirely subjective judgments.

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whole is reducible to its foundational parts, basic units are discrete and isolatable, and causation is direct, local and concrete" (ibid., 7).

57. Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," 162.

Assessments of power usually involve some degree of capability analysis. Atkins describes this as partly an "inventory of relative strengths and weaknesses as measured by a state's military, economic, political, and other resources."[58]

Certain elements of power may be accurately depicted using linear means. Compilations of numbers of tanks, aircraft, missiles, and ships provide an input into the equation of military power. Similarly, natural resources, population, and education level are subject to empirical analysis and comprise an important part of any economic assessment. However, as Nye contends, even "economic power cannot be measured simply in terms of tangible resources."[59] The problem becomes more acute when other elements of power are considered. Development of quantifiable measures of soft power components such as culture, religion, and ideology is exceptionally difficult. The most deleterious effects result not from use of linear methods, but from the over reliance upon and misuse of these techniques.

Despite these serious limitations, linearity should not be totally absent from the consideration of national power. Aware of this potential for use in the economic arena, Bearce provides, "Linear statistics may be useful to infer broad relationships, but the approach obscures any nonlinear patterns that may be hidden in their (mostly ordinal level) sanctions data."[60]

There is a temporal aspect also to be considered. Cederman contends, "As long as the analyst studies sufficiently short periods of time, the linear approximation is likely to

58. Atkins, *Latin America in the International Political System*, 11. While acknowledging the impact of environmental factors, he urges skepticism of theories of environmental determinism.
59. Nye, "The Changing Nature of World Power," 180. Factors such as relative costs and vulnerabilities are also essential components of economic power.
60. Bearce, "Economic Sanctions and Neural Networks," 272.

be helpful even in the presence of nonlinearity in the real world."[61] However, in the assessment of systems of national power, a longer-term view must be taken, particularly when examining the potential for secondary effects. Hence, the result is that most, but not all, linear solutions must be rejected.

This is particularly true in the understanding of the secondary effects of actions. While it is possible to predict the impact of a single action, the additional effects that result from that action are far more difficult to ascertain. For example, a naval enforced embargo may produce the desired effect of reducing a nation's ability to import strategic materials that are vital to an armament industry; however, it also may produce unintended effects that run counter to the initial objective of the embargoing nations. While the constriction of vital materials may negatively affect economic and military power, increased domestic political support for the targeted regime also may be a repercussion of the embargo. This is because of the linkage of one element of power (the general population) with the element influenced by the action (vital imported commodities). The disbanding of the Iraqi Army after the 2003 Gulf War provided the desired effect of removing a military threat. However, because of the complex linkage between the military and the political elements of power in Iraq, the action produced the unintended effect of leaving the nation without a viable internal security apparatus.

In these illustrations military and economic actions had unforeseen political effects due to the complexity of the environment. This dilemma resulted from the connections (or linkages) within and across elements of power in a complex environment. The consequence was the emergence of secondary effects that could not be satisfactorily understood completely using linear models.

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61. Cederman, *Emergent Actors in World Politics*, 43.

As in the case of the use of reductionism examined in the previous section, we should not totally reject utilization of linear analysis techniques. In assessments of national power, some relationships will be linear, and their use is appropriate and can benefit the analysis. However, due to the complexity that exists in most systems of national power, the occurrences of purely linear relationships are likely to be few. With this caution against an over reliance upon and the misuse of linear techniques established, the discussion may now proceed to the issue of how the condition of nonlinearity affects the ability to foresee the effect of actions.

Expectations of Predictability

While not always an essential product of academic inquiry, especially in the social sciences, the ability to transform an understanding of events and outcomes into practical extrapolative tools is potentially valuable to the decision-maker. Some argue that development of an ability to forecast outcomes is an essential objective for a scientific endeavor. Michael Young contends, "If political science cannot generate predictive theory, then any capacity for intervention in the world, for good or evil, is lost."[62] While he acknowledges that there is value in understanding why a particular person acted in a certain way, the goal should be higher. James Voss views prediction as "a rather lofty positivist goal," and contends, "prediction and control have been the watchwords of being 'scientific.'"[63] The objective should be to acquire at least a modicum

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62. Michael D. Young, "Representing Problem Representation," in *Problem Representation in Foreign Policy Decision Making,* ed. Donald A. Sylvan and James F. Voss (Cambridge: Cambridge University Press, 1998), 244. His essay attempts to provide an answer to, "can the "effectiveness of economic sanctions be forecast using the currently available case study data?"

63. James F. Voss, "On the Representation of Problems: An Information-Processing Approach to Foreign Policy Decision Making," in *Problem Representation in Foreign Policy Decision Making,* ed. Donald A. Sylvan and James F. Voss (Cambridge: Cambridge University Press, 1998), 23. He

of predictive power that would provide some ability to intervene in processes to influence outcomes. Although this goal is a worthy one, it remains elusive.

Nye sees an inverse relationship between complexity and predictability resulting from a density of networks that are "increasingly complex, and their effects are therefore increasingly unpredictable."[64] Due to its simplicity and apparent explanatory power, at times an understanding of linear relationships is extended in order to provide predictions of future results. Pure deductive reasoning is applied. If action A repeatedly produces effect B, then it may be expected to do so in the future. And if action C is similar to A, then C also is likely to produce B. In conditions of linearity, this is a reasonable conclusion. However, in dealing with the application of power, the limitations of this logic are apparent. In relations between nations, especially in those involving applications of coercive power, few actions are repeated precisely, and the environments in which they occur vary considerably.

A basic tenet of American foreign policy in the second half of the twentieth century was the professed lesson from Chamberlain's 1938 capitulation in Munich and the discredited policy of appeasement. While the predicted outcome of a dictator being emboldened by acquiescence to threats and demands may have been valid when applied to Nazi Germany, this conviction often was applied incorrectly in diverse regions and under political conditions that did not fit. That is not to say that domino theories are always incorrect, only that they are not universally applicable.

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acknowledges, "prediction is quite difficult in any subject matter domain and only possible under highly controlled circumstances."

64. Nye, *The Paradox of American Power*, 86. He refers to the density of the networks of interdependence as part of a "thickness of globalism."

Warfare represents the ultimate application of coercive power. The inability to predict accurately the outcomes of armed conflict has long been recognized. The nineteenth century strategist, Karl Von Clausewitz, recognized the limitations inherent in our ability to predict the outcome of a conflict and described war as, "inherently a nonlinear phenomenon, the conduct of which changes its character in ways that cannot be analytically predicted."[65] Despite the technological transformations in warfare, the capability to predict the consequences of actions in conflict has not improved dramatically since the days of Bismarck. The critical element that is missing is an ability to determine when reasoned inferences may be properly utilized and when the level of understanding is attained that is sufficient to provide at least some minimal predictive capability. Complexity and nonlinearity have an impact on the ability to relate effect to cause.

Bearce identifies limitations in the ability of some economic actions to provide even the primary intended effect: "Past efforts to explain and forecast the effectiveness of economic sanctions using traditional linear statistical methods have been remarkably unspectacular."[66] In modern societies, it is exceptionally difficult to segregate economic elements from those in the political and social spheres. Hence, it is particularly hard to assess or predict the resultant secondary effects of actions taken against economic nodes.

The primary explanation for the failure of linear solutions to provide a sufficient level of understanding and predictability is that in applications of coercive power the equations typically are complex and nonlinear. The elements of power are not isolated

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65. Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," 82. He adds, "linear relations and the predictability they offer are the exceptions in the real world."

66. Bearce, "Economic Sanctions and Neural Networks: Forecasting Effectiveness and Reconsidering Cooperation," 269.

and do not exist in a vacuum; they are interrelated and interconnected. Therefore, an action taken upon one is likely to produce an effect on the elements to which it is connected. Simple cause and effect relationships are rare and, as some argue, nonexistent. Jervis contends, "the effects of actions are always multiple"[67] This condition applies across all elements of international politics and is particularly evident is the uses of power.

The application coercion to change the behavior of an adversary may produce its intended effect in the near term, but may also produce an unintended effect in another area. Because of the geographic linkages, threats may also result in driving a neighboring state into a larger adversary's camp. A power relay station may be a legitimate military target; however, since it may also provide electricity to a civilian hospital, its destruction or incapacitation may have far-reaching effects on the population's willingness to resist and on world opinion.

In another illustration, if the desired effect is to reduce the funding available to insurgents, then the destruction of an opium processing facility may temporarily disrupt the trade in heroin that supports them. However, if the revenue obtained by the poppy cultivation is the sole source of income of a tribal group, the action may also generate economic, social, and political effects that run counter to overall objectives.

Because of the linkages and the resulting complications, complexity is the rule rather than the exception. Consequently, understanding and predictability in a macro sense has proven elusive. If concentration on the whole is not productive, then perhaps a

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67. Jervis, "Complexity and the Analysis of Political and Social Life," 570. In *System Effects*, 2, Jervis cites multiple examples across the spectrum of human interaction: welfare can decrease the incentives to work; providing housing for the homeless may draw additional homeless to that locality; subsidized flood insurance encourages building in areas prone to flooding; and increased defense spending sometimes results in making the adversary more belligerent.

focus on the connections between individual elements may provide an option worthy of consideration. The danger of falling into a reductionist trap is apparent. However, decomposition into more readily examined components to determine the linkages within and across systems can provide some useful insights—if applied carefully and with awareness of the limitations.

Summation

This chapter provided a basic review of terms and definitions and a suitable lexicon for use in the development of the methodology. This required a brief examination of power, its theoretical foundations, and components, and how it may be applied to influence the behavior of other actors. Despite the lack of a universally accepted definition, I referred to this type of application of power as coercion.

This led in to a brief consideration of the principal factors in decision-making. I determined that decision-makers employ a synthesis of rational and cognitive techniques in the use of coercive power. However, regardless of the intellectual domain selected, knowledge is an important factor in effective decision-making related to the employment of coercion.

While the overall system of power is most critical, this macro view is not receptive to analysis. Hence, some decomposition into components is justified. The elements of power were deemed not be universally fungible, however, they are characteristically interconnected. The first task in the hypothesis statement was to determine if systems of national power are nonlinear and complex. In response, based on the evidence presented, the conclusion is that these conditions of nonlinearity and

complexity do indeed exist. Illustrations of linkages within and across systems provided substantiation. These multiple connections between elements make the overall system of power complex.

Although some linearity exists within these subsystems, due to the existence of interrelated components and subcomponents, the conclusion presented is that the relationships are not universally amenable to linear analysis. This condition makes understanding of potential secondary effects exceptionally difficult. This problem has confounded those who must make decisions regarding the exercise of power. Multiple examples of deleterious unintended effects are evident. Some of these will be examined in the case studies to follow. If the only available tools are reductionist techniques and linear solutions, the worthy goal of a consistent ability to predict outcomes remains unattainable.

This leads to the conclusion of a need for an improved method of assessing complex nonlinear systems. However, even in the physical sciences, development of adequate explanations of nonlinear phenomena is embryonic; and these are near non-existent in the realm of international relations and foreign policy analysis.[68] This is the primary reason why a fresh approach to the problem is worthy of pursuit. An initial step must be to examine the work in other disciplines with the objective of determining if there are applications to the assessment of national power. An investigation into approaches to nonlinearity in other academic disciplines is, therefore, important to this

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68. Among the exceptions to this generalization are: Byrne, *Complexity Theory and the Social Sciences*; Alvin Saperstein, "Chaos: A Model for the Outbreak of War," *Nature*, 24 May 1984: Alvin Saperstein, "War and Chaos," *American Scientist* 83 no. 6 (November-December 1995); Keith Warren, "New Directions in System Theory: Chaos and Complexity," *Social Work*, July 1998; and, Nicanor Austriaco, "Causality within Complexity," *The Journal of Interdisciplinary Studies* XI (1999).

discussion. The overarching concepts are contained in complexity and chaos theory,

which is the focus of Chapter III.

CHAPTER III

THE ANALYSIS OF NONLINEAR SYSTEMS

A conclusion reached in the previous chapter was that national systems of power are complex and nonlinear. The significance of that condition is that development of an effective understanding of the effects of coercive actions and the secondary consequences resulting from those acts requires utilization of some form of nonlinear analysis. The objective of this chapter is to begin to respond to the second question in the hypothesis statement, i.e., can approaches recently developed in mathematics and the physical sciences contribute to enhanced understanding of nonlinear systems?

While scholars have long recognized the challenge of understanding the consequences of actions when nonlinear relationships exist, it was only in the mid-twentieth century that scientists attempted to discover order out of the apparent disorder of nonlinearity.[1] Two broad paradigms represent the vast majority of academic discourse in this area. Hence, *chaos* and *complexity* will be the central focus of the exploration of nonlinear systems presented in this chapter. This will require an analysis and assessment of their potential for their application to the understanding of the effects of actions.

Some argue that there is nothing new here, and that chaos and complexity have always existed, albeit "sometimes obscured to many, but always recognized by some."[2] Others see chaos-complexity as an "overdramatized fad," "too vague or cult-like," or

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1. In the late 1800's, French mathematician Jules Henri Poncaire was frustrated in his attempt to predict the behavior of as few as three interacting spheres.

2. Alvin Saperstein, "Complexity, Chaos and National Security Policy: Metaphors or Tools?" in *Complexity, Global Politics, and National Security*, ed. David S. Alberts and Thomas J. Czerwinski (Washington, DC: National Defense University, 1997), 104.

"just another conceptual spin around the block."[3] Despite the lack of a clearly defined and firmly established academic discipline of chaos-complexity, or widespread acknowledgement of the potential for its extension into the social sciences, there are examples of attempts to apply the principles of chaos and complexity into realms beyond mathematics.

Samir Rihani contends, "Assimilation of nonlinearity is now well established within the natural and life sciences," and has begun to "spill slowly into the social sciences."[4] Voicing a similar view, T. Irene Sanders offers that the "science of chaos theory and complexity is providing us with information about the dynamics of change in the real world."[5] Concurring with this outlook, historian Roger Beaumont states, "Interest in nonlinearity, chaos, and complexity has intensified since the mid-1970s."[6] Hence, application of these principles into the social sciences has precedent.

While possessing some similarities, chaos and complexity have several important differences. Consequently, I will examine each separately. The assessments of both chaos and complexity will follow a pattern of: (1) definition and explanation, (2) presentation of characteristics of each that may have practical application to the task of understanding secondary effects, and, (3) identification of limitations and hindrances to their incorporation into the process. Both chaos and complexity are expansive concepts, with a sizeable amount of research and analysis already applied to them. As with the examinations of national power, coercion, and linearity provided in Chapter II, these

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3. Roger Beaumont, *War, Chaos and History* (Westport, CT: Praeger, 1994), 3, 10, and 185.
4. Samir Rihani, *Complex Systems Theory and Development Practice* (New York: Zed Books Ltd, 2002), 7.
5. T. Irene Sanders, *Strategic Thinking and the New Science* (New York: The Free Press, 1998), 5.
6. Beaumont, *War, Chaos and History*, 3. He credits advances in information technology with enabling the enhanced exploitation of nonlinear phenomenon. In a later work he observes that historians and social scientists "have turned to chaos-complexity for images and metaphor" See Roger Beaumont, *The Nazi's March to Chaos* (Westport, CT: Praeger, 2000), 5.

sections will drill only deep enough to support the concluding evaluation of the potential for application of the principles of the theories. However, evaluation of relevance requires an establishment of a fundamental level of knowledge and familiarity with the terminology. Additionally, it is important for those whose expertise is outside the realm of mathematics and the physical sciences to develop at least a basic understanding of the lexicon and foundation of these approaches. Hence, I dedicate some time to extant views on both chaos and complexity. However, the primary objective remains to determine the existence of a concept or way of looking at organization, structure, and function that may be relevant to assessments of national power.

The chapter will conclude with a return to the hypothesis question and will address the potential for applying the principles of nonlinear analysis to the primary objective of the proposition, i.e., the development of an understanding of the secondary effects of actions. The objective here is not to condense the whole host of volumes of sometimes very technical material into a restricted number of pages. Rather it is to probe into these theories to determine if there is any realistic potential for incorporation of some of the principles contained within chaos-complexity into the process of determination of the effects of coercive actions.

Before proceeding further, a brief divergence from the chapter outline is appropriate in order to provide some qualifying remarks. Much of the work in chaos and complexity theory has been accomplished in mathematics, meteorology, physics, and biology. Consequently, the lexicon, processes, and subject area content might be unfamiliar to those whose background, experience, and interests are in political science or international studies.

The intended users of the methodology proposed by this dissertation are national security analysts and decision-makers, many of whom, while capable and intelligent, may not possess formal schooling in higher mathematics, physics, or engineering. This requires conducting this investigation into chaos and complexity at a level that is generally understandable to an educated person regardless of academic discipline. There is no condescension here. Some of the more distinguished figures in the social sciences have admitted their struggle with some of the concepts and equations contained in chaos and complexity theory.[7] Indeed, this is professed as a reason why there has not been an abundance of application of these theories into the social sciences. Hence, I present this analysis from the perspective of a non-mathematician.

Nevertheless, the concepts and mathematics associated with the study of complexity, and particularly with chaos, are complicated enough so that a few readers will find even this simplified presentation challenging. The qualification statement is complete. The focus of the outline may now return to the central topics and issues.

What possible benefits could accrue from examination of nonlinear systems? Are the skeptics correct, and are chaos and complexity merely vague and loosely constructed and coupled concepts without any serious potential for exploitation? Diana Richards would not agree. She argues, "The ramifications of nonlinearity have not been sufficiently realized," and believes that "one can gain explanatory power by considering

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7. Among these are Robert Jervis. The list includes myself, not as a notable in the field, but as a national security analyst with limited exposure to advanced mathematics or expertise in the physical sciences. Certainly, there are multiple exceptions to this broad generalization. For instances where these concepts have been applied outside of the hard sciences, see David Byrne, *Complexity Theory and the Social Sciences* (New York: Routledge, 1998). Among his relevant observations: "Chaos theory is founded on the mathematics of nonlinear systems. Economists and political scientists have applied chaos theory with considerable mathematical rigor and success to the temporal dynamics of a variety of phenomena in their fields" (ibid., 2-3).

endogenous interactions and relationships."[8] That acquisition of illuminating capability is the primary goal of the proposed methodology. The vital undertaking for this chapter is to explore the possibility: "If chaos-complexity theory enhances our ability to identify patterns and steer the crafting of history only a point or two closer toward absolute truth, that might put it ahead of the other models of the past."[9] With the chapter outline and objectives presented, and the necessary qualifying explanation provided, the discussion may now directly address the first of the nonlinear theories for consideration—chaos.

Chaos

Chaos is also known as dynamical instability. Some view it somewhat conservatively as "a new mathematical approach that allows scientists to study the behavior of nonlinear systems."[10] Others are more generous in their outlook. In 1990, Heinz-Otto Peitgen observed, "For many, chaos theory already belongs among the greatest achievements in the natural sciences in this century."[11] While this assertion is controversial, certainly the emergence of theories of chaos has provided an impetus to discussions within the scientific community across a wide range of disciplines.

Its most notable popularizer, James Gleick, views chaos as an expansive idea. "Chaos has become not just a theory but also a method, not just a canon of beliefs but

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8. Diana Richards, "Nonlinear Dynamics in Games: Convergence and Stability in International Environmental Agreements," in *Political Complexity: Nonlinear Models of Politics,* ed. Diana Richards (Ann Arbor: The University of Michigan Press, 2000), 2.

9. Beaumont, *Nazi's March to Chaos,* 186.

10. Sanders, *Strategic Thinking and the New Science,* 61.

11. Heinz-Otto Pietgen, "The Causality Principle: Deterministic Laws and Chaos," in *Chaos: The New Science,* ed. John Holte (Lanham, MD: University Press of America, Inc., 1990), 35.

also a way of doing science."[12] Care is required in dealing with this term, since its meaning varies depending upon its context. The word has a broad definition in its general usage, and a more constrained and precise elucidation when used in connection with modern paradigms aimed at the understanding of nonlinear systems.

First, I will address the more common connotation of chaos. Most widespread usages conform to the dictionary "extreme confusion or disorder." Integrating a set of definitions, Beaumont proposes, "an order of infinite complexity: intricate, turbulent, multicomponent processes, beyond effective monitoring and reasonable approximate depiction or prediction; cannot be precisely duplicated or simulated;"[13] Chaos implies randomness, instability and unpredictability. While these characterizations are suitable for non-technical discussion, the genesis of the new theories of chaos requires a more precise description.

A vital preliminary task is to differentiate between *social* chaos and *mathematical* chaos. The former term describes a condition, and is commonly used to indicate a total lack of any controlling mechanism, resulting in the absence of social order and the emergence of anarchy. It may result from a multiplicity of factors including a variety of natural disasters, or by societal upheavals as the result of interstate war or revolution.

In the mathematical usage, chaos is declared by some to be a "new science;" by others as "a heterogeneous amalgam of different techniques of mathematics and science."[14] Mathematical is the type of chaos that I will examine initially. However, the

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12. Gleick, *Chaos*, 1987), 37. The essential question that an investigation into chaos may provide some insight into is how "in a universe ruled by entropy, drawing inexorably toward greater and greater disorder, how does order arise" (ibid., 5)?

13. Beaumont, *War, Chaos and History*, xiv.

14. A. B. Cambel, *Applied Chaos Theory*, 14. The "new science" moniker is used by Gleick, Sanders, Holte, et al.

phenomena are similar in many ways, and the limited transfer of the principles of

mathematical chaos to conditions where social chaos is the issue is the central rationale

for this examination of chaos.

In the 1970's, some scientists who were not content with the reductionist

approach considered new models that would provide an enhanced view of the whole and

could serve to overcome some of reductionism's perceived limitations. These efforts

would be loosely combined under the umbrella of *Chaos Theory*.[15] James Gleick, in his

popular 1987 treatise, *Chaos: Making a New Science,* provides an excellent entry-level

overview of this new approach.[16] This employment of chaos refers to a much narrower

understanding of the term, and carries with it its own supporting concepts and lexicon.

Under the more restrictive rubric of Chaos Theory, additional precise definitions

are provided: Phillip Holmes, "The complicated, aperiodic, attracting orbits of certain

(usually low-dimensional) dynamical systems; Hao Bai-Lin, "A kind of order without

periodicity;" H. Bruce Stewart, "Apparently random recurrent behavior in a single

deterministic (clockwork-like) system;" and, Roderick V. Jensen, "The irregular,

unpredictable behavior of deterministic, nonlinear dynamical systems."[17] The field of

mathematics contributes, "Stochastic behavior occurring in a deterministic system."[18]

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15. Gell-Mann, *Quark and the Jaguar*, 27, cautions against careless utilization of the term, which is often incorrectly used as a "catchall expression for any sort of real or apparent complexity or uncertainty." For clarity, James, *Chaos Theory*, 17, suggests the use of *Chaos* to refer to the term in the context of the paradigm or theory, and the use of the lower case *chaos* in the general use of the term. James believes that "a Chaotic system must be bounded; nonlinear; non-periodic; and sensitive to small disturbances." Also see Cambel, *Applied Chaos Theory*, 16, for a discussion of what he considers to be the confusion between "chaos" and "chaos theory." The latter he defines as "a collection of mathematical, numerical, and geometrical techniques that allows us to deal with nonlinear problems to which there is no explicit general solution." In subsequent references I will use *Chaos Theory* to describe the most restrictive use of the term.

16. Chaos Theories have also been described as "nonlinear dynamics literature." See Chris C. Demchak, "Complexity and Theory of Networked Militaries," esp. 224-26.

17. Gleick, *Chaos*, 306.

18. John Holte, *Chaos: The New Science* (Lanham, MD: University Press of America, Inc., 1990), viii. This statement is seemingly oxymoronic. The system is simultaneously random, but with direction. He

Douglas Kiel argues, "Chaos is typified by behavior that can, over time, appear random and disorderly. However, it occurs with definable parameters or mathematical boundaries."[19] Williams offers, "Sustained and *random*-like long term evolution that satisfies certain special mathematical criteria and that happen in *deterministic, nonlinear, dynamical systems*."[20] Deterministic in the sense that behavior follows a rule, and a dynamical system being one that changes or evolves over time.

While a review of a selection of contributions is worthwhile, laboring further over development or identification of generally accepted descriptions of Chaos does not represent the most effective line of attack in development of this analysis. Within the context of this study and the objective of this chapter, an acceptable definition is that chaos is *a condition of system nonlinearity that displays apparent disorder and randomness, but may also provide some detectible order*. Although there is not universal acceptance of the precise definition of Chaos, the more important issue to this discourse remains the potential applications of the theory. Therefore, it is more productive to focus on what its proponents argue it can do, and what its detractors argue that it cannot.

Potential Uses of Chaos Theory

Proponents believe that Chaos Theory could be applied across a wide range of disciplines. As the most widely known advocate of the application of Chaos Theory

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argues that disagreement abounds among scientists on the definition of the term. Gleick, in *Chaos*, 307, describes this phenomenon as "a delicate balance between the forces of stability and the forces of instability.

19. Douglas L. M. Kiel, *Managing Chaos and Complexity in Government* (San Francisco: Jossey-Bass Publishers, 1994), 28, provides clarification: "Chaotic does not mean random; nonlinear does not mean chaotic."

20. Williams, *Chaos Theory Tamed*, 9. Emphasis in original. He defines random as behavior that is "based strictly on a chance mechanism, with negligible deterministic effects" (ibid., 12). Citing alternative views, he echoes that some consider chaos a mathematical curiosity and that a large group contends, "Nobody has yet conclusively found it in the physical world" (ibid., 13).

contends, "In our world, complexity flourishes and those looking to science for a general understanding of nature's habits will be better served by the laws of chaos."[21] Supporting this view, John Holte believes that "the range of applications of chaos theory is awesome: Information processing in the brain, protein formation, cardiac arrhythmias, epidemics, fluctuations in wildlife populations, business cycles, [and] the arms race."[22] Also having detected applications beyond the mathematical sphere, Kathleen Alligood contends, "Chaotic behavior can be observed in experiments and in computer models of behavior in all fields of science."[23] However, due to the relative novelty of the approach, at this point in time there may be more potential than progress toward practical applications in the social sciences. From the field of public administration comes the contention that Chaos Theory is a "misnomer" and is more properly, "the study of complex, dynamic systems that reveal patterns of order out of seemingly chaotic behaviors."[24]

Indeed, some contend that Chaos Theory is not a theory in the commonly accepted understanding of the term, "but rather is a frame of reference or a way of thinking about complex phenomena."[25] An essential element of Chaos Theory is that there is order within apparently totally random and unstructured systems.[26] Supporting this view, Beaumont contends that there exists within Chaos Theory, "a degree or order

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21. Gleick, *Chaos*, 308.

22. Holte, *Chaos*, ix. His explanation for the wide range of areas that may benefit from applications of chaos theory is that they have a common language, i.e., mathematics.

23. Kathleen T. Alligood, Tim D. Sauer and James A. Yorke, *Chaos: An Introduction to Dynamical Systems* (New York: New York: Springer Verlag New York, Inc., 1996), viii. While this collection concentrates on the physical sciences, the authors argue that chaos is a phenomenon that is common throughout science.

24. Overman, "The New Sciences of Administration," 487.

25 Kathleen A. Bolland and Charles R. Atherton, "Chaos Theory: An Alternative Approach to Social Work Practice and Research," *Families in Society: The Journal of Contemporary Human Services* 80, no. 4 (July-August 1999): 367. This article provides an excellent summary of the application of the new sciences to areas beyond mathematics.

26. Gleick, *Chaos*, 15. Lorenz described this as a "pattern of disturbances and orderly disorder."

that lies buried within what at first glance looks like random turbulence."[27] The existence

of evidence to support this order out of disorder proposition, and the possibility of

detecting some type of self-organizing pattern, shape, or structure in a seemingly random

entity, represent the most contentious aspects of Chaos Theory.

This order within disorder is centered on the existence of an *attractor*, or "the end

state or final behavior toward which a dynamical system moves."[28] Alternative

definitions view attractors as a way to describe the long-term behavior of a system. These

centers of attraction provide the emergence of patterning within a system. The simplest

systems reach a *fixed-point attractor*. However, in complex systems a variation of these,

known as *strange attractors*, emerge that "may take the form of events, interactions, or

developments that coalesce energy and focus attention."[29] Equilibrium and steady states

correspond to fixed point attractors ...and chaotic states to strange attractors.[30] The

mathematics and the resulting models that support the existence of these attractors are

themselves immensely complex, and acknowledgement of their occurrence must be more

of a matter of faith than an acceptance of proof for those whose education, experience

and interests are in other areas.

Cambel provides an elucidation of attractors that is useful for the non-

mathematician. The following illustration is an adaptation of his explanation. He uses the

examples of a child's swing or a clock pendulum that at some point will come to a stable

vertical position once the force (the parent's pushing or the effect of gravity on a weight)

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27. Beaumont, *Nazi's March to Chaos*, 5.

28. Sanders, *Strategic Thinking and the New Science*, 66.

29. Ibid. She adds, "Strange attractors may also be viewed as "chaotic systems that never settle into a predictable end state" (ibid., 74).

30. Peter Coveny and Roger Highfield, *Frontiers of Complexity* (New York: Fawcett Columbine, 1995), Glossary.

ceases to be applied. The points where the swing or pendulum comes to rest are the fixed-point attractors, which were addressed in a previous paragraph. The issue important to this discussion is whether the system is stable at the equilibrium state. In both the swing and pendulum examples, and assuming the absence of external forces, the response would be yes; the systems are stable.

The next test is determination of the durability of system stability: Is it possible for any disturbances of the system to change the arc or orbit of the objects? If changes produce consequences that are highly irregular, then the previously identified phenomenon of strange attractors is said to exist. Returning to the pendulum example, assume a small change in the arc. If that motion remained stable and predictable, fixed attractors remain the dominant equilibrium state. If however, a wild oscillation that defies predictability results, strange attractors may be evident. Since strange attractors exhibit bizarre and unpredictable motions, they are also called *chaotic attractors*.[31] This condition of random and unpredictable behavior is most relevant to an assessment of the secondary effect of coercive actions. The existence of attractors is important to a basic understanding of Chaos Theory, but in isolation, it provides but one piece of the puzzle. Further investigation is required in order to develop some useful insight.

The study of Chaos Theory may be subdivided into various schools or approaches. N. Katherine Hayles notes that there are two major branches of emphasis in the study of Chaos Theory. One, dubbed the *order-out of chaos* branch, accentuates chaos

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31. Cambel, *Applied Chaos Theory*, 13-17. While the terms chaotic attractor and strange attractor are commonly used interchangeably, this is not true in all cases. "Strange attractors are not necessarily chaotic" (ibid., 70). For those who wish to examine this concept in more depth, his Chapter 4 provides illustrations and a much more detailed explanation of attractors. The abbreviated explanation provided here represents only the most cursory excursion into the phenomenon. It should be noted that in mathematical models the chaotic behavior is not caused by outside sources, but rather by exponentially close trajectories within a bounded system.

as "order's precursor and partner," rather than as its antithesis; the other, the *strange attractor* branch, emphasizes the ability of chaotic systems to generate new information and the "hidden order that exists *within* chaotic systems."[32] Providing a similar analysis and acknowledging that there are subtle but important differences between the American and European outlooks regarding Chaos Theory, David Byrne cites contentions that the US view is to find the "order that lies hidden in chaos," while the more common European focus is on "order that emerges from chaos."[33] This *deterministic* chaos, generated by fixed rules, is a key discovery upon which the behavior within a chaotic system may be understood.[34]

The presence of attractors is less contentious than is the potential for applications of this characteristic of chaotic systems. The element most important to all of these perspectives is agreement that systems that display apparent completely random behavior contain some type of pattern. The existence of a pattern suggests at least a basis for understanding, and perhaps even for some level of predictability. Since deterministic chaos involves nonlinear systems that conform to dynamical laws, then an understanding of these laws and the initial and present state of the system may provide some ability to project into the future. If this perspective is valid, and predictability is possible, then decisions regarding the use of power could benefit immensely from the incorporation of Chaos Theory into the process.

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32. N. Katherine Hayles, *Chaos Bound: Orderly Disorder in Contemporary Literature and Science* (Ithaca, NY: Cornell University Press, 1990), 9-10. Emphasis in original. She acknowledges Ilya Prigogine as the leader of the first school, and associates Edward Lorenz, Mitchell Feigenbaum, Benoit Mandelbrot and Robert Shaw with the second.

33. Byrne, *Complexity Theory and the Social Sciences*, 16.

34. Pietgen, "The Causality Principle: Deterministic Laws and Chaos." 36. He identifies other significant achievements of Chaos Theory, including development of methodologies that will evaluate the presence of chaotic behavior. However, Saperstein, "Complexity, Chaos and National Security Policy," 108, cautions, "Determinism does not imply predictability," and that prediction requires knowledge of the present state.

Jack Cohen and Ian Stewart believe that an important element of Chaos Theory is that "simple laws can have very complicated—indeed, unpredictable—consequences."[35] Ian King contends, "Chaos theory builds on Newtonian world view" and that "chaos is a dialectical, incorporating seeming contradictions within a nonetheless unified, coherent, yet dynamic framework." He adds that this can provide "a subtle, yet powerful form of order."[36] James offers, "When we construct an attractor we construct *an image of the system's global dynamics.*" This condition "allows us to predict *short term trajectories and long term trends* for pattern recognition."[37] Adding their support for the potential contributions of the study of Chaos Theory, David Peak and Michael Frame assert, "Fortunately, deterministic chaos does allow some prediction."[38] The general consensus of this sampling of scholars and authors is that this order and framework do, at minimum, indicate some potential for an ability to envisage concealed order within apparently chaotic systems.

An important question is whether the concept of attractors presents any practical uses. An earlier section addressed the distinction between social and mathematical chaos. It is conducive to understanding to present an illustration of how the emergence of strange attractors in mathematical chaos may provide some insights relative to social chaos. This potential for transforming the end-state of a stable system into one that is chaotic is pertinent to considerations for the application of coercive power. If overall system stability were an objective, then it would be valuable for those planning such

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35. Jack Cohen and Ian Stewart, *The Collapse of Chaos: Discovering Simplicity in a Complex World* (New York: Viking, 1994), 2.

36. Ian T. King, *Social Science and Complexity*, 51.

37. James, *Chaos Theory*, 33. Italics in original.

38. David Peak and Michael Frame, *Chaos under Control: The Art and Science of Complexity* (New York: W. H. Freeman and Company, 1994), 151. For those with the background and interest, this volume provides an abundance of mathematical equations, graphs, and illustrations to further an understanding of Chaos.

actions to be able to predict that a specific action may result in the emergence of strange

attractors that could possibly send the system into unpredictable chaos.

For example, if removal of a particular political leader results in the collapse of

the internal political system and destroys any ability to further influence that system, that

action may run counter to overall objectives. The danger of inadvertently creating a

chaotic situation through coercive actions should be a concern of those who must

undertake such decisions. If the contentions of its adherents are accepted, then Chaos

Theory, or at least the condition of deterministic chaos, may provide some degree of

predictability. However, there are other complicating factors.[39]

Another component of chaotic systems is *sensitivity to initial conditions*, which is

described as "The propensity of non-linear systems to change properties far out of

proportion to the scale of forces changing their original state."[40] That is, even minute

changes in the point of origin can result in large changes to the outcome, or as Gleick

describes "Tiny differences in input could quickly become overwhelming differences in

output—a phenomenon given the name 'sensitive dependence on initial conditions.'"[41]

The discovery of this phenomenon is popularly credited to Meteorologist, Edward

Lorenz.[42] Although the logical presumption is that the future should be determined from

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39. Any transfer of elements of mathematical chaos to examples of social chaos is fraught with danger, and a mathematician could find this analogy weak, since an outside force caused the chaotic behavior and not the internal dynamics of a chaotic system. The important point is that if a system is on the critical point or edge of chaos, then even very small changes can push a system into chaotic behavior, or alternatively, lock it into a fixed state.

40. Beaumont, *War, Chaos and History*, xiv.

41. Gleick, *Chaos*, 8. For a clear explanation of the relationship, see James, "Chaos Theory," 31-33. He professes, "The presence of sensitivity to initial conditions (SIC) will not always result in chaos; however, a system without SIC will not be Chaotic" (ibid., 32).

42. Lorenz is credited with the discovery of the Butterfly Effect," which has been widely misinterpreted to suggest that the movement of the wings of a single insect could produce a miniscule change in airflow patterns that eventually causes a major meteorological event. His important lesson, rather, is that in a chaotic system even the minutest perturbation (as represented by the butterfly's wing flapping) could result

the past, Lorenz discovered that minute changes in measurement are amplified over time and can lead to unpredictability in the long term. Therefore, although the behavior of two systems may be identical, very small changes in their point of origin, when amplified, could produce dramatically different results. Herein resides the major limitation on applying the principles of Chaos Theory to the understanding of effects. There are no agreed criteria for determination of whether or when this condition exists.

James proposes that if a system is sensitive to initial conditions (SIC), then "any two initial states that deviate by the slightest amount must deviate from each other exponentially."[43] He adds "If a system is SIC, you are not guaranteed to find Chaos; if, however, a system is not SIC, it cannot exhibit Chaos," and that SIC is a "necessary but not sufficient cause for Chaos to occur."[44] Hence, the most obvious indicator of sensitivity to initial conditions is the presence of a chaotic system.

In Cambel's view, this sensitivity to initial conditions causes the system to be unstable; and this instability leads to uncertainty. "Deterministic chaos in not just arbitrary randomness; there is order involved."[45] However, the presence of deterministic equations that have unpredictable results may be an indicator of chaos. Therefore, whether or not a system is sensitive to initial conditions could be an indicator of its potential for becoming chaotic. While this may be of value to the decision-maker, there are significant problems in determining the existence of sensitivity to initial conditions.

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in abject failure in predictions. See Peak and Frame, *Chaos under Control*, 146-150, for a more detailed explanation along with illustrations.

43. James, Chaos Theory, 30. In his definition, for a system to be chaotic, it must be bounded; nonlinear; non-periodic; and sensitive to small disturbances.

44. Ibid., 32.

45. Cambel, *Applied Chaos Theory*, 14.

Although the theory provides a tool that may assist understanding of chaotic systems, its practical applications appear to be limited.

Chaos Theory is concerned with finding underlying order in data that appears to be disordered and random. Proponents of the application of the principles of Chaos Theory to disciplines beyond pure mathematics acknowledge the relative immaturity of the concept and the difficulty in grasping many of its components. Some have observed, "Since formal chaos theory is primarily a mathematical construct, the nonmathematical use of it is primarily as an analogy."[46] However, some argue that a total understanding of Chaos Theory or of the system under examination is not a prerequisite for its use. James contends, "Chaos theory can provide an idea of behaviors and dynamics to expect without knowing anything about the workings of the system."[47] If this is correct, then Chaos Theory offers significant improvement to analyses related to the effects of actions.

However, skeptical observers see this as at best a possibility in the future. Additionally, they consider the determination of the presence of attractors and sensitivity to initial conditions, and the finding any of this alleged order out of chaos, as problematic. Therefore, any ability to predict behavior is unlikely at the current state of development of the theory. I will next consider a sampling of the recognized limitations and problems associated with the use of the principles of Chaos Theory.

Limitations on the Use of Chaos Theory

Saperstein presents a piercing but essential question regarding Chaos Theory and other "fashionable" approaches and asks, do we gain anything "besides some new, exotic

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46. Bolland and Atherton, "Chaos Theory," 370.
47. James, *Chaos Theory*, 21.

descriptive metaphors?"[48] Some consider chaos a mathematical curiosity; a large group

contends, "Nobody has yet conclusively found it in the physical world."[49] Dismissing

commonly expressed examples of its applicability, in Beaumont's view of Chaos Theory,

"Rational assumptions and simple stratagems align with reality only by coincidence."[50]

Most damaging to the conclusions of its proponents is the reality that practical

applications of Chaos Theory have not been abundant, even in the field of mathematics

where much of the previous and ongoing research is conducted. While I have identified

multiple problems, the determination of the existence of sensitivity to initial conditions,

and the appropriate use of this information if detected, provide the major obstacles for

analysis and understanding.

Sanders argues, "It is important to recognize a system's initial conditions before

they erupt as a strange attractor."[51] Going beyond this declaration, Gell-Mann affirms that

successful exploitation of Chaos Theory requires precise knowledge of initial conditions,

i.e., near perfect knowledge of the extant conditions of the system, so that any predictions

may be made as to the system's future conditions.[52] Unfortunately, this perfect

knowledge remains unattainable even with the most sophisticated information gathering

equipment and analytical processes. Saperstein believes that perfect knowledge is not

possible, that there will always some measurement errors.[53] If this is challenging in the

hard sciences, some deem it unattainable in matters concerning relationships between

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48. Saperstein, "Complexity, Chaos and National Security," 101.
49. Williams, *Chaos Theory Tamed*, 13.
50. Beaumont, *War, Chaos and History*, 10.
51. Sanders, *Strategic Thinking and the New Science*," 74.
52. Gell-Mann, *Quark and the Jaguar*, 26. Poincare observed in 1903 that because we can only know initial conditions approximately, prediction becomes impossible. Expanding on this, Gell-Mann contends, "Since nothing can ever be measured with perfect accuracy, chaos gives rise to effective indeterminacy."
53. Saperstein, "Complexity, Chaos and National Security Policy," 108. He contends that when dealing with chaotic systems, "prediction is difficult or impossible."

states. Therefore, if the value of predictive capability relates directly to the quality of knowledge of present conditions, and our ability to obtain this perfect knowledge is limited, then Chaos Theory may not provide much potential for practical use.

Byrne contends, "If we can deal with robust, determined, organized chaos, then we may be able not to predict, but to act so that some things happen and others don't happen."[54] For those responsible for foreign policy decisions, a methodology that can provide for prediction would be a most welcomed, albeit an elusive capability. If we could predict the precise effect of an action, as well as secondary effects of that act with any degree of accuracy, this would simplify the task of meeting foreign policy objectives. Others assert, "Any system that obeys rules—even if the behavior is chaotic—can be controlled once the rules are known."[55] While the statement in itself may be supportable, when dealing with chaotic systems there is inadequate evidence to sustain the assumption that the conventions are recognized and accepted.

Saperstein observes, "It is not evident to me that a single metaphor/tool—like chaos—is available or useful to us in dealing with a world system characterized by 'complexity.'"[56] Based on this limited analysis, and focusing on the use intended for the application of principles of nonlinear analysis, I conclude that while Chaos Theory provides some interesting perspectives, and apparently has proven useful at least in the field of mathematics, the potential contributions for its use in the development of understanding of secondary effects is extremely limited.

A supposition made earlier was that the detection of chaos might be an indicator of sensitivity to initial conditions. If the reverse were true, and if there were some

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54. Byrne, *Complexity Theory and the Social Sciences*, 26.
55. Ibid., 26. Claim is attributed to Peak and Frame.
56. Saperstein, "Complexity, Chaos and National Security Policy," 120.

mechanism, other than the presence of chaos, for determination of when sensitivity to initial conditions exists, then the theory would be more useful. If Chaos Theory could provide some ability to define when a system is on the edge of chaos, that knowledge could enable better decisions regarding actions that could influence the movement of the system toward or away from the precipice.[57] With such a potential capability, its application would be extremely useful. However, in its current state of development, Chaos Theory does not provide such contributions.

This assessment of Chaos Theory resulted in a negative response to one part of the hypothesis question. Can approaches recently developed in mathematics and the physical sciences contribute to enhanced understanding of nonlinear systems? I presented arguments to support the conclusion that application of the principles of Chaos Theory will not appreciably facilitate prediction of the ramifications of actions, or enhance description of the systems of power. However, reaching this conclusion does not justify discontinuation of the quest. Further examination is required to reveal models of nonlinear processes that may be more appropriate for application to the problems presented by secondary effects. To that end, I will now address the other major perspective on the nature and operations of nonlinearity.

Complexity

Since both provide a means of understanding nonlinear systems, and because many of their principles are similar, the terms chaos and complexity are frequently

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57. For a detailed description of this critical point, see M. Mitchell Waldrop, *Complexity: The Emerging Science at the Edge of Order and Chaos* (New York: Simon and Schuster, 1992), 12. "This balance point— often called the *edge of chaos*—is where the components of a system never quite lock into place, and yet never quite dissolve into turbulence, either."

confused. Consideration of several offerings of definitions helps to alleviate some of this misunderstanding. A good place to begin is to regard complexity as "a characteristic of systems made up of two or more elements, suggesting intricacy of structure and process, but not randomness, sometimes with a high degree of regularity in their dynamics up to a point of transition; usually implies a reasonable degree of predictability and controllability."[58] This rather lengthy description provides a basis upon which to compare and contrast chaos and complexity.

Among the available alternative definitions that may be appropriate for use in this discussion, complexity is "a type of dynamical behavior in which many independent agents continually interacting in novel ways."[59] As with Chaos Theory, the more limited scope of the term that is germane to theoretical discussions should be distinguished from the more general usage of complexity. As the antithesis of simplicity, complexity commonly is used along with similar terms such as complication, intricacy, convolution, and entanglement. While the use of the word in the scientific community is more precise, this same direct contrast with simplicity applies.

The lack of explicit definitions for either term makes comparison exceptionally difficult. Indeed, in some treatments "chaos theory, the nonlinear and complexity are treated as a single paradigm."[60] Chaos Theory and complexity share some characteristics. Cohen and Stewart describe as a basic tenet of complexity theory that "complex causes can produce simple effects" and they contend, "simplicity in nature is generated from

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58. Beaumont, *War, Chaos and History*, xiv.
59. Williams, *Chaos Theory Tamed*, 449.
60. John Urry, *Global Complexity* (Cambridge, UK: Polity Press, 2003), 17.

chaos and complexity"[61] The connection is between the simplicity emerging from complexity and the order within disorder believed to result from chaos.

Adding to the difficulty in understanding the differences between these phenomena is a certain degree of overlap, or fuzziness, resulting in a state of complexity that is not wholly random or chaotic. Seeing similarities in the two models, at least in a temporal sense, Byrne contributes, "Chaos and complexity are not time reversible."[62] That is, both involve a continuum of time that is not repeatable, because the conditions have changed irreversibly. These similarities exacerbate the difficulty in clearly defining the boundaries between chaos and complexity. However, a brief look at characteristics provides a means for enhanced understanding of the ways in which the two are alike, and therefore, difficult to differentiate.

Rosenau proposes four underpinnings of complexity theory: (1) self-organization; (2) adaptation and co-evolution; (3) the power of small events; and, (4) sensitivity to initial conditions. Self-organization refers to the characteristic of complex systems to generate "some type of pattern or structure from a (usually) orderless dynamical system."[63] This is not too distant of a departure from the order out of disorder characteristic of Chaos Theory. Adaptation is "The capacity of the agents to cope collectively with the new challenges." The power of small events results in the "often massive disproportionalities between causes and effects," and "unpredictable and yet irreversible patterns seem to characterize all social and physical systems."[64] Sensitivity to initial conditions explains "The quality whereby two slightly different values of an input

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61. Cohen and Stewart, *Collapse of Chaos*, 2.
62. Byrne, *Complexity Theory and the Social Sciences*, 15.
63. Williams, *Chaos Theory Tamed*, 467. For added clarity, consider, Cambel, *Applied Chaos Theory*, 20. "Not all complex systems are self-organizing, but all self-organizing systems are complex."
64. Urry, *Global Complexity*, 7.

variable evolve to two vastly different trajectories."[65] Hence, there is commonality among many of the characteristics of Chaos Theory and complexity. However, the two models are distinct in several aspects, and it is possible to identify lines of demarcation.

Axelrod and Cohen propose a concise answer to the common question regarding the differences, asserting, "chaos deals with situations such as turbulence that rapidly become highly disordered and unmanageable. On the other hand complexity deals with systems composed of many interacting agents."[66] The inference obtained from this observation is that there is little potential for successful prediction or influencing of behavior in chaotic systems. The important difference in their view is that in complex, but not chaotic systems, there is some possibility of altering the systems through "thoughtful interventions."

In Beaumont's opinion, chaos is random and not directly predictable, whereas complexity is complicated, but "reducible to a high degree of predictability and precise numerical expression."[67] According to Axelrod and Cohen, complexity is a way of thinking and it "indicates that the system consists of parts which interact in ways that heavily influence the probabilities of many kinds of later events."[68] The important distinction is that complexity is a necessary, but not sufficient, condition for chaos. However, not all complex systems are chaotic. Further examination of definitions of complexity will help to emphasize these distinctions.

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65. Williams, *Chaos Theory Tamed*, 496. James, "Chaos Theory," 30, views this divergence in trajectories as exponential. Beaumont, *War, Chaos and History*, xiv, describes SIC as the propensity of non-linear systems to change properties far out of proportion to the scale of forces changing their original state."

66. Robert Axelrod and Michael D. Cohen, *Harnessing Complexity* (New York: The Free Press, 1999), xv.

67. Beaumont, *War, Chaos and History*, 12.

68. Axelrod and Cohen, *Harnessing Complexity*, 7.

Adding the temporal aspect, Covey and Highfield describe complexity as "the study of the behavior of macroscopic collections of such units that are endowed with the potential to evolve in time"[69] Others advocate consideration of the situation and environment in any description of the term. Gell-Mann offers, "Complexity, however defined, is not entirely an intrinsic property of the entity described; it also depends to some extent on who or what is doing the describing"[70] While insightful, this observation does not bring us any closer to development of a consensus on terminology.

As with the often-cited Supreme Court opinion on obscenity, complexity is sometimes described as an "I know it when I see it concept." Cambel contends, "There is no agreed-upon definition of complexity, because it manifests itself in so many different ways," and he proposes four basic characteristics for consideration: purpose and function; size and configuration; structure; and, type of dynamics.[71] Size is not a criterion for determination of the existence of complexity. The interaction of the parts is the critical element, not the number of parts. Gell-Mann also contends that there are several different kinds of complexity and "any definition is context dependent."[72] Hence, the definition of complexity is a function of the purposes for which it is employed.

Since agreement on a definition is difficult, a means of determining when a system is complex is useful. King provides such a guide. In his view, several factors indicate the presence of a complex system. Detection of the following conditions indicates that a system is complex:

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69. Coveny and Highfield, *Frontiers of Complexity*, 7.
70. Gell-Mann, "The Simple and the Complex," 4. He later adds, "randomness is not what we mean by complexity." 7.
71. Cambel, *Applied Chaos*, 2. Description being more readily achieved than definition, he provides 15 statements that can be applied to complexity in systems. Among the most valuable is "The system is neither completely deterministic nor completely random, and exhibits both characteristics." pp.3-4.
72. Gell-Mann, *Quark and the Jaguar*, 17.

1. Large number of elements, whose interactions defy description by differential equations

2. Interacting elements; the interactions are dynamic and nonlinear

3. Loops in the interactions, positive and negative

4. Operations in conditions far from equilibrium, and

5. Complexity emerges as a result of patterns of interactions between the elements[73]

Caution must be exercised in the use of these conditions. These factors are some indicators of complexity, and not an all-inclusive list for determination of its presence.

Presentation of a means of quantification can be useful in understanding when it exists. Demchak offers factors for measurement of complexity:

Complexity (C)

$C = f(N, D, I)_{t0}$ in operation at time zero

Where N = number of components

D= differentiation among components

I= interdependence among components

$t0$ = initiating time period zero[74]

The important elements are multiple, varied and interacting components. The degree of complexity is a function of those factors. Her listing includes consideration of differentiation, which King does not include in his inventory of factors provided earlier.

As with the discussion of Chaos Theory, it is more productive to look at the consequences of complexity than it is to struggle with definitions. H. A. Simon avoids presenting a definition of complexity, preferring to "regard a system as complex if it can

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73. King, *Social Science and Complexity*, 77-78. Several factors were combined from the author's more extensive list.
74. Demchak, "Complexity and Theory of Networked Militaries," 246.

be analyzed into many components having relatively many relations among them, so that *the behavior of each component depends on the behavior of others.*[75] This interaction between elements represents the essence of complexity as it relates to this study. Since it is behavior and the product of complexity that is most critical to this assessment, it is prudent to shift focus to the potential uses of an understanding of complexity.

Potential Uses of Complexity

As a precursor to any utilization, an imprecisely defined condition such as complexity requires some type of framework for development of understanding. The emergence of organizations dedicated to the study and advancement of complexity theory is an indicator of the belief that that there may be promise in this area. The *Santa Fe Institute* in New Mexico, the *Center for the Study of Complex Systems* at the University of Michigan, *The Ilya Prigogine Center for Studies in Statistical Mechanics and Complex Systems* at the University of Texas, and the *Center for Social Complexity at George Mason University* are a few of the educational and research structures that focus on complexity theory and are dedicated to its advancement.[76] Refereed journals such as *Complexity International* and *Complexity Digest* complement the work and products of these institutions.[77]

In its most basic sense, complexity theory provides a basis for investigating the properties of nonlinear systems. However, its proponents see a larger role. Coveny and

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75. H. A. Simon, "Near Decomposability and Complexity: How a Mind Resides in a Brain," in *The Mind, the Brain and Complex Adaptive Systems*, ed. Harold. J. Morowitz and Jerome L. Singer (Reading, MA: Addison-Wesley Publishing Company, 1995), 26. Emphasis added.

76. Of these, the Santa Fe Institute is the best known. See Waldrop, *Complexity*, for an engaging narrative of the origins and workings of this organization.

77. The Complexity in Social Science site, http://www.irit.fr/COSI.html (accessed 11 October 2004), provides an excellent introductory tutorial into nonlinear systems as well as multiple links to related sites.

Highfield contend that the science of complexity is "the quest to see the forest through the trees, distill unity from diversity, and seek an account of the emergence of organization."[78] Urry adds, "Complexity theory generally analyzes systems as unstable, dissipative structures."[79] Providing a connection to more focused studies of this phenomenon, Rihani asserts, "Complex and Complexity refer to certain systems that have large numbers of internal elements that interact locally to stable, but evolving, global patterns."[80] Nicolis and Prigognine prefer to consider complex *behavior*, rather than complex *systems*, since in their view, "simple systems can display complex behavior."[81] Even the most cursory review of the activities of the academic and scientific disciplines to which complexity theory has been applied confirms that the theory is wide-ranging. However, escape from the current confines of research institutes requires consideration of its potential practical applications.

James Rosenau poses the question: Can complexity theory "point the way to policies which can ameliorate the uncertainties inherent in a fragmegrative world?"[82] In his search for applications of complexity into the social sciences, Byrne presents a bold assertion: "Complexity theory can be used as a technique that allows us to

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78. Coveny and Highfield, *Frontiers of Complexity*, 2. "This complexity is intrinsic to nature; it is not just a result of the combination of many simple processes that occur on a more fundamental level."
79. Urry, *Global Complexity*, 28.
80. Rihani, *Complex Systems Theory and Development Practice*, 6. He adds, "Complex behaviour is defined to a large extent by local interactions between their components" (ibid., 7).
81. Gregorire Nicolis and Ilya Prigognine, *Exploring Complexity* (New York: W. H. Freeman and Company, 1989), 8. The objective of an analysis of complex behavior should be the determination of "common characteristics among different classes of systems."
82. James N. Rosenau, "Many Damn Things Simultaneously: Complexity and Theory in World Affairs," in *Complexity, Global Politics, and National Security*, ed. David S. Alberts and Thomas J. Czerwinski (Washington, DC: National Defense University, 1997), 73. *Fragmegration* relates to globalization pushing and pulling in complex and conflicting ways. He concludes, "complexity theory does have insights to offer," but cautions that their potential benefits may have been exaggerated. (ibid., 74).

understand the changing social world."[83] Extending this theme of a search for

knowledge, Sanders argues, "while it may not be possible to solve or predict the future of

nonlinear systems, it is possible to provide a qualitative description of its characteristics

and behavior as a whole over time."[84] Adding a British perspective, Urry believes that the

complexity sciences may be emerging as a potential new paradigm for the social

sciences, and also may provide "concepts and methods that begin to illuminate the global

as well as a system or series of systems."[85]

While achieving understanding is a worthwhile goal in itself, the ultimate

objective is some type of prognostic capability. The potential for using the principles of

complexity theory for prediction emerges as a desirable trait; however, debate continues

over whether this is a realistic aspiration. Cohen and Stewart assert, "Complexity may be

unpredictable in detail, but its general course may be comprehensible and foreseeable."[86]

Rihani supports this view: "Within a complex regime, some global patterns are

predictable."[87] Although skeptical of what he considers to be exaggerated claims by the

proponents of chaos-complexity, Saperstein concedes, "Complexity theory may be useful

in modeling how real-world situations get out of control."[88]

Precise prediction, while desirable, is not mandatory for a model to provide

benefits. "If you have a truly complex system, then the exact patterns are not repeatable.

And yet there are themes that are recognizable."[89] However, the ability of complexity

theory to deliver even the more restricted product of recognizable themes remains

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83. Byrne, *Complexity Theory and the Social Sciences*, 71. The key to this understanding is the "individual interactions may constitute the source of changes in the social order itself."
84. Sanders, *Strategic Thinking and the New Science*, 60.
85. Urry, *Global Complexity*, 7.
86. Cohen and Stewart, *Collapse of Chaos*, 3.
87. Rihani, *Complex Systems Theory and Development Practice*, 9.
88. Alvin Saperstein, "War and Chaos," 548.
89. Waldrop, *Complexity*, 332.

contentious. This, and other perceived limitations of the use of complexity theory is the topic for the following section.

Limitations of the Use of Complexity Theory

Earlier discussions concluded that a complex system consists of many interacting parts, many of which are interacting nonlinearly. The existence of interrelationships between the components of a system and the nonlinearity of these relationships is commonly accepted. However, recognition that a complex system exists and that linear solutions are not applicable, does not provide much practical assistance. The utility is in being able to use the principles of complexity theory to provide, at minimum, a level of understanding that could contribute to some predictive capability.

Addressing the optimistic views of the proponents of complexity theory, Axelrod and Cohen counter, "it can still be very disquieting to act on the 'fiction' that we have a reasonable prediction of the consequences of a particular event in a complex system."[90] The problems associated with assuming a predictive capability that does not exist are obvious. Although he discerns some potential for further study, Rousenau cautions, "For despite the strides, there are severe limits to the extent to which such theory can generate concrete polices."[91] He expresses concern that in searching for a panacea for the shortfalls in understanding nonlinear systems, some proponents have overstated the potential benefits of complexity theory. Based on his analysis he concludes that complexity theory "cannot presently—and is unlikely ever to—provide a method for

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90. Axelrod and Cohen, *Harnessing Complexity*, 13.
91. Rosenau, "Many Damn Things Simultaneously," 74.

predicting particular events and specifying the exact shape and nature of developments in the future."[92]

Eve Mitleton-Kelly cautions against "adapting the widespread practice of using complexity as a metaphor or analogy" and advocates developing an understanding of the nature of complex social systems.[93] Misunderstanding and misuse of the analogies represent the major weakness in the arguments of advocates of complexity theory. Demchak observes a poor system fit in attempts by many nations to modernize their militaries, due "in large part to the widespread misunderstanding of complexity and surprise among defense leaders."[94] The errors are not in assertions that complexity can provide useful insights; rather it is the exaggerated and unjustified claims for its predictive capabilities. While these may evolve in some point in the future, the current offerings are more limited. Theory and animated discussion are abundant; practical uses, less so. Richards believes that much of the difficulty in applying nonlinear methods, including complexity, is that there is "no template for nonlinear modeling."[95]

Complexity theory attempts to describe the operation of complex systems, but is not helpful for those who must make decisions and operate within multifarious systems. Previous attempts at utilization of complexity theory in the realm of relations between nations have not been helpful because they often only acknowledge that complexity exists, without providing guidance on how to make decisions when dealing with a

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92. Ibid., 89.

93. Mitleton-Kelly, *Complex Systems and Evolutionary Perspectives on Systems*, 5.

94. Demchak, "Complexity and Theory of Networked Militaries," 222. The author uses the term "surprise" which is roughly equivalent to "unexpected" or "unintended." Sensing a proportional relationship between knowledge, system complexity and the potential for unintended effects, she contends, "Increases in complexity are inextricably linked to increases in surprise, unless accommodated" (ibid., 225).

95. Richards, *Political Complexity*, 10. It follows that "the ramifications of nonlinearity have not been sufficiently realized" (ibid., 2).

complex system. The critical shortfall is that if theory is considered to be a set of interrelated propositions, then a true theory of complexity does not exist. Hence, it is preferable to consider complexity as a condition rather than as a theory. If treated as a condition for further analysis, then the potential remains for development of propositions for methodologies with utility to the decision-maker.

Summation

This chapter provided a brief examination of the two most predominant approaches to the problems presented by nonlinearity. Chaos Theory describes a situation where system nonlinearity displays apparent disorder and randomness, but may also provide some detectible order. While displaying some similarities, complexity is less of a theory or concept, and I concur with its more accurate depiction as a characteristic of systems that contain interacting components. Complexity was determined to be a requirement for chaos, however, not all complex systems are chaotic.

The potential benefits and the limitations of the use of these approaches were presented, and I concluded that chaos-complexity theory provides some interesting and challenging paradigms. These insights can provide a description of the inner workings of interrelated elements of systems. Hence, their major contribution to this effort lies in the presentation of models of system behavior. As Beaumont contends, chaos-complexity theory "may give us new metaphors and make us more sensitive to its intricacy and to the possibility that the range of possible outcomes may be greater than common sense or linear thinking leads us to believe."[96] Metaphors and models have value; however, they

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96. Beaumont, *Nazis' March to Chaos*, 36.

can provide only limited practical applications, especially when based on emerging, unrefined, and largely unproven scientific concepts.

At their current level of maturity, Chaos Theory and complexity approaches do not provide a practical means to understand the elements of national power or a viable ability to anticipate the nature of secondary effects of actions. Additionally, there is no credible evidence that these approaches can provide much prognostic capability. This is largely due to the need for near perfect information upon which to base any predictions of behavior. Beyerchen concludes that the knowledge required to anticipate effects is unattainable: "Due to our ignorance of the exact initial conditions, the cause of a given effect must, for all intents and purposes, often be treated as unavoidable chance."[97] Demchak concurs: "Knowing all the possible outcomes of a dynamic system is theoretically impossible, and thus there remains a final subset of unknowns that are simply unknowable."[98] If a high degree of predictability is the objective, then clearly chaos-complexity approaches fall short.

However, even this limitation does not signify that there is no value in consideration of these approaches. Saperstein agrees that chaos-complexity can provide no more than metaphors, but identifies possible benefits from their use: "Instead of specific new tools, these metaphors can contribute to the development of the new attitudes required for the more complex modern world."[99] Rosenau notes that the lack of

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97. Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," 77.
98. Demchak, "Complexity and Theory of Networked Militaries," 226.
99. Saperstein. "Complexity, Chaos and National Security Policy," 120. See also Saperstein, "War and Chaos," 548. "Complexity theory may be useful in modeling how real-world situations get out of control."

an ability to predict "is not a serious drawback" and urges the adoption of a *complexity perspective.*"[100]

This leads to the response to the hypothesis question that is the focus of this chapter: Can approaches recently developed in mathematics and the physical sciences contribute to enhanced understanding of nonlinear systems? Based on the evidence examined the response would be a qualified yes. Plainly, Chaos Theory and complexity can provide some degree of enhanced understanding. However, that level of awareness is limited. The principal benefit is an appreciation of the exceptional difficulties, and some argue impossibility, associated with prediction of behavior in nonlinear systems.

The brief examination of chaos provided in this chapter introduced the lexicon and provided a non-technical overview of the theory. This excursion led to the conclusion that Chaos Theory does not represent the most advantageous approach to nonlinearity that could support development of a useful instrument for assessments of national power and the determination of effects of actions. In this context, Chaos Theory can provide little beyond interesting analogies and metaphors. Claims for its application in this context that extend beyond this contribution should be viewed with skepticism. The examination of complexity produced a fundamentally different conclusion. Complexity, considered as a condition rather than a theory or paradigm, could provide a foundation for further development of useful methodologies.

Despite a wide range of academic backgrounds and viewpoints, the cited authors concur that complexity studies are nascent. Nevertheless, attempts to advance beyond mere recognition of complexity should be taken at this time, and not await maturation of existing theories of nonlinearity. Supporting this view, Cederman contends,

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100. Roseneau, "Many Damn Things Simultaneously," 92.

"Policymakers cannot afford the luxury of a wait-and-see attitude, and neither can theorists. Conceptual innovation is needed now and not after the action has already taken place."[101]

Nonlinear approaches, and particularly complexity, have potential for exploitation. However, they have not yet advanced to a stage where they provide any immediately useful tools to the decision-maker. Rosenau contends, "We do not have techniques for analyzing the simultaneity of events such that the full array of the interconnections and feedback loops are identified."[102] This statement of existing limitations does not mandate the discarding in their entirety ideas emerging from studies of complexity. The essential tasks are to take advantage of the existing immature conceptual principles and to attempt to discover the requisite skills and techniques.

Waltz succinctly describes the problem facing the decision-maker: "The same causes sometimes lead to different effects, and the same effects sometimes follow from different causes. We are led to suspect that reductionist explanations of international politics are insufficient and that analytic approaches must give way to systemic ones."[103] Arguing for new methodologies, Jervis states, "When we are dealing with systems ...we have to understand complex interactions, and these present a series of challenges to standard comparative methods."[104]

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101. Cederman, *Emergent Actors in World Politics*, 4. A worthwhile goal is to develop "new heuristic devices that deal directly with complexity and change in world politics" (ibid., 5).

102. Rosenau, "Many Damn Things Simultaneously," 89. "For despite the strides, there are severe limits to the extent to which such theory [complexity] can generate concrete polices they lessen the uncertainties of a fragmegrative world" (ibid., 7).

103. Waltz, *Theory of International Politics*, 39. A systems approach will be needed "if outcomes are affected not only by the properties and interconnections of variables but also by the way in which they are organized."

104. Jervis, "Complexity and the Analysis of Political and Social Life," 582. He also offers, "Actions often interact to produce results that cannot be comprehended by linear models" (ibid., 574).

Herein resides a potential course for further exploration. The system emerges as the key ingredient for enhanced understanding; for as Byrne contends, chaos-complexity is "inherently systematic."[105] While other potential solutions may have merit, the integration of perspectives on complexity with a systems approach appears to be a promising path toward enabling advancement beyond mere acceptance of complexity as a nearly universal condition.

The existing work regarding nonlinearity and complexity described in this chapter provides the underpinning for continuation of the search for an effective methodology. However, further progress toward this objective requires additional resources. Systems theory can supply the framework to build upon this foundation. At its center is the concept of a *complex adaptive system*, an approach that affords the structure required for the proposition. However, adaptation of systems theory to the objective of this proposition requires further development. Therefore, an examination of the potential of the complex adaptive system to serve as a basis for a methodology that can lead to understanding of secondary effects of actions is the subject of Chapter IV.

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105. Byrne, *Complexity Theory and the Social Sciences*, 51.

CHAPTER IV

THE SYSTEMS APPROACH

Preceding chapters examined the impact of nonlinearity when considering system

behavior. I determined that when dealing with systems with multiple interrelated parts,

linear approaches were not adequate for the task of developing an understanding of the

effects of coercive actions. Two of the more frequently studied approaches to

nonlinearity were selected for more detailed examination, and a conclusion was reached

that one of these, Chaos Theory, provides little potential for practical application in this

context. However, complexity treated as a condition rather than a theory, and teamed

with another approach, offers some promise.

Systems have been described as "instances of *organized complexity.*"[1] Hence, the

linkage of systems to complexity does not represent a radically new pairing. However,

further development requires a firmer theoretical underpinning. A premise essential to

exploitation is that the potential for the enhanced understanding of the effects of actions

emerges when complexity is coupled with the framework of systems theory. Recently,

significant effort has been made in this area, resulting in a complex adaptive system

(CAS) model that provides this necessary connection. Consequently, the complex

adaptive system may provide an appropriate structure for further development of the

proposed methodology. I will expand on this supposition later in this chapter.

Earlier sections captured the essential elements of complexity; however, the

defining and establishing of boundaries of *systems* require some additional examination

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1. John W. Sutherland, *Systems Analysis, Administration and Architecture* (New York: Van Nostrand Reinhold Company, 1975), 7. Italics in original.

to support arguments for the application of a systems approach. A notable advocate of the

systems approach argues: "Although we all know that social life and politics constitute

systems and that many outcomes are the unintended consequences of complex

interactions, the basic ideas of systems do not come readily to mind and are often

ignored."[2] Therefore, an essential step in the development of this proposition and

methodology is the rectification of this condition through the establishment of systems as

the core of further analysis.

This chapter initially will examine the concept of systems and the associated

terminology. This will be followed by an appraisal of some of the relevant elements of

systems theory. Since the field is expansive, the focus will be on the central theme of the

proposition, i.e., the interaction of units (actors) within and across systems. Since the

complex adaptive system has been selected as the model, a review of the most insightful

and directly applicable studies on CAS will be conducted. Concentration will be on the

principles that are relevant to an examination of the effects of the application of national

power. The concluding argument is that national power may be properly described

through utilization of a complex adaptive systems model.

Three key questions were presented in the Introduction to the dissertation. The

objective of this chapter is to present additional evidence with which to respond to the

first of these: *Can the sources of national power be examined and understood through

utilization of a systems approach?* Moving beyond that query, the *system of systems*

construct will be introduced and shown to be an effective way of portraying interactions

of elements across system boundaries. That is, how a holistic approach can help to

overcome the analytical problems associated with reducing large complex systems into

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2. Jervis, "Complex Systems," 45.

manageable parts. The goal is to begin to respond to the second vital question: *Can the interaction between elements (actors or entities) within a system be determined using a system of systems model?* While steps leading to an answer will be taken, a complete response to this query must be deferred until the presentation of the methodology in Chapter V.

Elements of a Systems Approach

Although the term *system* appeared in earlier chapters, it was used in a very generic context, as *a regularly interacting or interdependent group of items forming a unified whole, under the influence of related forces*. While that portrayal was adequate for those excursions, further development of the utility of the complex adaptive system model requires more rigor and specificity in terminology. Therefore, prior to embarking upon a discussion of the application of systems theory, boundaries must be established and a set of adequate definitions must be provided.

Waltz supplies a simple yet practical characterization of a system as "a set of interacting units." However, more importantly, he observes that the system also includes structure, which makes it more than simply a collection of units and the interaction between these units. The aim of systems theory is to show how the levels operate and interact, and that requires marking them off from each other."[3] Similar definitions are provided: Williams, "an assemblage of interacting parts;" Atkins, "the interaction between two or more units and the functions of that interaction;" and, Lorenz, "collection

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3. Waltz, *Theory of International Politics*, 40. Although the focus of this seminal work is the international system, not specifically national systems of power, his insights on system theory are particularly useful to this examination. He further expands on this distinction between structure and interaction of units: "Any approach or theory, if it is rightly termed "systemic" must show how the systems level, or structure, is distinct from the level of interacting unit." An important element is how structure affects unit interactions, and vice versa.

of parts along with some recipe for how those parts move and change."[4] Raymond

DeCarlo describes systems as "some physical process which generates outputs, finished

products, desired behaviors, etc. in response to input stimuli."[5]

Other attempts at defining a system include a "set of objects together with the

relationships between the objects and between their attributes."[6] Dictionary entries

provide, "a functionally related group of elements; a set of objects or phenomena grouped

together for classification or analysis."[7] Morton Kaplan offers: "A system consists of a

set of variables related by one or more functions."[8] While even a cursory investigation of

the concept of systems will reveal an abundance of characterizations, the terms that

appear most consistently in definitions of systems, and those that are most important to

this analysis—*structure* and *function*.

While there is a range of acceptable definitions of the term, this examination of

the elements of national power will expand on the generic definition and regard a system

as a *set of interacting parts with a common function, purpose or utility*. That

characterization represents a good place to start; however, as with attempts to grasp what

is meant by complexity, it is useful to look at when a system is extant as a means of better

understanding the concept.

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4. Williams, *Chaos Theory Tamed*, 3. Atkins, *Latin America in the International Political System*, 4. Definition attributed to Meteorologist Edward Lorenz in James, *Chaos Theory*, 28.

5. Raymond A. DeCarlo, *Linear Systems* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1989), 2. These stimuli "activate the operation of some process to produce some result or response." p. 1.

6. David Berlinski, *On Systems Analysis* (Cambridge, MA: The MIT Press, 1976), 3, crediting A.D. Hall and R.E. Fagen with the view that objects are "parts or components of the system;" attributes are "properties of objects;" and relationships are those things that "tie the system together."

7. *The American Heritage Dictionary*, 3rd ed., s.v. "system."

8. Morton A. Kaplan, *Macropolitics* (Chicago: Aldine Publishing Company, 1969), 26.

Determination of when a system exists is not precise. Indeed, as J. David Singer argues, "a system exists largely in the eye of the beholder."[9] Although perhaps accurate, this characterization is not particularly conducive to further development. Jervis provides useful input: "We are dealing with a system when a set of units or elements are interconnected so that changes in some elements or their relations produce changes in other parts of the system, and the entirety exhibits properties and behaviors that are different from those of the parts."[10] A Sociologist, Daniel Metlay, offers, "Two components are part of the same system if they are involved in reciprocal exchanges of resources."[11]

Most depictions concur that a system may be viewed as a collection of interacting parts that share common characteristics. However, the important common theme in the criteria for determining the existence of a system is that it must be more than merely a collection of interacting units. The key element is that the whole is different than the sum of the parts. In earlier discussions this was observed to be an essential element of nonlinearity. Since most systems, almost by definition, are nonlinear, an understanding of the principles of nonlinearity is critical to any employment of a systems model. This is the rationale for the brief introduction to nonlinearity provided in Chapter III. Having briefly described a system, identified means for determination of its presence, and restated the connection between systems and nonlinearity, it is now possible to attach some theoretical vigor to this concept of systems.

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9. Singer, "The Global System and Its Sub-Systems," 22. Singer contends that when examining a cluster of groups or individuals and determining patterns of interaction between these, "the researcher may legitimately label as a system that which he observes."

10. Jervis, "Complexity and the Analysis of Political and Social Life," 570.

11. Daniel Metlay, "Social Systems," in *Organized Social Complexity*, ed. Todd R. La Porte (Princeton, NJ: Princeton University Press), 1975), 27.

Systems Theory

A basic tenet of systems theory is the existence of a set of near universal conditions that provide a framework for explanatory thought. That is, there are common characteristics in systems across a wide range of disciplines, and that explanatory models may be derived from these. As Sutherland argues, "Certain concepts, principles, and methods have been shown not to depend on the specific nature of the phenomenon involved. These can be applied, without any modification to quite diverse areas of science."[12] The implication is that the systems model need not be the exclusive domain of the mathematician, physicist, and engineer.

If, as Weltman contends, system theory is "an approach to an underlying structure of reality,"[13] then the potential emerges to apply the work accomplished and ongoing in mathematics, the physical sciences, and biology, to other disciplines. The supposition is that models derived from the hard sciences may be useful in other fields.

The connection, and potential for application to this methodology, is that if we can understand systems in a mathematical context, and if national power may be viewed as a system, then there may be extant models that can provide enhanced understanding of political, social, and economic systems. These must include the key components of the systems and their interactions within and across categories. Hence, the search for a general theory of systems, elements of which may be applied to the problem of determination of the effects of actions, becomes a meaningful quest and an endeavor worth undertaking.

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12. Sutherland, *Systems Analysis*, 4.
13. John J. Weltman, *Systems Theory in International Relations* (Lexington, MA: Lexington Books, 1973), 14.

Ludwig von Bertalanffy is one of the earliest, and among the most often cited, proponents of the existence of general systems laws that apply regardless of system type or elements. An advocate of a wide-ranging theory, he argues that some abstract generalizations that are applicable to all systems may be made, and asserts: "Independently of each other, similar problems and conceptions have evolved in widely different areas."[14] Therefore, a "basic re-orientation of scientific thinking," represented by adoption of a systems approach becomes necessary. This requires integration of a more expansive and inclusive range of sources. He observes that academic disciplines tend to become inwardly focused and are often protected by "cocoons" that provide impenetrable membranes that stifle intellectual progress. This protective sheath must be removed so that knowledge may be shared, synthesized, and advanced.[15]

Bertalanffy's search is not necessarily for direct application of mathematical models to social and political systems, but rather he seeks certain paradigms, principles, and laws, "which apply to generalized systems irrespective of their particular kind, elements, and the 'forces' involved."[16] He views systems as "complexes of elements standing in interaction," and refers to these common structural similarities between systems as *isomorphisms*. If properly understood, these similarities may be exploited and potentially applied to fields beyond those in which they were discovered.

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14. Ludwig von Bertalanffy, *General Systems Theory*, Revised ed. (New York: George Braziller, 1969), 30.

15. Richards, *Political Complexity,* 339-40, opines, "Just as early political science could not be understood without incorporating both politics and economics, a political science based on dynamic complexity arising from interaction and learning would need to rely on close association with fields such as cognitive science or biology and from computational tools from fields such as computer science."

16. Bertalanffy, *General Systems Theory,* 33. Recognizing the extreme difficulty of this task, he readily admits the limits of current models. However, "A verbal model is better than no model at all" (ibid., 24).

The essential principle, and that which is critical to this study, is that systems are "not understandable by investigation of their component parts in isolation."[17] Rather, insight and understanding may be better achieved through looking at the interactions between elements and the wholeness of the system. This strategy is applicable across a wide range of scientific endeavors. A cross-matrixed, interdisciplinary approach can provide an opportunity to incorporate the work conducted in one field into the problems of another. To pursue the validity of this assumption, it is necessary to briefly expand on the use of systems as a model.

The Systems Model

A system may be seen as causal sequence, which finds a stream of inputs being transformed by some process into a flow of outputs. Therefore, we can view a system as "an ordered combination of inputs, outputs and process."[18] A characteristic common to all systems is that they include some level of input, which undergoes a process, and subsequently provide output. The exact nature of this process may vary significantly and is not always precisely understood. Indeed, it is often described and depicted as a "black box" suggesting the mystery of the process contained within. The Figure 2 provides a simplified depiction of this relationship. This simplified diagram, common to all systems, displays the progression from inputs, through a process, and subsequently to outputs. The environment is the domain in which the system operates.

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17. Ibid., 37. He rejects the notion that we can reduce social elements down to the lowest levels of the construct of physics, but contends that we "can find constructs, and possibly laws within the individual levels" (ibid., 49).
18. Sutherland, *Systems Analysis*, 24.
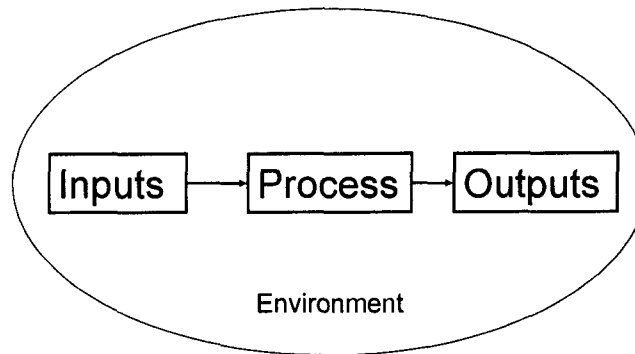
Figure 2. A Generic Systems Model

In a closed system, such as the energy generation component of a simple steam engine, the input is heat. In the process (boiler) this water in transformed into steam, and the output is energy. Since the boiler can receive inputs from one source, and the only output is the steam, this may be described as a *closed* system. In the closed system model, there are no interactions external to the boundaries of the system; outputs are isolated from and have no influence on inputs. Noting of course that *closed* is a relative term. No engine has achieved 100% efficiency, and total isolation from the environment is not possible.

In a classical closed system, the Second Law of Thermodynamics prevails. That is, increased movement toward a state of positive entropy where equilibrium is achieved and movement would stop. Another example of a closed system are stable atoms, which normally do not exchange energy with their environments; "they arrest entropy within

their own structure."[19] A simple depiction of a closed system is provided for illustration

in Figure 3.[20]

$$X1 \longrightarrow \boxed{} \longrightarrow O1$$
INPUT   OUTPUT
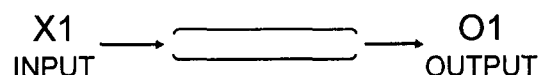
Figure 3. A Closed System Model

The obvious advantage of a closed system is that it may be controlled precisely or

regulated through manipulation of the input. The output of a closed system becomes very

predictable since, "In any closed system, the final state is unequivocally determined by

the initial conditions."[21] Again using the exceedingly simple steam engine analogy, the

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19. Ervin Lazlo, *The Systems View of the World: A Holistic View for Our Time* (Cresskill, NJ: Hampton Press, Inc., 1996), 33. Although the atoms may be affected by high energies and heat, in this type of system, the degradation of energy predicted by the Second Law of Thermodynamics is effectively withstood. See Bertalanffy, *General Systems Theory*, 124-32, for additional examples and illustrations. "Entropy: derives from second law of thermodynamics in a closed system, entropy increases until a maximum state of equilibrium is reached. Eventually a closed system reaches a state where there is no organization, just randomness or some other variant of chaos." Sutherland, *Systems Analysis*, 43.

20. Diagram adapted from Sutherland, *Systems Analysis*, 42. Readers with an engineering background may find this analogy overly simplified and a poor explanation of the true operation of a steam engine. I acknowledge that limitation, however, the importance is in the model, not in the engine design. See Pierre Faurre and Michel Depeyrot, *Elements of Systems Theory* (New York: North Holland Publishing Company, 1977). Chapter 1 provides an introduction, which includes the basic mathematics for those seeking a more precise technical exposure to systems theory.

21. Bertalanffy, *General Systems Theory*, 40. He refers to this principle as *equifinality*.

primary input is heat. As it increases, the level of output (steam) should show a commensurate change. Here we have a predictable and controllable linear system. However, this model provides little utility to this study in that the systems that comprise national power are never closed. Even systems and societies that are sometimes referred to as *closed*, e.g., North Korea, are in fact forced to deal with outside inputs. Despite its inward focus the DPRK must deal with and respond to neighbors, e.g., China and Japan, and international organizations such as nuclear regulatory regimes. Hence, a better paradigm is required.

Open systems take in, as well as release, energy into the environment. Figure 4 provides a simple depiction of an open system.[22]

Figure 4. An Open System Model

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22. Diagram adapted from ibid., 99.

Such a system may be defined as one that displays "exchanges of matter with its environment, presenting import and export, building up and breaking-down of its material components."[23] Most natural systems fall into this category. The openness lies in their need to absorb energy in order to maintain their steady state or stability. In the world in which coercive power is employed the system is open and dependent on interchanges with the environment. Indeed, the environment is a critical element in understanding the functioning of the system.[24]

As shown, the open system is influenced by multiple inputs, and these affect the process, resulting in multiple and indeterminate outcomes. "The study of open systems becomes the study of interactions, resonations, concatenations, and complex causal sequences"[25] Since the system is open to the environment; any ability to control or to regulate the input is diminished. It follows that even if the process is fully understood, development of an ability to manage or to predict the nature of multiple outputs becomes exceptionally problematic. Returning to the discussion of Chapter III, the open system displays nonlinearity and presents the same challenges to effective analysis and prediction. Hence, open systems are, by their definition and nature, complex. With this basic premise established, the next issue for consideration is how these complex systems respond to stimuli from their environment.

The principle means by which systems retain their stability is through feedback. Although a system may be properly described as open, it may have a *closed loop* feedback system for regulation. The governor or regulator on a steam engine is a readily

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23. Ibid., 141.
24. Sutherland, *Systems Analysis*, 41. Since open systems are highly dependent upon external events, we are unable to regulate interfaces with precision.
25. Ibid., 46.

understood means of effecting control on a system. [26] Figure 5 provides a depiction of a

simple feedback scheme.

STIMULUS   MESSAGE   MESSAGE   RESPONSE
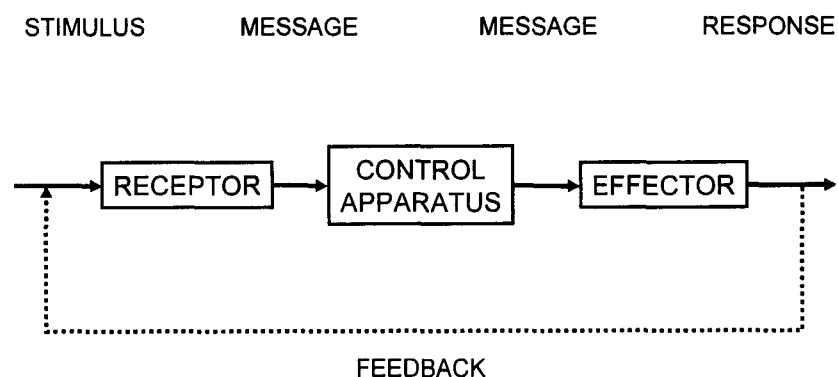
Figure 5. A Simple Feedback Model

A common example of an open system with a closed-loop feedback mechanism is

the thermostat, where the system becomes self-regulating by making adjustments based

on inputs (feedback) from the environment. The sensor (receptor) detects a change in

temperature (stimulus) and sends a signal (message) to the regulating device (control

apparatus), which adjusts the system by sending a voltage (message) to alter the output to

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26. In Thomas Watt's steam engine regulator, two pendulums with balls on the end rotate around an axle attached to the engine. As engine speed increases so does the speed of the balls, which move upward due to the centripetal force. This in turn reduces the supply of water, which results in the engine slowing down. This provides the classic example of self-regulation. Attempts at transference of this principle and making political and economic systems self-regulating have met with varied degrees of success. The Federal Reserve Board and the Securities and Exchange Commission are examples of regulators of economic systems.

the heating or cooling equipment (effector). This provides feedback to the receptor in the

form of altered room temperature and the process starts or stops heating or cooling based

on this feedback.[27]

Feedback may be negative, i.e., the system detects a shortfall or anomaly and

forces some type of change; or positive, in the sense that it supports a self-reinforcing

process. This implies some type of internal, and in some cases naturally occurring,

effective organization. If a system is able to maintain stability through time, it is

considered to be *homeostatic* or one that "allows a constant feedback between system and

environment."[28] Discovery of any self-regulating mechanisms within systems would be

of immense value to their understanding, and perhaps to prediction or even control. One

effort at applying this principle across a wide-range of disciplines that emerged in the

latter half of the twentieth century is *cybernetics*.

The *new science* of cybernetics attempts to show that feedback is the basis for

purposeful behavior in natural as well as social systems, and it may be utilized to explain

internal organization. Cybernetics presupposes a mechanism of self-regulation that results

in equilibrium. This form of automatic control that occurs within natural systems, e.g.,

perspiration as a temperature regulating process in humans, may also be applied to

economic, political, and social issues.[29] System theory looks more at structure;

cybernetics is focused primarily on function.

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27. Illustration adopted from Bertanlanffy, *General Systems Theory*, 43.

28. Sutherland, *Systems Analysis*, 69.

29. Cybernetics, first articulated in 1948 by mathematician Norbert Wiener, has experienced cycles of popularity and neglect. More recently, elements of cybernetics, notably automatic control, have been extended to the development of artificial intelligence. See Oskar Lange, *Introduction to Economic Cybernetics* (New York: Pergamon Press, 1970), 1-10, for a brief tracing of the antecedents and early applications of cybernetics. Written in then communist Poland, the critique of *bourgeois economics* and comparison of it to *scientific socialism* provide an interesting perspective on how politics can influence science.

While interest in cybernetics ebbed and flowed, it fell short of being regarded by most as a new science. Examples of practical applications are not abundant; effective thermostat-like devices for complex social systems have evaded development. However, the notion that at least some level of automatic control may exist in social, economic and political systems should not be totally disregarded. Therefore, any analysis of these systems should include an assessment of any internal regulating mechanisms.

A contribution from the field of management that dates back to the early 1960's is *System Dynamics*, which its most noted proponent, Jay W. Forrester, describes as "the study of information-feedback characteristics of industrial activity to show how organizational structure, amplification (in policies), and time delays (in decisions and actions) interact to influence the success of an enterprise."[30] Its applications are widespread, and its adherents have applied concepts developed in engineering to social systems. System Dynamics emphasizes the study of the whole system and its feedback loops. Feedback, where output becomes an input, is the critical element in System Dynamics. This feedback may be positive or negative, and the internal structure determines the manifestation of changes in the system. Importantly, System Dynamics acknowledges that an action taken to influence A, may have an effect on B, which will in turn have an effect on A. Hence, both influences must be considered. This is the complex relationship described in earlier chapters, and the dilemma that provides the major challenge to an understanding of system behavior.

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30. Jay W. Forrester, *Industrial Dynamics* (Cambridge, MA: The MIT Press, 1961). The approach initially used this title, but in later writings, Forrester introduced the more expansive, *System Dynamics*, which is the commonly accepted term to describe this model. His Chapter 1 provides an excellent introduction to systems and the importance of feedback. See also, Jay W. Forrester, *The Collected Papers of Jay W. Forrester* (Cambridge, MA: Wright-Allen Press, Inc., 1975) for a more detailed appreciation of the evolution of the model and some of its practical applications.

A more recent endeavor is the *agent-based modeling* approach. Less developed and more loosely defined than System Dynamics, agent-based models focus on the individual parts that comprise the whole. This perspective also has also described as *bottom-up modeling*. Its basis is that understanding of the parts and their interactions can provide insights into global behavior. Macro-level system behavior is the result of the interactions of the individual agents. Hence, comprehensive knowledge of relationships at the global aggregate level is not necessary. This results in models that are easier to maintain. Some exploration of the use of agent-based modeling in the social sciences is evident. Robert Axelrod, uses it to overcome some limitations of his *prisoners' dilemma model*, and explains that the purpose of agent-based models is "to understand the properties of complex social systems through the analysis of simulations."[31] The principles of agent-based modeling, and its focus on the individual elements (agents) as a tool to understand the whole, provide an intellectual foundation for the assessment methodology that follows in Chapter V.

This cursory examination provided the necessary foundation for further analysis. While critical to this discussion, a basic understanding of systems does not in itself adequately respond to the essential question: Can a systems model, that may be appropriate for engineers and physicists, provide any advantages to the understanding of political, economic, and social systems? Any response is dependent upon the level of acceptance of the principles of general systems theory.

There is no universal acknowledgement of the existence of a general theory of systems suitable for application across multiple disciplines. In a highly critical essay on

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31. Robert Axelrod, *The Complexity of Cooperation* (Princeton, NJ: Princeton University Press, 1997), 3. He argues that agent-based approach is neither induction nor deduction, but rather a third-way of doing science, and that its purpose is to aid intuition.

what he believes to be erroneous extensions of mathematical principles, David Berlinksi

finds "fundamental obscurities in its overall conception," describes this approach as a

"triviality," and contends that the theory is so inclusive that it becomes little more than

extension of the laws of logic.[32] Weltman cautions that the operation of systems "cannot

be explained solely through consideration of the interrelation of its elements," for it is the

extrasystemic environment and the interactions with the system that are critical to

understanding.[33] Even advocates, such as Kaplan, caution against overextension and

assert that there is no general theory of all systems and that "different kinds of systems

require different theories for explanatory purposes."[34]

While many of the arguments that question the very existence, or much less the

potential for effective utilization, of a general theory of systems are intellectually sound,

they represent more of a case for the appropriate use of the relevant principles of the

premise than they do a denial of the soundness of a general system theory. Critics such as

Berlinski fall into the trap that Bertalanffy, Weltman, Jervis, and others warn against, that

is taking an overly parochial and purest approach to systems. Clearly, there exists a lack

of precision in our understanding of social systems. However, it does not follow that the

lack of a mathematical formulation precludes adoption and adaptation of a useful model.

Hence, utilization of the systems model in the pursuit of understanding of secondary

effects remains a valid scheme. However, a paradigm being valid does not necessarily

presage usefulness.

32. Berlinski, *On Systems Analysis*, 4. In a particularly pointed comment, he contends: "General Systems Theory marks what Scientologists, I believe, call a point of minimal adequacy. This is a movement that is all craving without content" (ibid., 179).

33. Weltman, *Systems Theory in International Relations*, 3.

34. Kaplan, *Macropolitics*, 62, contends that a "completely general theory would lack explanatory power," and advocates "movement away from general to comparative theory."

This is not a theoretical treatise. Rather, the objective is to consider the previous work done in this area and to exploit the tenets of apposite theory in order to provide some practical applications. John Weltman concludes that if system theory means nothing more than interrelations between elements, then as a method of analysis of social events the concept of system is "both irrefutable and useless."[35] An essential premise of this study is that application of principles of system theory goes beyond the mere acceptance of interconnections, and that the wisdom of the adoption of a systems approach is constructive as well as indisputable. However, further exploitation requires that this assertion be supported.

Why a Systems Approach?

If the application of systems theory is to move beyond the acknowledgement of interrelated elements, then it is important to accept the other critical premise, i.e., systems have structure, pattern and function, and that there are structural as well as functional relations between units.[36] The conduct of a proper analysis of systems requires simultaneous consideration of both structural and behavioral properties. While the previously presented definitions of systems theory included references to examinations of structure and function, the discussion must proceed beyond mere description and attempt to focus on the process and the behavior of the system as a whole.[37] However, this

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35. Weltman, *Systems Theory in International Relations*, 80. Taking a minimalist view of systems theory, which he describes as a "framework for explanatory thought," he views systems thinking as essentially the acknowledgement of interrelationship between components. He considers this statement of interrelationships is a matter of faith that students of system theory must subscribe to before conducting further investigations.

36. Michael Pidwirny, "Fundamentals of Physical Geography," http://www.physicalgeography.net/ fundamentals/4b.html (accessed 16 November 2004).

37. Structure is an essential part of Bertanlanffy's theory and *set of interacting parts with a common function, purpose or utility* has been established as a working definition of a system. Weltman, *Systems*

requires moving beyond the confines and valid debates of systems theory and toward

examination of practical applications. Therefore, it is useful to consider the utilization of

a systems approach that incorporates the appropriate principles of systems theory.

This is not the first consideration of such an approach. The intellectual foundation

for a practical application of systems theory as an organizing device responds to three

essential questions:

What is it? "An approach, paradigm, or quasi-theory; a conceptual or analytic

framework... A grouping of organized assemblies of resources, methods, and procedures

regulated by interaction or interdependence"

What does it do? Enables the analyst to present methodically the selected data in a

coherent and logical manner

Why should an analyst use it? A systems approach facilitates the orderly comparison of

related sets of phenomena.[38]

Coherent, logical, orderly and organized: If a systems approach can bring these benefits

to the analysis, then it clearly is worth adoption.

A basic premise of a systems approach is the presence of a set of characteristics

and properties that are common to all systems regardless of the specific domain.

Additionally, the existence of some level of organization in the world, with patterns

concepts and principles, must be accepted if the approach is to be applied to political and

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Theory in International Relations, provides an excellent tutorial on the basic elements of systems theory in the IR context in Chapter 1.

38. Atkins, *Latin America in the International Political System,* 3. He prefers *analytic framework* to *organizing device.* A systems approach would conform to either term.

social processes. If so, then, "A systems analysis promises a more expansive, inclusive and flexible theoretical structure."[39]

Conducting an analysis of national power from a systems perspective provides several specific advantages. Advocates of such a stratagem contend, "The systems approach to political theory amounts to an attempt to theorize about political bodies and political events in terms of precisely specifiable structural and dynamic characteristics."[40] A systems approach emphasizes not only the interactions between elements, but also how the interconnections between units define the whole. Through a systems approach examination of interrelated variables and their response to environmental disturbances may be achieved. With the potential value of a system approach established, further concentration on national power from a systems perspective may now be undertaken. This first requires confirmation that we are, in fact, dealing with systems in assessments of national power.

Sources of National Power as Systems

Anatol Rapoport provides the following criteria for the determination of the existence of a system: (1) a set of identifiable elements; (2) among at least some of these are identifiable relations; (3) certain relations imply others; and, (4) a complex of relations at one time implies complex of relations at another time.[41] This provides a useful guide to test the premise that national power may be considered to exist and be employed as systems. While seemingly intuitive, provision of some brief examples is

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39. Anatol Rapoport, *General Systems Theory: Essential Concepts and Applications* (Cambridge, MA: Abacus Press, 1986). Cited in David Easton, *Varieties of Political Theory* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1996), 47.
40. Easton, *Varieties of Political Theory*, 141.
41. Ibid., 129-130.

warranted. Table 1 provides an illustrative depiction of the U.S. system at the macro

level.

Table 1. Sample Elements

System	Identifiable Elements
Political	President Secretary of Defense Secretary of State Cabinet level agencies Congress State and local governments National political parties
Economic	Transportation infrastructure Financial institutions Labor Unions Securities Exchanges Manufacturing industries Service industries
Military	Armed Services Defense industries Bases National Guard and Reserves Intelligence Agencies
Social	General population Media Racial minorities Religious groups Ethnic minorities

(1) A set of identifiable elements. Using the systems of power of the United States as an

example, the existence of identifiable elements within the systems is apparent. In the

discussion of the elements of power in Chapter II, four categories were identified:

political, economic, military, and social. I noted that this classification is somewhat

arbitrary and the number of systems may be greater.[42] However, for purposes of this analysis and the proposed methodology, the number of categories is less important than the framework they provide. If the overall system of power is segregated into these four broad categories, determination of identifiable elements within each of these groupings is not a difficult task.

In an observation that I will expand upon later, the categorization is somewhat arbitrary, and entities could be included in multiple systems. For example, defense industries could reasonably be placed in the Economic or Military blocks. While some of these, e.g., the President, represent an element that is not amenable to additional reduction, others such as Congress may be further broken down into party and regional blocs, committees (and subcommittees), and eventually to individual members. Hence, the first criterion for a system has been met.

(2) Among at least some of these, are identifiable relations. Again, meeting this requirement is not problematic. Although the President, in his role as Commander in Chief of the Armed Forces, may employ military power, he acts through his Secretary of Defense, who will in turn task the regional commanders, who then will task their Service component forces. However, the power of the President is not unlimited. Through the constitutional powers to declare war, and more practically their ability to appropriate or withhold funding, the Congress clearly interacts with the Executive Branch.

(3) Certain relations imply others. Assuming the existence of this President-Congress relationship within the political domain, and if a relationship between the Congress and

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42. The concept development and experimentation efforts of the U.S. Joint Forces Command (USJFCOM) and NATO's Allied Command Transformation use these four, but add *Infrastructure* and *Information*. Most infrastructure elements could also be categorized as military or economic; and information is a broad area that can be included in social or political. This study will limit the numbers to four in order to simplify the illustration.

the defense industries has been established (normally through defense related activity within the districts of members), then a relationship between defense industries and the President exists.

So based on Rapoport's criteria, the structure and function of power within the United States may be regarded as a system. Using the conclusions reached in earlier sections of this chapter, this may be best described as an open system, i.e., multiple inputs and outputs from and into the environment, including some ability to respond to feedback. These inputs and outputs are broadly defined. The former include "any event external to the system that alters, modifies, or affects the system in any way."[43] In the case of political systems, outputs may be in the form of decisions or actions. While critical to this proposition, this conclusion is hardly momentous. Therefore, this premise requires further development to become more than a blinding flash of the obvious. Having established that sources of national power operate as systems, the next step is to consider structure and function in more detail and to provide more granularity to the model. This may be achieved through consideration of the sources of power as complex adaptive systems.

The Complex Adaptive System

Prior to an examination and assessment of its potential, the concept of the complex adaptive system (CAS) must be defined. This requires a return to some of the principles of complexity and nonlinearity provided in Chapter III. Sanders describes complex adaptive systems as "Open nonlinear systems that are constantly processing and

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43. Easton, *Varieties of Political Theory*, 151. Effects transmitted across a boundary are outputs of one system and inputs to the other.

incorporating information."[44] This means that CASs change and evolve in reaction to external stimuli, as well as to feedback within the system. Gell-Mann offers that a CAS "acquires information about its environment and its own interaction with that environment."[45] These are not isolated entities. "A complex adaptive system (CAS) may be an integral part of another CAS, or it may be a loose aggregation of complex adaptive systems, forming a composite CAS."[46]

Most of the essential components of modern societies may be depicted as *systems*. Sophisticated communications, transportation infrastructure, information management, manufacturing, distribution of resources, and health systems are but a few. An example is warranted to reinforce the premise that elements of national power display the characteristics of a CAS outlined above.

CASs change and evolve in reaction to external stimuli. In capitalist economic systems the law of supply and demand predominates; securities prices reflect this condition. The environment provides the primary stimulus to the system. In order to preclude the system from descending into chaos, control mechanisms have been incorporated to suspend trading in specific circumstances.

A CAS is constantly processing and incorporating information. Due to advances in information systems technology, transactions in large stock exchanges occur near instantaneously and prices fluctuate at the same rate.

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44. Sanders, *Strategic Thinking and the New Science,* 69. These systems "exist at the boundary between chaos and order." Waldrop, *Complexity,* 330, observes that in a CAS "agents are constantly adapting to each other and things are always in flux."

45. Gell-Mann, *Quark and the Jaguar,* 17. The result is the determination of regularities in that information that condensed into a "schema" or model that influences actions. CAS's are not static, or limited to a specific purpose. "Complex adaptive systems ...have a general tendency to generate other such systems" (ibid., 19).

46. Gell-Mann, "Simple and the Complex," 10.

A CAS may be an integral part of another CAS. The economic system, as are the political, social, and military systems, is one of the fundamental elements of the larger complex adaptive system that represents the overall system of power. Accordingly, based at least on the criteria established above, sources of power may be regarded as operating as a CAS. However, additional outlooks should be considered.

Czerwinski identifies several basic attributes of the CAS. Among these are properties: aggregation, nonlinearity, flows and diversity; and, mechanisms: tagging, internal models, and building blocks[47] Rihani assigns the following traits to CAS:

(1) Active internal elements that furnish sufficient local variety to enable the system to survive as it adapts to unforeseen circumstances

(2) System's elements are lightly but not sparsely connected, and

(3) Elements interact according to simple rules to provide the energy needed to maintain stable global patterns, as opposed to rigid order or chaos[48]

Again, fulfillment of these criteria may be provided by an example, this time using the U.S. military system. Using the above-delineated traits:

(1) The doctrine of centralized control and decentralized execution is fundamental to the U.S. military and provides the individual assigned on scene leadership, from squad and platoon leader to battalion commander, with guidance; but, also delegates to them the authority to make decisions based on evolving local conditions.

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47. Tom Czerwinski, *Coping with the Bounds: Speculations on Nonlinearity in Military Affairs* (Washington, DC: The National Defense University, Institute for National Strategic Studies, 1998), 14.

48. Rihani, *Complex Systems Theory and Development Practice*, 81. He later adds, "The process by which CAS evolve, survive, and gather information is a slow activity that involves the gradual assembly of successive layers of elaboration" (ibid., 87).

(2) The American military's adoption of *jointness*, i.e., the full integration of Service combat capabilities, while maintaining autonomy for personnel and procurement, is an example of this type of connectivity.

(3) Joint doctrine is purposefully kept at a low enough level to avoid deleterious rigidity, and a sufficiently high level to prevent unnecessary disorder, confusion, and battlefield anarchy.[49]

Based on these traits, we may characterize national power as being exercised through complex adaptive systems. However, that recognition, while useful for understanding, does not reveal universal truths, or in itself provide tangible benefit to the decision-maker. Several issues remain unaddressed.

Sanders provides: "CAS are open nonlinear systems that are constantly processing and incorporating information and exist at the boundary between chaos and order."[50] Any new patterns that emerge in a CAS do so because of adaptation. Variations in prevailing conditions result in many minor changes and a few mutations, but it is not possible to predict the outcome in advance. The complex and dynamic environment in which systems of power operate rules out a precise control function. Therefore, acceptance of the CAS model may enhance understanding; however, it cannot completely solve the problem of the prediction of effects of actions. So if the potential for accurate prediction is remote, what benefits can the adoption of the of the CAS model provide?

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49. Defense Technical Information Center, "Joint Publication 3-1, Doctrine for Joint Operations, " http://www.dtic.mil/ doctrine/jel/ new_pubs/jp1_01_1.pdf (accessed 22 March 2005) provides the essentials of joint doctrine for the U.S Armed Services. "It addresses the translation of national strategy into assigned missions and military objectives, capabilities, and concepts of employment for component forces in joint operations. It also details the principles of command organization for all aspects of joint force operations."
50. Sanders, *Strategic Thinking and the New Science*, 69.

Advocates of the CAS model suggest a paradigm shift that "treats nations and their evolution as CASs."[51] They contend that we need devices and models that can contend with complexity and change in international affairs. While not elegant, the CAS provides a suitable model or metaphor upon which to base assessments. Support for its adoption includes the argument that "the flexibility of the CAS approach facilitates modeling states and nations as emergent phenomena rather than reified entities."[52]

Some observe that a CAS can have lever points and can exhibit coherence under change. Knowledge of these critical points could produce guidelines for development of applications that can enhance the understanding of systems operation.[53] Mitleton-Kelly views theories of complexity as providing a conceptual framework and a thought process and prefers the term Complex Evolving Systems (CES), which she describes as broader than the common understanding of CAS.[54] While the operation of the system at all levels may not be possible, "globally the system exhibits an orderly pattern."[55] The common theme is that the CAS model is the best available depiction of the manner in which organizations operate and respond to their environment. However, designation as best available does not necessarily connote that the use of CAS principles is appropriate. Even those who are strong advocates of the use of CAS as an analytical model acknowledge its limitations.

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51. Rihani, *Complex Systems Theory and Development Practice*, 234.
52. Cederman, *Emergent Actors in World Politics*, 7. He contends that the CAS provides a suitable model or metaphor upon which to base assessments.
53. Czerwinski, *Coping with the Bounds*, 13.
54. Mitleton-Kelly, *Complex Systems and Evolutionary Perspectives on Systems*, 23-26. This CES includes additional characteristics of complex systems and emphasizes interrelationships and interdependence. Rihani, *Complex Systems Theory and Development Practice*, 7, believes that this ability to evolve is an inherent characteristic and when systems are capable of evolution, they become CAS. This is a slow and iterative activity.
55. Rihani, *Complex Systems Theory and Development Practice*, 7.

Rihani accepts that evolution, constant adaptation, and accumulation of regularities represent the causes of the chronic state of unpredictable flux that characterizes all CASs. He identifies critical factors that conspire to make unpredictability a standard component of CASs: "even infinitesimal disturbances in initial conditions can be magnified by positive feedback to induce large global changes."[56] He does not conclude that these phenomena would, in theory, be unpredictable, but massive computing power is necessary to provide the knowledge upon which to base any viable prognostications. The conclusion must be that while the CAS concept does not in itself resolve the problem of predictability of outcomes, it may provide a useful model for understanding the employment of national power.

This exceedingly condensed and restricted examination of systems was necessary to respond to the key question: *Can the sources of national power be examined and understood through utilization of a systems approach?* By any accepted definition and criteria, power may be viewed as being employed as a system with inputs, processes and outputs. While the specific processes may vary between systems, the structure and function of these systems have many characteristics in common. Although feedback may be provided thorough a closed loop system, these open systems interact and respond to stimuli from the environment. Therefore, examination through a systems approach can contribute to enhanced understanding of both the structure and function of national power. That said, every model has its limitations.

It may be that a systems approach may be no more than a tool for examination of a large number or interrelated entities. However, if it can achieve this objective, systems theory can make significant contributions to the understanding of the effects of actions. If

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56. Ibid.

a systems approach and the complex adaptive system model can provide only partial progress along this path, then additional means must be devised in order to reach the objective. The key is to drill deeper into one of the fundamental characteristics of systems, i.e., the interrelationships between entities, and to explore the possibilities for understanding the whole through study of its elements. Accordingly, a system of systems approach may be able to provide this essential holistic methodology. The section that follows, therefore, will begin to respond to the second key question presented in the introduction to this chapter: *Can the interaction between elements (actors or entities) within a system be determined using a system of systems model?*

Assessment through a System of Systems

Further progress toward understanding requires an organized and effective analytic framework for examination of the elements of national power. The nonlinear nature of relationships between elements within the overall system of power mandates this type of approach. The task becomes more daunting, since these interrelationships occur within and across system boundaries. However, adopting a different perspective can mitigate the degree of difficulty.

A statement on terminology must be made for clarity. Although the political, economic, military, and social categories could be designated as sub-systems of the larger system of national power, the term *system* will continue to be applied to them since they display all the previously identified characteristics of systems and should not be considered merely as parts of the larger system.[57] The critical issue here is not the number

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57. The analogy is to the human body. Although the endocrine, circulatory and respiratory systems cannot function independently of the larger human system, they are commonly referred to as *systems* due to

or limits of these systems; it is the fact that the systems overlap and elements in one system interact with elements in others. Consequently, actions can alter the behavior of those systems as well as the overall system as a whole. Hence, the proper depiction of national power is a *system of systems*.

If national power is viewed as a collection of subsystems, then a decomposition of these into smaller parts, which are more amenable to comprehension, emerges as an option. In a reductionist approach, these sections would be examined independently and the results would be brought together to form the entirety of the system. The following illustration depicts the overall system of power as being comprised of independent subsystems. The barriers between these are rigid and impermeable. Figure 6 depicts system from a reductionist approach.

Political	Military
Economic	Social
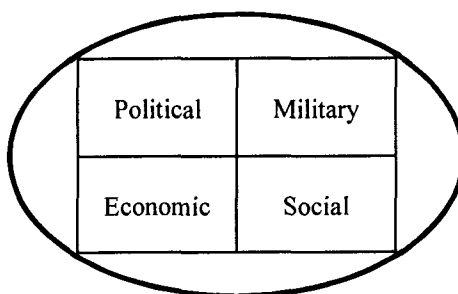
Figure 6. Reductionist Approach

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their structure, function, and interconnectedness of elements. Hence, the human body is an ideal example of a system of systems. The methodology that I provide in Chapter V will use this convention, and refer to divisions below the level of political, military, social, and economic systems as *subsystems*.

The oval represents the overall system of power; the rectangles, the four sub-systems described earlier. Predicting the effects of actions that are designed to influence this system would be possible, since the whole is merely the sum of the parts. An action, for example, against a military entity, would not be expected to have an effect on a social or economic element. However, this type of linear model is not representative of the existing geo-political environment. A more accurate depiction follows in Figure 7.
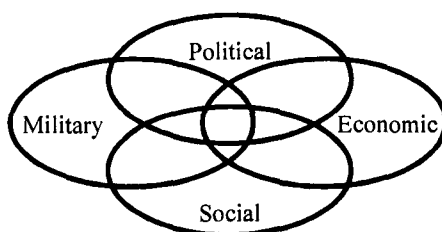
Figure 7. Systems Approach

Since these systems float and overlap, and the relationships are nonlinear and multiple, prediction of the effects of actions becomes exceptionally difficult, since an action taken to influence one system will have an impact on the others. Herein resides the critical dilemma.

Chapter II examined how nations, alone or as part of alliances, attempt to influence the behavior of other nations. While the defeat, or deterrence, of the military forces of an adversary is the principal and most visible manifestation of coercive power,

other entities may also be targeted. An embargo or blockade, with the intent of influencing the economic or social systems, was shown to be a common instance of this strategy. Part of the rationale for the Allies' strategic bombing campaign against Germany in World War II was to damage the factories providing material support for the Wermacht, as well as to diminish civilian morale in the attacked cities. Hence, this interrelationship across systems is not a totally new concept. While the existence of these linkages between elements has been recognized previously, exploitation of this condition has been irregular and disjointed and has lacked practical tools and doctrine for employment.[58]

An earlier discussion ascertained that the placement of an entity within a specific system of national power was relatively arbitrary. That is, an individual, organization, or physical element could reside within several systems. For example, in a theocracy a religious leader could be an element of the social, political and/or economic systems. Indeed the number and boundaries of these systems themselves may vary. Four systems were utilized in earlier illustrations. However, it was noted that there could be more or less. A lack of precision in placement is not fatal to the analysis because it is the interaction between elements and their impact on the system of power as a whole that is most critical.

Singer advocates a systemic and holistic approach and warns against inappropriate segmentation and rigid boundaries between systems. Additionally he provides the rationale for concentrating on the interactions between entities. "We observe

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58. See Edward J. Felker, *Airpower, Chaos and Infrastructure: Lords of the Rings* (Maxwell Air Force Base, AL: Air University Press, 1998), 3. In the mid-1980's U.S. Air Force *Checkmate* group studied Soviet fuel systems, and the link between these systems and Soviet military doctrine. Examining these linkages, he contends, "The vulnerability of an entire system (the adversary's operational and doctrinal culture) is determined by the vulnerability of nodes linking the system together."

structural, cultural and physical properties of a system in order to describe it in being; we observe the rates and direction of change of such properties in order to describe or predict what it is becoming; and we observe their propensities to interact with each other and to respond to external inputs in order to predict, and partially explain, the system's modes of behaving."[59] Hence, the objective continues to be the elusive ability to anticipate system behavior in response to external stimuli and the environment.

The limited predictive capability of the CAS model has been established. Since there do not appear to be technological solutions in the near term to provide the requisite level of knowledge to greatly alter this condition, a remaining option is to look at the elements of these systems as a source of information about effects of actions. Again, an illustration is useful. Table 2 provides some examples of various high level entities that could be included within the four selected systems.

The existence of connections between entities within each system was briefly introduced in Chapter II and is both readily evident and of great importance to this approach. Linkages between the media and the political leadership; factories and the military forces; and, universities and political parties are common in most societies (although the nature of these relationships will vary greatly). Earlier arguments established that nations employ power through systems that are complex, adaptive, and open. The basic open system model depicts multiple inputs being processed by the system with multiple outputs produced. Any ability to predict the nature of these outputs requires near perfect knowledge of the inputs and the processes of the system. A degree of knowledge of the operation of a complex system is a requirement for prediction of

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59. Singer, "The Global System and Its Sub-Systems," 7, warns against "Horizon-narrowing, rigidifying mechanistic reductionism."

future behavior. Since that level of information is not currently available, an alternative

means must be employed. Linkages between entities may provide some utility.

Table 2. Entities within Systems

System	Generic Elements
Political	Elected officials Career government employees Political parties Local and regional government
Economic	Banks Stock exchanges Factories Seaports Airports Railroads Roads Electrical power grid
Military	Ships Aircraft Missiles Senior leadership Command and Control
Social	Media Ethnic groups Tribes Religious groups Artists Universities

An example directly related to the application of coercive power from the Balkans

follows. A stated U.N. objective was to prevent the ethnic cleansing perpetrated by the

ethnic Serbs in Bosnia-Herzegovina. If described from a systems perspective, specific

elements and nodes could be categorized as in Table 3.[60]

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60. Specific military objectives included forcing the withdrawal of Bosnian Serb heavy weapons from the 20-kilomenter total exclusion zone around Sarajevo. See Robert C. Owen, *Deliberate Force: A Case*

Table 3. Categorization of Elements

System	Generic Element	Targeted Node
Political	Elected officials	Slobodan Milosevic
Economic	Seaports	Port of Dubrovnik
Military	Air Forces	MIG-21 interceptors
Social	Media	Yugoslav Television

U.N. sanctioned actions targeted each of these, whether through the actual downing of

aircraft, to enforcement of embargoes, to implementation of information campaigns.

Clearly there are connections within systems, e.g., rail lines to seaports used for export;

radar facilities for fighter aircraft; and, between political parties and the elected officials.

However, due to the connections between the President, the military forces, economic

interests, and the press, actions taken against one of these also resulted in effects within

the other systems. As Jervis observes, "We can never do merely one thing."[61] That is, an

action taken is likely to have effects that are either unanticipated, undesired or both.

For example, while the NATO bombing of Bosnian Serb military forces may have

had the desired effect of disrupting their ethnic cleansing campaign, the result was also

that the Yugoslav press resented this intervention and worked to influence public opinion

to back the political leadership. Similarly, the UN imposed economic embargo served for

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Study in Effective Air Campaigning, ed. Robert C. Owen (Maxwell Air Force Base, AL: Air University Press, 2000), for an excellent collection of studies related to the employment of air power as a coercive force.

61. Jervis, *Systems Effects*, 10. He attributes the statement to Garret Hardin, "The Cybernetics of Competition," *Perspectives in Biology and Medicine* 7 (Autumn 1963), 79, who argues that there is not "a highly specific agent which will do only one thing."

a time to enhance the popular support for the political regime.[62] Optimization of these coercive acts required near perfect information; hence, any prediction as to the change in behavior of the political leadership resulting from the embargo was at best informed conjecture. This resulted from the multiple linkages of entities within and across system borders.

There is a need for an approach that can provide some insight into this phenomenon of secondary effects. This requires a means of employment of the complex adaptive systems model, one that focuses on elements within and across systems. A methodology based on the system of systems construct, with concentration on linkages within and across system boundaries can fulfill this requirement.

Summation

This chapter evaluated the potential for a systems model to contribute to an understanding of the sources of national power. Since the term is broadly utilized, this initially required synthesis of definitions of systems to establish one that is best suited to this task. This effort produced *a set of interacting parts with a common function, purpose or utility.* An examination of indicators of when a system exists concluded that a system must be more than interconnected parts; it must also produce a whole that is different than the sum of its elements.

The rationale for the excursion into the principles of nonlinearity conducted in Chapter III was that systems, in the context of this study of national power, are nonlinear. Hence, an understanding of the principles of nonlinearity is critical to any analysis of

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62. These examples are utilized for establishing familiarity with the potential for unintended effects. I will examine the secondary effects of actions in significantly more detail in the cases studies.

systems. Some systems were shown to be capable of self-regulation, and study of these systems should include an assessment of any internal controlling mechanisms.

A basic tenet of general system theory is that there is a set of near universal conditions that can provide a framework for understanding across a wide range of disciplines. Through a systems approach, examination of interrelated variables and their response to environmental disturbances may be achieved. Despite the limitation inherent in any paradigm, utilization of the systems model in the pursuit of comprehension of secondary effects remains a legitimate design.

Upon establishment of the requisite theoretical foundation, the analysis turned to focus on the potential for exploitation of systems theory to determine if examination through a systems approach can contribute to enhanced understanding of both the structure and function of systems of national power. When compared to previously established criteria, sources of national power were recognized to operate as systems.

Investigations in pursuit of a more directly applicable model determined that national power may be characterized more accurately as being exercised through complex adaptive systems, and that the CAS model is the best available depiction of the manner in which organizations function and respond to their environment. Therefore, the response to the first question is yes. *The sources of national power can be examined and understood through utilization of a systems approach.*

An objective of this chapter was to confirm that systems could be the core of further analysis related to development of this proposition and methodology. To this end, the complex adaptive system emerged as a likely model. Although the CAS may provide a constructive model for insight into the effects resulting from the employment of

national power, it in itself does not resolve the dilemma of predictability of outcomes. An ability to predict the behavior of a complex adaptive system requires near perfect knowledge of the initial conditions, the structure and functioning of the system, and the environment. That degree of information is not currently available, nor is it likely to be in the near term. Therefore, additional methods of analysis must be employed.

I determined that systems of national power overlap and that an individual entity could be properly placed within different categories. The assignment of elements within a particular system is not critical, since the connections between entities and the impact on the entire system of power are most important. Finally, I explained how the system of systems construct provides an appropriate basis for a methodology that can contribute to the understanding of the secondary effects of actions.

The introduction to this chapter stated that I could provide only a partial response to the question: *Can the interaction between elements (actors or entities) within a system be determined using a system of systems model?* While the theoretical underpinnings and assessment of the complex adaptive system model and the system of systems construct support this contention, I have not yet provided sufficient evidence that these may be exploited and transformed into some useful tools for the decision-maker.

The discussions contained in the two previous chapters framed the problem of secondary effects and examined some intellectual efforts that may contribute to its mitigation. Since the dilemma inherent in determination of the ancillary consequences of actions does not fit neatly into any one existing academic domain, I selected the concepts that may offer elucidation from multiple disciplines. The next tasks are to draw upon

these ideas, propose a practicable methodology, and illustrate its potential in a series of

case studies. Those are the objectives of the next four chapters.

CHAPTER V

A METHODOLOGY FOR ANTICIPATION OF SECONDARY EFFECTS

I asserted in Chapter II that employment of coercive power was likely to continue as an element of foreign policy and that these coercive actions would produce ancillary as well as the desired primary effects. This is due to the linkages between elements within and across the systems of power and the nonlinear nature of the relationships between them. The lack of an adequate means of determining the nature of the consequences of actions led to the conclusion that an investigation into various approaches to nonlinearity in multiple academic disciplines was fundamental to further analysis.

This was accomplished through the examination of nonlinearity that was presented in Chapter III. Complexity, if viewed as a condition and not a theory, emerged as the most appropriate model to pursue. However, the mere acceptance of a condition lacks sufficient structure for fruitful examination. This situation severely limits practical applications. Hence, a linkage of complexity to another approach, i.e., systems theory, was determined to be a rational path. After the subsequent discussions related to the systems approach in Chapter IV, I contended that the complex adaptive system provides a satisfactory model for future analysis and that a system of systems construct affords a means for the assessment of power.

Since an ability to predict system behavior requires near perfect knowledge, and that level of information is not likely to be available, then attainment of a total understanding of system operation and behavior is not a realistically achievable goal. While the potential for the secondary effects of actions is not contentious, workable

methods to contend with this phenomenon have not yet been provided. Therefore, some means to overcome the predicament generated by the existence of complexity is required. The linkages between entities (actors) with the systems that comprise a nation's overall system of power surfaced as a likely foundation upon which to base a methodology.

With the requisite intellectual groundwork and a basic understanding of the theoretical underpinnings now provided, the proposal of a workable scheme with which to confront the challenges provided by the phenomenon of secondary effects of actions may now be undertaken.

This chapter initially will restate and strengthen the rationale for development of such a capacity. Next, I will address the goals and objectives, i.e., what capabilities a tool should provide. Following that presentation, I will describe the expected outcomes of the process and explain how these can contribute the identified goals and objectives. This will segue into a delineation of the steps required to produce this increased awareness of ancillary effects. Since there is no pretense that this methodology can precisely meet all the needs of the decision-maker in this environment, I will also address its limitations.

Richards succinctly delineates the rationale for this effort: "Nonlinear models will get nowhere by merely presenting more and more complex information. The challenge is drawing inferences from the complex dynamic output."[1] The overall purpose of the aforementioned steps is to provide additional evidence to support the contention that the interaction between elements, actors, or entities within a system can be determined using a system of systems construct; and, that this effort can provide a metaphor for increased understanding of the secondary effects resulting from coercive actions. Moving beyond

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1. Richards, *Political Complexity*, 16. She adds: "The challenge is to think about how one moves from merely presenting an example to actual scientific inference."

the consequential goal of developing increased understanding of system behavior, this chapter will propose a practicable scheme for the assessment of power and anticipation of secondary effects through a system of systems construct.

Rationale and Objectives

Nations have long been engaged in the quest for effective means with which to examine and assess the power resources of potential adversaries. I argued in Chapter II that there are no practical models currently available to decision-makers that focus on the unintended, unexpected, or undesired effects resulting from actions designed to influence the behavior of other actors. This is because existing methodologies cannot provide the requisite holistic knowledge of the relationship between elements within and across complex systems. Traditionally, assessments are based on treating the sources of power, independently, and consequently do not provide an accurate portrayal of the adversary. If employing an attrition-based model, this shortcoming is manageable. However, if the focus is on effects, rather than targets, a holistic view of the adversary is required. This is the key shortfall that this methodology is intended to meet.

Observing shortfalls in the Kosovo operation, Joseph Nye contends that American foreign policy should "Develop potential rules that allow the United States to meld its strategic, economic, and humanitarian interests into an effective foreign policy."[2] While that is a laudable and probably uncontroversial proposition, the execution of such a policy requires knowledge of the systems upon which those power assets will be employed. Historically, the focus has been on military capabilities, with other areas considered only

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2. Joseph S. Jr. Nye, "Redefining the National Interest," *Foreign Affairs* 78, no. 4 (July/August 1999): 35.

for their contributions to military operations, e.g., the industrial might of Krupp industries in Wilhelmian Germany. However, the nature of conflict in the twenty-first century suggests that this approach is no longer appropriate. As a former senior U.S. military commander observes, "Future military operations will be overlaid with political, humanitarian and economic considerations."[3]

Nations behave and operate as complex adaptive systems, with interconnected, and at times interdependent, elements. The number and nature of these connections can be immense and the knowledge management task, insurmountable. Hence, the problems facing the decision-maker related to the determination of effects are considerable.

Robert Jervis identified a most important reason for the inability to formulate policy effectively. That is, any attempt to alter one element of a system will result in changes in the other components with which it interacts. Consequently, it is extremely difficult to distinguish between "causes" and "effects," since initial behaviors influence subsequent ones. Therefore, outcomes do not always conform to intentions.[4] The resultant quandary is that even if we can predict with an exceptionally high degree of certainty that action A, will result in effect B, the problem of what other events will occur remains unaddressed. As affirmed earlier, *we can never do only one thing.*

In conditions of linearity, if an action is taken against a component in the system, the effect of that action could be understood and possible secondary effects predicted. Because systems of national power are complex adaptive systems, and relationships between elements are nonlinear, we can recognize only that one element is related to

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3. Anthony Zinni, "A Commander's Reflections," *Proceedings* 126, no. 7 (July 2000): 34.
4. Jervis, "Complexity and the Analysis of Political and Social Life," 582. He notes, "in a system, actions have unintended effects on the actor, others, and the system as a whole, which means that one cannot infer results from desires and expectations, and vice versa" (ibid., 578).

another, that interactions are likely, and that secondary effects may emerge; even if their nature is not determinable.[5] Hence, prediction of every effect that may result from an action is not possible. That condition is accepted. However, the premise that recognition of this situation must lead to the conclusion that there is no feasible way to generate insight into secondary effects is not.

The stratagem is to attack this condition of complexity with simplicity, i.e., to present the dilemma and a possible contribution to resolution in an uncomplicated manner, using a readily understandable and generally applicable technique. This is not an unprecedented approach; decomposition of the complex into smaller and more reasonably understood segments is central to scientific methods. However, the danger of regressing into a reductionist approach described in Chapter II is apparent. Therefore, care will be taken to abide by Rapoport's admonition, "Embrace simplicity, but distrust it."[6] With that warning firmly in mind, I will turn to a more detailed explanation of the extant situation facing the decision-maker. The objective is to identify the most critical shortfalls that currently confound analysis. Only then may I move on to presentation of a process that may provide a contribution to the resolution of the problems of secondary effects.

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5. Axelrod, *Complexity of Cooperation*, 1997), 3. Complexity theory involves the interactions of multiple actors. Acknowledging that managing the interactions between numerous actors and interactions is too difficult for mathematical solutions, he advocates use of computer simulation as a primary research tool.

6. Sutherland, *Systems Analysis*, 23, credits Rapoport with the warning. Sutherland adds: "Abstractions properly applied, become engines of stability." Supporting this approach, Cohen and Stewart, *Collapse of Chaos,* 3, contend, "complexity may be unpredictable in detail, but its general course may be comprehensible and foreseeable. Simplicity of form, function or behavior emerge from complexities at lower levels because of the action of external constraints." They have introduced the term *simplexity,* or the "tendency of simple rules to emerge from underlying disorder and complexity, in systems whose large scale structure is independent of the fine details of their substructure."

The Need for Enhanced Understanding

This is an appropriate time to introduce the use of the term *node,* which will serve as an inclusive term for elements, actors, and entities of the system. Hence, nodes are fundamental to the process. Nodes are tangible, and represent persons, places, or things upon which actions may be taken in order to influence system behavior. Examples include government officials, religious leaders, transportation infrastructure, financial institutions, and military command and control facilities. A point that is important to the proposed methodology is that not all elements, actors, and entities are nodes. Consequently, determination of when an entity is to be designated as a node is vital to the process; and I will expand on the term and its utility later. However, this initial level of detail is sufficient for the immediately ensuing discussions. The following illustrations provide a simplified view of the problem facing the development of an understanding of secondary effects of actions.

In a simple linear relationship, as depicted in Figure 8, an action taken against a node can be expected to produce an effect. As with all linear relationships, the effect is projected to be directly proportional to the intensity of the action.

However, this type of simple linear relationship is rarely exhibited in systems of national power. This is because it is exceptionally difficult to identify an element of a system that is not is some way connected to another. Attempts to segregate any individual actor within the political system, for example, would meet with frustration, and most likely with failure. Similarly, a completely isolated economic, military, or social node defies unearthing. Figure 9 provides a case where two nodes are interrelated. For example, a military action that is designed to degrade an electrical power production

facility may be successful in that aim, but if that facility also is related to a hospital, as

the only electricity to it, then there will be a deleterious effect on that medical facility.
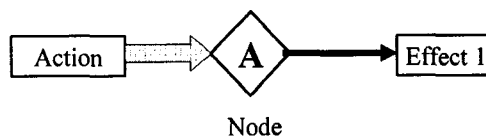
Node

Simple linear: An action applied to Node A will
produce an effect

Figure 8. Simple Linear Relationship
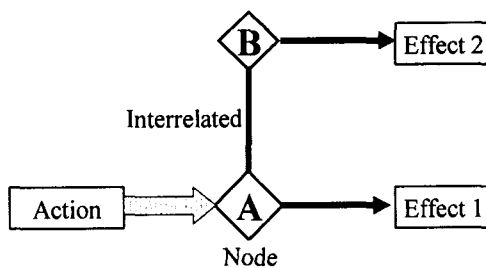
Simple nonlinear: If there is a direct relationship
between Node A and Node B, then an action applied
against Node A may produce an effect on Node B

Figure 9. Simple Nonlinear Relationship

Adding additional complications to the analysis, if a third node-to-node

relationship exists, the effects produced by the original action may influence the

interrelated nodes, which in turn produces effects that may further influence the

interrelated nodes in other ways. The result is a set of effects that is beyond determination

or prediction. Although the use of computers may permit an enhanced ability to display

the relationships, even as few of three objects makes the number of permutations

unmanageable. Figure 10 provides a simplified illustration of this phenomenon.
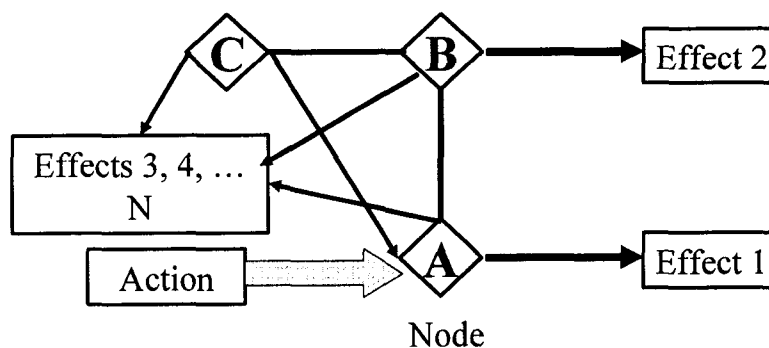
Complex Nonlinear: If there is a direct relationship between
Node A and Node B, and between Node B and Node C, then an
action applied against Node A may produce effects that
influence Nodes B and C, which results in influences on Nodes
A and B, and ultimately results in an indeterminate succession of
effects

Figure 10. Complex Nonlinear Relationship

As illustrated, the interactions between as few as three entities are nonlinear, and

therefore are not disposed to precise prediction. This is the central problem that is the

object of this analysis and the main rationale for development of the methodology. and is

likely to have scores or hundreds of nodes, and the ability to maintain awareness of their interactions becomes exceptionally difficult.

Following on from the previous example, assume that the hospital is linked to a certain ethnic group by virtue of being the major provider of essential medical services for an ethnic minority. Also assume that an action, e.g., destroying an electrical power station, is taken that has an effect on the hospital. The level of support of that group for the objectives of the nation or nations taking that action is likely to change.

Murray Gell-Mann provided the following illustrations of the many possible patterns of connections.[7] In View A of Figure 11, the dots represent a collection of eight nodes; View B displays a few instances of connections between nodes. At this point, with very few connections, expectations of secondary effects are relatively easily managed.
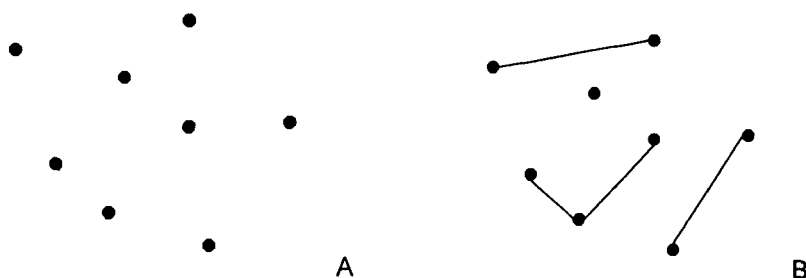
Figure 11. Few Interconnections between Nodes

In view C, presented in Figure 12, the number of connections and possible secondary effects is increased. View D displays all possible connections between nodes. The secondary effects of a single action upon a single node become indeterminable.

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7. Gell-Mann, *Quark and the Jaguar*, 31.
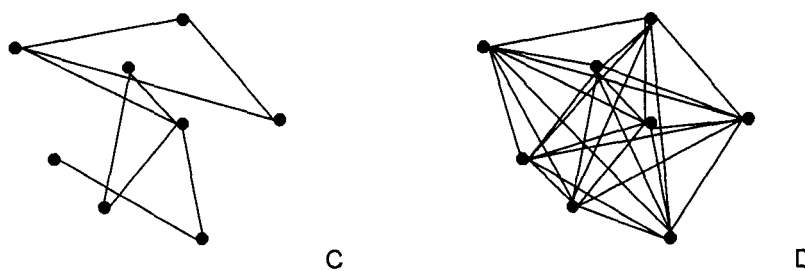
Figure 12. Multiple Connections Between Nodes

The purpose of the above discussion and examples was to reinforce the assertion that accurate prognostication of ancillary effects resulting from actions intended to influence a complex adaptive system is not feasible. Although precise prediction of secondary effects may not be possible, this does not mean that confronting the problem cannot provide benefits. There is a valid requirement for methods to assist the decision-maker in dealing with this condition. Determination of what they should provide, i.e., what information can be useful to the analyst, should precede development of such tools.

Capability Needs

Confronting the issue of the effects of actions, a senior military analyst offers that an effective strategy must incorporate an understanding of the interests and incentives of the political leadership and knowledge of the decision process within that structure. He cautions, "efforts to map out the structure of an organization or system are an essential precursor to any attempt to exert influence on that system."[8] Rosenau adds, "We do not have techniques for analyzing the simultaneity of events such that the full array of the

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8. Spencer Abbot, "Airpower Strategy and the Problem of Coercion," in *Immaculate Warfare*, ed. Stephen D. Wrange (Westport, CT: Praeger, 2003), 34.

interconnections and feedback loops are identified."[9] Byrne observes, "we need

descriptions of system characteristics which consist of something more that the mere

addition of the properties of the elements that compose the system."[10] Demchak contends

"the goal is to seek out the minimal set of underlying rules that govern the surprising

outcomes in complex systems and to be able to identify the broad outlines of likely

outcomes—the "trends"—in advance.[11] Therefore, based on these assertions, any selected

methodology should be able to provide: (1) a view of the structure and functioning of the

system; (2) an ability to identify key connections between elements; and most

importantly, (3) a means to do all this while maintaining a holistic perspective.

These are not necessarily mutually supporting tasks. Focus on structure and

element interrelationships can result in a loss of concentration on the overall systems

perspective that has been determined to be essential to understanding. Therefore, an

essential question emerges: Can an intellectual grasp of system structure and functions be

combined with identification of the interconnections between nodes to provide the

holistic knowledge that has been identified as the key to a system of systems construct?

Structure and Function

An organization's structure may be depicted through the use of charts and

graphics that display the hierarchy of elements. This type of a display is a hallmark of

most any government or commercial bureaucracy. However, formal organization wiring

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9. Rosenau, "Many Damn Things Simultaneously," 82. He believes that the focus should be on determining the long-term transitions.

10. Byrne, *Complexity Theory and the Social Sciences*, 68. He continues, "The world does consist of things which contain things and we need to know both about the properties of the things contained and the things containing, and how the one set relates to the other."

11. Demchak, "Complexity and the Theory of Networked Militaries," 224. She considers unintended secondary effects as "surprises," and briefly discusses a branch of complexity studies known as "surprise theory." An important characteristic of complexity is that it produces surprise. Surprise is greatest in complex systems. Her discussion of surprise and "rogue outcomes" is of significant value to intellectual excursions into this area.

diagrams rarely provide the total picture. Rather, the informal relationships and networks oftentimes surpass the official configuration in importance. As noted earlier, structure is normally easier to depict and understand than is function. In addition, as Zeng asserts, "the exact functional forms of social and political relationships are rarely, if ever, known."[12] However, despite these qualifiers, it is still possible to make some determinations about structure and function; hence, determination of these characteristics normally represents the initial steps in most assessments.

Analysis of the structure and functioning of a system is a common task in the intelligence community. Indeed, recent comments regarding the employment of coercive power include: "Any effort to target decision-making processes with air power, however, requires a fundamental understanding of not only the characteristics of the targeted actor, but of the structure and dynamics of organizations."[13] There is nothing new or transformational in recognition of the requirement.

Although an essential part of the analysis, the development of an understanding of the structure and function of the systems is an embedded part of current assessments. Included in these are determinations of system inputs and outputs as well as organization and role. Even the most basic and unclassified assessments of power, such as those provided by the Central Intelligence Agency, provide this basic data.[14] These appraisals have an existing set of processes and methodologies; however, there is no need to

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12. Langche Zeng, "Neural Network Models for Political Analysis," in *Political Complexity: Nonlinear Models of Politics,* ed. Diana Richards (Ann Arbor: The University of Michigan Press, 2000), 239.

13. Spencer Abbot, "Airpower Strategy and the Problem of Coercion," 33. He later adds, "A detailed analysis of the means by which an opposing leadership structure seeks to accomplish its political, strategic ands personal objectives should be made in advance of air campaign planning" (ibid., 44).

14. The CIA Factbook, http://www.cia.gov (accessed 1 April 2005), provides this type of information on essentially every nation. Similar information is available on multiple government and commercial sites. Clearly, this is not adequate for a sophisticated assessment as evidenced by the large and expensive intelligence agencies in existence throughout the world.

elaborate on these further. The less developed, but more innovative and important aspect of the analysis is the identification of nodes and the connections between them.

Nodal Relationships

It is time to elaborate more expansively on the use of nodes as the basic element of analysis. As with many other terms used in this treatise, *node* has a variety of meanings dependent upon context. For purposes of this analysis, a node is *a nexus; a point of connection or a link, at which subsidiary points originate or center.* Nodes are *junctions, intersections and leverage points,* and are important due to their connections to other nodes and their potential to affect system behavior.

Earlier I asserted that nodes are tangible entities, elements, or actors, but that not all of these would always be identified as nodes. Decisions regarding inclusion of an entity in the listing of nodes are not totally objective; their basis must be the expertise, experience, and judgment of the analyst. While it is possible to promulgate criteria for designation as a node, the most useful guidance for discrimination is as follows: *Consider an entity a node when a change in it can be expected to significantly influence the system.* While useful, this criterion is still relatively broad and requires additional explanation. The decision calculus becomes somewhat less daunting when we consider elements individually.

For example, a member of congress is clearly an entity within the U.S. political system. However, removal or a change in an individual representative's conduct may not produce any substantial impact on the political system. If this were the case, this particular representative probably would not be characterized as a node. In an economic

illustration, it was possible for the vast commercial entity, Enron, to evaporate without causing the collapse, or even seriously endangering the overall U.S. economic system. Hence, sheer size or occupying a seemingly crucial position within the organizational structure in itself does not provide sufficient grounds for classification as a node.

Conversely, a minor cleric in a theocracy may not at first glance appear to be a node, but further examination may reveal considerable power within the political and social systems. His influence may far exceed his apparent position in the system; therefore, he could meet the criteria for a node. Similarly, a small pumping station within a complex crude oil distribution system may seem insignificant. However, an action taken against it could cause serious degradation of product flow with ensuing impact on the economic system. Again, the potential for influence on the system is the principal criterion for status as a node.

It should be apparent that the determination of when to characterize an entity as a node is rather inexact, subjective, and context dependent. This is the art of the analysis, and it provides advantages as well as complications to the assessment. Even with sophisticated information processing capabilities, available knowledge of systems of power is not unlimited. Hence, the number of nodes will vary with the quality and capacity of information gathering, analysis, and retrieval capabilities. Additionally, the nature of the objectives will necessitate varied depths of assessments. The knowledge requirements for a localized humanitarian assistance mission would be less intensive than situations where the aspiration was to collapse, or make ineffective, a nation's entire military system.

The critical issue is not the number of nodes or the criteria for designation. Instead, it is the recognition that system entities are interrelated. The number of potential individual elements is unbounded. However, information collection, analysis, and promulgation assets are finite, so a focus must be on those elements that can appreciably influence the behavior of the system. Those elements are best described as nodes, and these become the basis for further development of the methodology. However, noting the cautions against regression to an inappropriate reductionist approach, the focus must return to the holistic perspective.

The Holistic Perspective

The tasks related to merging the examination of systems structure and function with identification of nodal interconnections may not directly support concurrently maintaining a holistic perspective. However, that does not entail that they are mutually exclusive. Rapoport observes, "Investigation of a system is frequently directed at uncovering the identities of the elements, the nature of the relations, and the dynamic laws governing the behavior or evolution of the system in time."[15] Providing further support for this contention, Byrne asserts, "we can describe the character of the system as a whole and seek to identify what key changes in controlling variables led to changes in that character."[16] The premise upon which to base further effort is that the nodes represent these controlling variables.

The advantage of focusing on nodes as an essential part of the assessment of power is that as tangible entities they are more amenable to analysis than are esoteric

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15. Rapoport, *General Systems Theory.* Cited in Sutherland, *Systems Analysis, Administration and Architecture*, 130.

16. Byrne, *Complexity Theory and the Social Sciences*, 72.

conditions and phenomena such as complexity and systems behavior. Processes that concentrate on system elements and their interrelationships are not abundant and most have been limited to the military sector. As early as the 1930's some proponents of air warfare argued for a focus on key strategic nodes, which were often described in terms of military centers of gravity. The calculus was relatively simple. If an entity was determined to be essential to the functioning of an adversary's military strategy, then destroying or incapacitating that target was likely to force capitulation. These nodes could be traditional military targets, such as fortresses, or vital industries that propel the war machine.

While this level of application may be adequate for a traditional force-on-force conflict between relatively comparable militaries, the long-established center of gravity model is less useful in other types of conflicts. Contentions that are more recent include that strategists must "replace the assumption of pure rationality with sensitivity to the psychological, cultural, and political variables that may influence the adversary's behavior"[17] Hence, assessments of the totality of the system must consider nodes from all of the systems that comprise national power.

Due to their nature as tangible entities, nodes are conducive to scrutiny. Their position and function in the system may be determined. Similarly, any connections to other nodes are possible through research and examination. The challenge is to ensure that the analysis does not fall into a reductionist trap. However, the behavior of components and the system are linked. As Singer observes, "system attributes and sub-system interaction patterns can never be too dissonant from one another;" and that

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17. Alexander L. George, "Coercive Diplomacy: Definition and Characteristics," in *The Limits of Coercive Diplomacy*, ed. Alexander L. George (Boulder, CO: Westview Press, 1994), 20.

"innovative behavior on the part of one entity or actor can induce changes in the reciprocal behavior of others, producing modified interactions in due course."[18]

The key to solving this dilemma is development of satisfactory models that present the relationships while continuing to take a systems perspective. As noted earlier, this is not a challenge-free undertaking, for "actions often interact to produce results that cannot be comprehended by linear models."[19] Adding to the predicament, as Richards notes, there is "no template in nonlinear modeling."[20] However, some endeavors in a variety of academic fields may present insights.

Since systems of power involve the connections of multiple nodes, the system may be described as a network (an interrelated set, group, or chain). Examination of ongoing work in network analysis may provide some benefits. Zeng offers, "neural network models are potentially better suited for the analysis of typical political data than simple linear models."[21] He advocates development of models that are appropriate for handling data with complex functions and from unknown sources. However, he acknowledges that these have not received much attention from political scientists and their potential has not been exploited. Others see the value in being able to look at elements and to determine the functionally important interdependencies among them, but noting, "as we move away from the physical systems the conceptualizations become progressively less rigorous."[22]

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18. Singer, "Global System and its Sub-Systems," 40.
19. Jervis, "Complexity and the Analysis of Political and Social Life," 574.
20. Richards, *Political Complexity*, 10. However, she also contends, "nonlinearity can be combined with both rigorous formal analysis and traditional empirical techniques."
21. Zeng, "Neural Network Models for Political Analysis," 240. He describes neural networks as, "a particular class of nonlinear input-output models and as such are applicable to any problem of pattern recognition, prediction or classification."
22. Demchak, "Complexity and the Theory of Networked Militaries," 231.

Although the network model works so well in physiology and electrical engineering, it is not directly applicable to interactions between nodes, since these relationships are far less precise in nature, direction, and intensity. The minute electrical charge between synapses in the central nervous system may be described and predicted with much more certainty than the relationship between political and religious leaders. Therefore, while there are parallels between networks and nodal interactions within a system of systems, the network model is not amenable to direct application to this task. Hence, there remains a need for a more appropriate process that considers the special challenge of secondary effects.

This section has stated the problem in more detail and has focused on the key objective, i.e., merging of examinations of systems structure and function with identification of nodal interconnections, while maintaining a holistic perspective. It is now possible to provide a proposed methodology for commencing to address these challenges.

A Proposed Process

As I previously argued, an understanding of structure and functioning is critical to the system of systems construct. However, this is not the part of the analysis in the greatest need of improvement. Rather, the ability to respond to the second challenge, i.e., determination of the linkages between components is lacking. Consequently, the interconnections between elements, and how these may have potential for exploitation, will be the principal focus of this section.

National systems of power represent an immense field for study. Hence, a useable

assessment demands a mix of area expertise, e.g., economics, sociology, military, etc.,

and a structure that allows for efficient collection and analysis of information. For

organizational purposes, the proposed process divides the sources of national power into

the four categories introduced in Chapter IV: Political, Economic, Military, and Social

(PEMS).[23] However, this sorting is conducted primarily for organizational purposes; the

objective is to structure the analysis, take advantage of specialist skills and experience,

and ensure that all elements of power are considered.

The boundaries between the PEMS areas are flexible and permeable. A basic

assumption is that very few components must reside exclusively within one grouping. For

example, a governmental agency may be primarily political, but its responsibilities are

likely also to have economic and social implications. For that reason, the segregation of

elements into categories is relatively arbitrary; the essence of the task is determination of

relationships between elements, not the placement of the components themselves. These

are critical aspects that are essential to avoiding a purely reductionist approach.

The division into categories, while a necessary step, does not provide the basis for

the analysis. Rosenau offers a similar perspective in his advocacy of the aggregation of

micro parts in understanding the relationship between the components and the whole: "It

is only for analytic purposes that we separate them out to trace and assess their

consequences."[24] Establishment of the relationship between elements, within and across

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23. As stated earlier, the number of categories is relatively unimportant, as long as a provision is made for inclusion of all possible nodes.

24. James N. Rosenau, *Turbulence in World Politics* (Princeton, NJ: Princeton University Press, 1990), 157. "Macro structures and collectives may have a perceived existence of their own, but they draw their sustenance from their micro components, and, like the system, they eventually have to adapt to the sources of support if they are to persist." See pp. 141-77 for his discussion of the micro (element) macro (system) linkages. See also Axelrod, *Complexity of Cooperation*, 3. Complexity theory involves the interactions of

political, economic, military, and social (PEMS) areas is the key task of those conducting

a system of systems analysis.

The principal function of the system of systems analysis is first to establish the

key elements of the systems, then to determine the key components within those

elements, and finally to identify nodes and the connections between them. While the

process is continuous and seamless, for simplicity I describe it as a series of steps.

Sutherland provides a valuable and adaptable framework.

1. Isolate system boundaries and identify the major components of the system.

2. Develop a (spatial) distribution that illustrates where each component resides relative

to the others.

3. Represent prevailing relationships between components, which potentially interact

with the others.[25]

Each of these requires some elaboration:

Isolate boundaries and identify component. The principal rationale for this step is

to provide guidance for the assignment of nodes to a particular area. Focus will be on

structure, and this activity will be the basis for subsequent analysis, since the "structural

analysis of a system is roughly equivalent to a geographical map."[26] As stated previously,

boundaries of the Political, Economic, Military, and Social (PEMS) systems are flexible.

The goal is to draw the borders between PEMS systems to best suit the analysis

objectives and the available resources.

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multiple actors. Acknowledging that managing the interactions between multiple actors and interactions is
too difficult for mathematical solutions, he advocates use of computer simulation as a primary research
tool.

25. Sutherland, *Systems Analysis,* 25.

26. Ibid., 25. He adds, "Every system has properties that serve to distinguish it as a unique entity."

Develop a distribution: This task involves placement of nodes within one of the PEMS systems. While multiple systems potentially could be the primary locus of an individual element, for organizational purposes a decision on placement is required. For example, The Federal Reserve Board may be considered primarily either as an economic or a political node. Similarly, a religious leader may have political as well as social aspects and could reasonably be assigned to either area. While the analysis related to making this decision will be useful to ensuing steps, the question of the optimum PEMS system to which an element is assigned may have multiple correct answers.

Represent relationships between components. Herein lies the essential element of the analysis, i.e., determination of the interconnections between nodes within and across PEMS systems. Through knowledge of these interconnections we can begin to address the problems presented by secondary effects. Returning to the earlier depictions of node connections, if we know that two nodes are related, and we determine that we want to take an action against one of these, then it follows that there may be a derivative effect on the second node. Hence, knowledge of the nature, strength, and stability of these interconnections becomes a primary focus.

Sutherland provides the basis for a methodology; however, a more precise delineation of the steps is required to describe properly the assessment process. The progression is depicted in Figure 13. For clarity, I will expand on each of these individually:

Step 1. Identification of the essential elements within each system. With the broad categories that comprise the system of systems (PEMS) already identified, the next step in the process is to determine the critical components of each of these. The identification

of a person, organization, or segment of infrastructure as an essential element is

subjective and will vary based on the system of power under assessment.
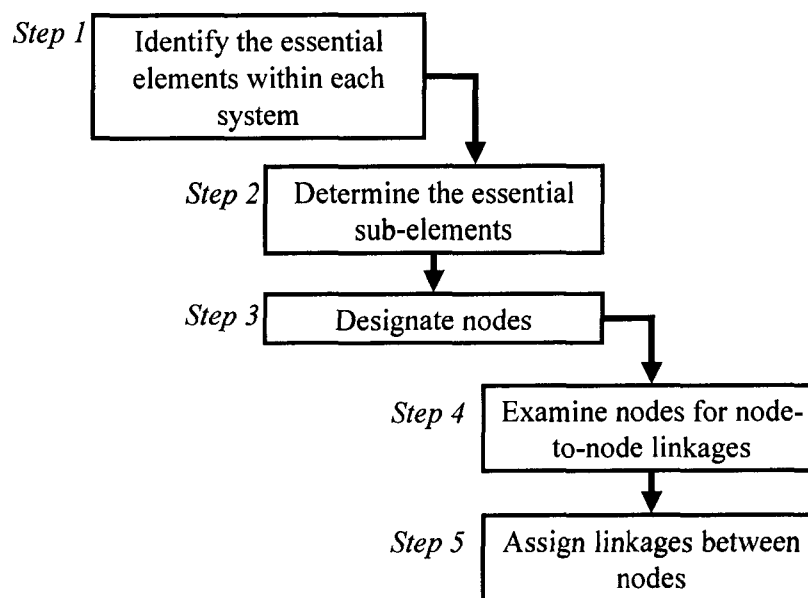
Figure 13. The Assessment Process

For example, a highly developed industrial nation is likely to have a different set of

essential elements within its PEMS systems than in the case of a developing nation. Some

elements were introduced in Chapter IV. Table 4 provides additional refinement.[27]

Step 2. Determination of the essential sub-elements of each of these. Since the essential

elements are too broad for a comprehensive analysis, further decomposition is required.

As with the elements, the number and character of these sub-elements will not be the

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27. This listing is neither exhaustive nor universally applicable, and is provided only for illustration. While a generic listing could be developed that would apply to the majority of sovereign nations, the essential elements listing requires adaptation based on the objective of the assessment and its environment.

same universally and the assessment should use those that are appropriate for the ongoing assessment.

Table 4. Illustrative Essential Elements

System	Essential Elements
Political	National executive leadership Political parties Judicial Branch Parliaments/Congresses Local and regional government officials
Economic	Natural resources Transportation infrastructure Communications infrastructure Essential utilities Critical imports Capital reserves Means of production
Military	Uniformed Personnel Air, land and maritime Forces Logistics Senior leadership Command and Control
Social	Media Ethnic groups Religious groups Universities Cultural elites

An illustration will contribute to understanding. If a Persian Gulf nation is the object of the analysis and the economic system is being investigated, determination of the essential elements may not be particularly challenging. Natural resources become an obvious essential element of its economic system. Other elements, such as transportation and communications infrastructure, would also exist; however, their relative importance would be dwarfed.[28] Within natural resources, crude oil reserves and the means of

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28. These essential elements would also be subject to analysis and deconstructed further. Since natural resources, and especially crude oil, are so important in this specific Persian Gulf scenario, they were singled out for illustration.

production are likely to be essential sub-elements. Within the means of production are multiple entities. Among these are drilling platforms, storage and distribution facilities, and refining complexes. While this brings us closer to a practicable methodology, further refinement is mandated.

Step 3. Determination of junctions, intersections, and leverage points (Nodes). Previous discussions concluded that an entity could be considered to be a node when a change in it is expected to significantly affect the system. Hence, the analyst again is faced with somewhat imprecise criteria. An effective determination of status as a node requires extensive knowledge of the system as well as of the component under consideration. Here is an instance where the effort in examining the structure and functioning of the system can have a synergistic effect on the efforts related to determination of node interactions. The research and analysis that examines the systems will also contribute to the identification of nodal linkages and vice versa.

Following on from the previous example, if distribution facilities represent the segment of the sub-element being examined, then the multiple components that comprise it provide the set of candidate nodes. Among these are multiple pipeline intersections, pumping facilities, oil terminals, and transfer stations. In this case, determination of the nodes would require considerable specialized skills and expertise. However, even a knowledgeable petroleum engineer also would require additional information on the specific distribution system to complete this task. Consequently, identification of nodes is a highly complex and information intensive task.

Step 4. Examination of nodes both within and across PEMS areas for determination of node-to-node linkages. This step requires adoption of the system of

systems construct. For as already established, nodes may interact with other nodes within and across Political, Economic, Military, and Social (PEMS) system boundaries. Due to the flexibility and permeability of the edges of the PEMS systems, interactions may occur anywhere within the overall system of power. Continuing with the illustration string, if pumping stations are being considered as candidate nodes, then the objective of the detailed analysis is to determine which individual stations, when acted upon could be expected to significantly influence the oil production element of the economic system. That is, can actions that would destroy or degrade that specific facility have a considerable impact on the system? It is important to note, that a selected action need not always be destructive or harmful. If the objective is to preclude disruption of the economic system, and if a node is determined to be critical to the functioning of that system, then the appropriate action may not be to degrade or destroy, but instead to protect that facility.

Step 5. Assigning linkages between nodes when a significant relationship exists. These node-to-node linkages provide the basis for determination of possible secondary effects of actions. This in turn will provide insights for further understanding of the system as a whole. Concluding the string of examples, if crude oil pumping station A is determined to be dependent upon electrical production facility B, then an action against A is likely to influence B. Figure 14 illustrates these examples inserted into the sequence of tasks outlined in Figure 13.

If a particular official in a government petroleum agency controls the supply of critical parts for that pumping station, then that political node is connected to the economic node

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┌─────────────────────────┐           ┌─────────────────────────┐
│   Identify the essential │           ║  Natural resources      ║
│   elements within each   │───┐       ║  Means of production    ║
│         system           │   │       ╚═════════════════════════╝
└─────────────────────────┘   │
                              ▼
              ┌─────────────────────────┐   ┌──────────────┐
              │  Determine the essential │   ║ Distribution ║
              │      sub-elements        │   ║  facilities  ║
              └─────────────────────────┘   ╚══════════════╝
                              │
                              ▼
┌──────────────┐   ┌─────────────────────────┐
║  Pumping     ║   │    Designate nodes       │───┐
║  Station A   ║   └─────────────────────────┘   │
╚══════════════╝                                 │
                                                 ▼
┌──────────────────┐   ┌─────────────────────────┐
║ Electrical Power ║   │  Examine nodes for node- │
║    Sources       ║   │     to-node linkages     │
╚══════════════════╝   └─────────────────────────┘
                                   │
                                   ▼
┌──────────────────┐   ┌─────────────────────────┐
║ Pumping Station A;║   │  Assign linkages between │
║  Power Facility B ║   │          nodes           │
╚══════════════════╝   └─────────────────────────┘
```
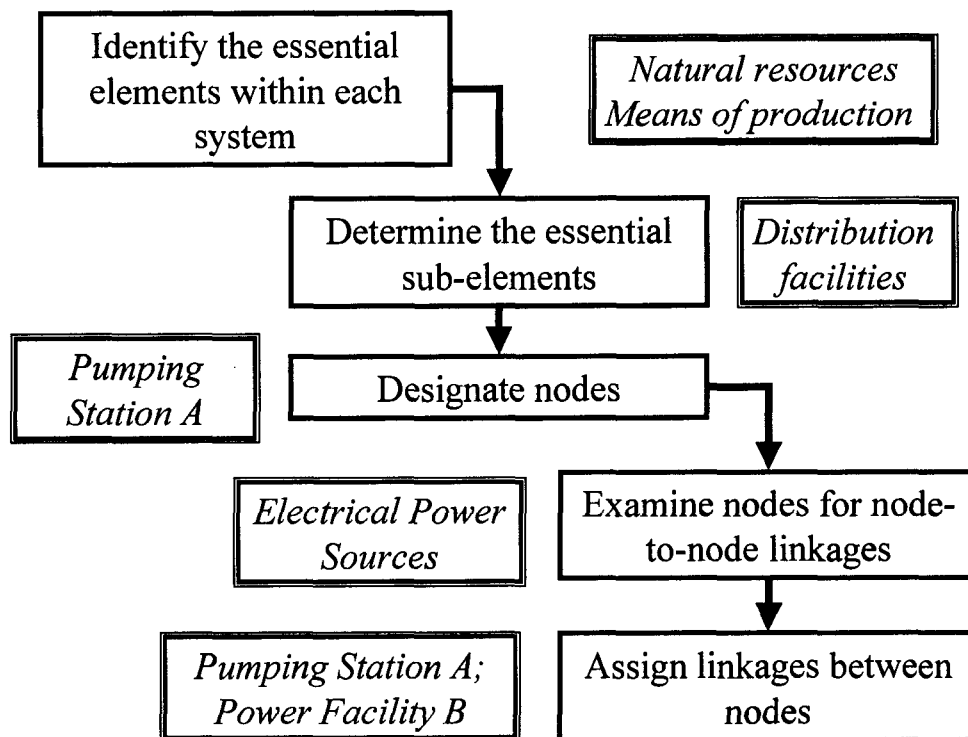
Figure 14. Sample Elements and Nodes

. And if that official is a member of a particular religious or ethnic minority, a religious leader may also be a node to which it is connected. Additional connections are likely. As displayed earlier in Figure 15, the number of permutations is indeterminable.

From a systems perspective the inputs are information about the system of power. The analytical process provides outputs in the form of an overview of the PEMS systems that comprise an overall system of power, as well as a set of node-to-node linkages that can provide an indicator of secondary effects. The question that remains to be addressed is: Can these outputs be of any value to the decision-maker whose current inventory of analytical tools is lacking?

<u>Benefits</u>

There is no pretense that mere recognition of the linkages between nodes can provide precise predictions of system behavior or of the ancillary effects of coercive actions. However, awareness of the connections, combined with an understanding of system structure and functions, is a powerful tool if it can allow analysts to focus their efforts on a fraction of the immense number of potential secondary effects, which are currently beyond comprehension. Even if a full understanding of the behavior of the system is not obtainable, an ability to narrow the set of probable outcomes and to focus more clearly the search for potential secondary effects is of substantial utility to the decision-maker.

Figure 15 reproduces the system of systems depiction used in Chapter IV. Added to it is a set of nodes (*P1, M1, M2, E1, E2, S1, S2*), showing the interrelationships between nodes within and across the PEMS system boundaries. Hence, an action taken against any of the interconnected nodes has the potential to produce secondary effects. In this example, assume that analysis determined that military nodes, *M1* and *M2* are related. If so, then an action taken to influence *M1* can reasonably be expected to also have an effect on *M2*. The nature and severity of this secondary effect is dependent upon the character and strength of the relationship between *M1* and *M2*.

Recognition of this situation provides a number of possible advantages. I offer three as the most valuable to the decision-maker.

1. Amplification of the effects of actions. An action designed to influence a specific node also is likely to have an effect on any nodes connected to it. This can result in extension of the effects of actions.
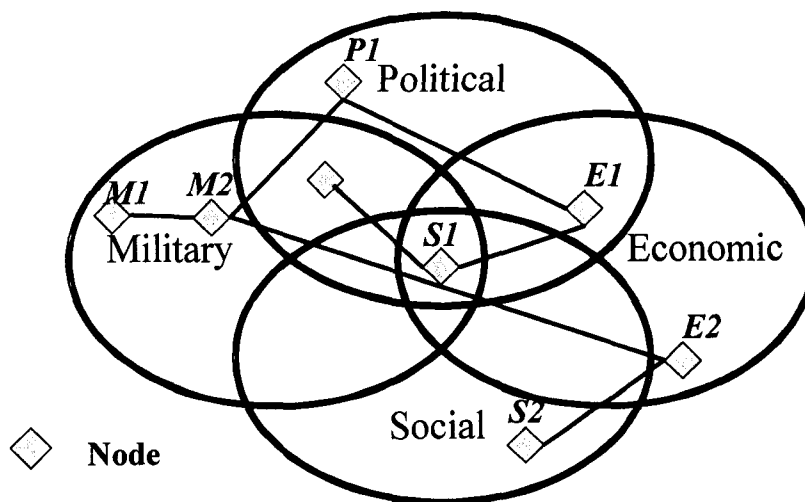
Figure 15. Nodes within Systems

Continuing the illustration with the use of military nodes, if a particular air

defense radar is determined to be connected to a specific air interceptor command and

control facility, that facility may be degraded by destruction of the radar site.

Furthermore, if that same radar site is connected to additional command and control

facilities, then the action to influence it may have cascading effects on those facilities.

Hence, a single action may produce multiple desired effects. However, in a complex

adaptive system, the equation is rarely so simple. The final analysis and decision also

must consider factors such as redundancies in the overall system, e.g., back-up radars or

other detection capabilities. Nevertheless, the potential for expanding the impact of the

action due to knowledge of the connections is readily apparent.

2. Indication of possible undesired effects.   It is conceivable that an action taken

against a node in one Political, Economic, Military, and Social (PEMS) system will have

an undesired effect on another. This is the phenomenon of *surprise* and *rogue outcomes.*

Using another military example, the destruction of a bridge that is being used by

insurgents to transit to and from a specific geographic area also may be on the primary

route for the provision of humanitarian supplies to refugees within and beyond that area.

If that bridge is destroyed, the intended military effect may be achieved. However, the

unintended reduction in the ability to sustain the refugees could have a deleterious

influence on the social, economic, and political systems, and run counter to the overall

objectives of the mission. The recognition of this possible outcome does not rule out the

destruction of the bridge, but it does provide the decision-maker with additional

information upon which to select or reject that action. As Demchak contends, "Only

greater knowledge lessens the effects of rogue outcomes."[29]

3. Recognition of alternative actions. In the application of coercive power there

are likely to be situations where the analysis indicates that an action taken to influence a

specific node has a high probability of generating the desired effect. However, that action

may not be possible for a variety of reasons, e.g., proximity to critical civilian

infrastructure, political considerations, lack of resources, etc. In these cases, knowledge

of the connections between nodes may allow a node to be influenced indirectly, i.e.,

through exploitation of a secondary effect. Using the illustration in Figure 19, assume

that node *P1* is determined the primary node to be influenced, but actions against that

person are proscribed. Since the analysis indicates that node *E1* is linked to that node, it

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29. Demchak, "Complexity and the Theory of Networked Militaries," 227. Rogue outcomes are those unintended, unexpected and unanticipated results of actions.

may be possible to influence $P1$ though actions taken against $E1$. For example, if the owner of a commercial facility ($E1$ in this illustration) has close ties with a senior government official ($P1$), and action against $P1$ is prohibited, then an alternative course may be to take an action against the economic node ($E1$) with the objective of influencing the political node ($P1$).

These illustrations describe three potential benefits of the methodology: (1) identification of opportunities for extension of the effects of actions; (2) indications of likely undesired effects; and, (3) recognition of secondary effects to mitigate targeting dilemmas. Even if partially available, such insights can be of immense value to those who must consider options in the application of coercive power. However, the limits on application of the process must be recognized so that expectations are managed and to preclude its inappropriate use.

Limitations

The ability to perform these tasks and to produce the desired outputs is directly related to the degree of comprehension of the system and its nodal linkages. The depth and breadth of this knowledge is the principal limitation of the methodology since "Knowing all the possible outcomes of a dynamic system is theoretically impossible, and thus there remains a final subset of unknowns that are simply unknowable."[30]

Some argue that attainment of even a rudimentary knowledge of the behavior of a complex system is a daunting task. King contends: "Parts or elements or individuals within a complex system are not isolatable or discrete phenomena," and "a purely

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30. Ibid., 26. She contends that every system has a set of "unknowable unknowns."

objectivist, mechanistic-reductionist scientific stance is literally impossible."[31] Other relevant observations include that causality is holistically relational, and that there are "no clear cut dependent and independent variables as such."[32] By extension, this implies that precise determination of cause and effect, and an ability to discriminate between primary and secondary effects, is not attainable.

While these views should be considered, acceptance of their arguments does not preclude utilization of the proposed methodology. Instead, their impact is to limit the applications of this model and construct. While not providing a panacea for understanding or predicting effects within complex adaptive systems, if used appropriately, the insights attained can be of considerable value when decisions regarding application of power are undertaken.

The discussions of nonlinearity, complexity, and system effects provided in earlier chapters contained one consistent message, i.e., understanding the behavior of complex adaptive systems is a most intricate and demanding task. The lack of a capability to provide an appreciable level of knowledge and comprehension supports that conclusion. However, if the desired complete solution is not possible, a process that can satisfy a portion of that requirement remains worthwhile. The nuclear physicist cannot claim to understand completely all aspects of subatomic structure. However, the model of electrons in orbit around a set of protons and neutrons, while not perfect and never directly observed, was sufficient to lead to the development of nuclear power.

The shortfall in suitable tools for the decision-maker in this context is partially due to the unrequited aspiration for a model that can withstand the rigor of empirical

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31. King, *Social Science and Complexity*, 91.
32. Ibid., 90.

proof used in the physical sciences. This is not an attainable goal. Models in the social sciences rarely attain precision. However, "A complex, highly relational system is no less ordered just because raw empiricism cannot appraise it."[33] The geo-political environment provides no laboratory for experimentation and there are no means for providing a control set with which to test the hypothesis. Therefore, more restricted applications must be the objective. We cannot change the nature of the system of systems that comprise national power. Nor can the environment in which they exist be significantly altered. Therefore, the objective should be for tools that can enhance decision-making and anticipation of secondary effects under those conditions.

Czerwinski asserts that a worthwhile goal is to command and manage complexity rather than to predict or control.[34] Singer adds, "Explanation may not be possible; description is a more modest goal."[35] I concur with these observations. This proposition is designed to provide utility, not paradigmatic exactness. Thus, the desired product of this process and methodology is not precise prediction; instead, it is the less ambitious objective of providing the decision-maker with a practical, albeit limited, tool.

Summation

This chapter provided a practicable scheme for the assessment of power and anticipation of secondary effects through a system of systems construct. The rationale for development of such a design is: (1) actions taken to influence one element of a system will result in changes in the other components with which it is connected; and, (2)

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33. King, *Social Science and Complexity*, 89. He adds, "Contingency, systematic error, ambiguity, openness, and indeterminacy are therefore, inherent in non-linear holistic systems."
34. Czerwinski, *Coping with the Bounds*, 2.
35. Singer, "Global System and its Subsystems," 32. He advocates, "developing operational descriptions" and "producing data-based empirical solutions."

existing methodologies do not provide an understanding of the relationships between elements or the requisite holistic knowledge of the system to allow for anticipation of secondary effects.

The source of the dilemma is that when more than two entities interact, the number of possible resultant effects of an action becomes indeterminable. Since systems of national power are comprised of hundreds of possible nodes, precise prediction of secondary effects is not possible. However, I rejected the deduction that this condition entails that there can be no feasible ways to generate insight into secondary effects.

Development of a means to confront this situation requires a methodology that provides a view of the structure and functioning of the system as well as an ability to identify key connections between elements while maintaining a holistic perspective. Of these, the ability to understand structure and function currently is the most developed. Therefore, subsequent discussion focused on the other requirements, particularly the interaction between nodes within and across systems.

Although operating as a continuous and seamless process, the proposed methodology was presented as a series of steps that: (1) identify the essential elements within each system; (2) determine the essential sub-elements; (3) designate nodes; (4) examine nodes for linkages; and, (5) assign linkages between nodes. This provides a plot of the connections that could be exploited by the analyst and decision-maker.

Accepting that complete understanding of system behavior and prediction of secondary effects was not possible, I presented three potential benefits of the methodology: (1) identification of opportunities for extension of the effects of actions;

(2) indication of likely undesired effects; and, (3) recognition of alternative nodes and actions.

I acknowledge that the accrued benefits are limited. However, since the nature of the systems of power and the environment in which they exist is not alterable, the objective should be for tools that enhance decision-making and anticipation of secondary effects under those conditions. This methodology provides the foundation for development of that limited but valuable capability.

The lack of a suitable experimentation milieu and mechanisms for controlling the behavior of the actors results in an inability to provide empirical data to support the hypotheses that interactions between elements within a system can be determined using a system of systems construct. Likewise, it is not possible to prove that awareness of these interactions can lead to an enhanced ability to anticipate the secondary effects of actions. The quandary is that since this is a proposed methodology that has never been overtly employed, there are no examples of its utilization that can provide indications of its worth. However, there may be occasions where the fundamentals of this process were utilized, and these scenarios may provide some insight into the possibilities for future applications. Herein is an avenue for further illustration and examination of the proposal.

The objective is to transform analyses of past applications of coercive power into the language and process of the system of systems construct to determine if there are parallels and lessons to be accrued. The means of accomplishment is a set of three *ex post* case studies of attempts to achieve national or alliance objectives. These endeavors were conducted by means of coercive actions designed to influence systems of power. Through these examples, which experienced varying degrees of success in the attainment of

objectives, the potential for the methodology may be better understood. These studies—

Somalia, Kosovo, and Afghanistan—are the focus of the following three chapters.

CHAPTER VI

SOMALIA 1992-1995

The methodology presented in Chapter V provides the framework of a process for assessments of national power that allows some ability to anticipate the primary and secondary effects of actions. Since there are no clear examples of overt applications of this type of approach, evaluation of its effectiveness is problematic. However, recent history may provide illustrations of the application of the basic principles and assumptions of the methodology.

The premise of this contention is that although planners may not have overtly employed a systems approach to the planning and execution of their campaign, they did adopt and utilize many of the aspects of the systems approach. In some of these instances, the selected actions supported the attainment of goals. In other cases, measures designed to provide the intended effects produced secondary consequences that ran counter to stated objectives. In both circumstances, however, the utilization of a systems approach may have been useful in understanding the primary and secondary effects that resulted from these actions. The framework methodology presented in Chapter V, combined with identification of a number of primary and secondary effects *ex post facto*, provides the structure for the analysis contained in this chapter.

As will the two that follow, this chapter provides a very brief narrative that sets the stage for the conflict. I study the major protagonists to show cases where their objectives were conflicting—and where they were compatible. From these, the intended effects that were designed to accomplish objectives will be postulated. Following that

necessary activity, I utilize the process presented in Chapter V to illustrate with actual data the potential for employment of the process. I then extract a set of representational nodes from available sources and delineate the actions taken against those nodes in order to identify instances where knowledge of node-to-node relationships may have served as an indicator of subsequent secondary effects.

The United Nations intervention in Somalia during the period from December 1992 to March 1995 provides an appropriate and relevant scenario upon which to test the supposition that the elements and principles of a system of systems construct were utilized by decision-makers who wished to influence behavior within that collapsed state at the Horn of Africa. This mission was unique in several ways. The United Nations (UN) embarked upon a military action without the specific invitation of the host nation, it represented one of the first cases of a multinational response to a humanitarian crisis in the post-cold war era, and it explored various models of international actions in response to failed states. Additionally, the intervention, which began as a humanitarian relief mission, transitioned to the multifaceted aspects of peace operations—from peacekeeping to nation building.

In order to provide a clear depiction within the space available, I will focus on the period of the most intense interactions, i.e., from the deployment of the U.S.-led multinational Unified Task Force (UNITAF), in December 1992, through the extraction of the follow-on second United Nations Mission in Somalia (UNOSOM II) in March 1995. However, the crisis that generated the intervention did not begin in 1992; therefore, any assessment must consider the environment in which the coercive actions were taken. Hence, a brief outline of recent history of the region is appropriate.

As are most African nations, Somalia is an entity created by colonial powers. Independent since 1961, the current borders were established when the former British Somaliland and the Italian Trust Territory of Somaliland were merged into the Somali Republic. The newly independent state established a parliamentary form of government based on European models, with political power concentrated in the former Italian occupied area of southern Somalia and the capital of Mogadishu. Despite an exceptionally low level of modernization and economic development, Somalia's initial decade of autonomy represented one of the few examples of a successful transition from colonialism in sub-Saharan Africa. This condition was to be short-lived.

Uniting all Somali peoples under a single nation-state initially was a preoccupation of the Somali government. This quest produced friction with its neighbors, particularly its ancient adversary, Ethiopia. With little hope of achieving this goal through peaceful means, and not possessing the military power to do so by force, Prime Minister Mohamed Ibrahim Egal moderated Pan-Somali nationalism in the late 1960's.

Partly as a response to the rejection of a Greater-Somali state, a revolt of military officers led by Major General Mohamed Siad Barre ended in a bloodless coup in October 1969. Political and military power resided within the 20-member Supreme Revolutionary Council (SRC) that proclaimed the Somali Democratic Republic. The basis of the newly established government was a Somali adaptation of Soviet style communism known as "scientific socialism." Barre became President of the Republic and Secretary General of the ruling Somali Revolutionary Socialist Party. An absolute and dictatorial ruler, Barre succeeded in establishing a cult of personality around himself and centralizing power on

his Marehan clan.[1] The regime had close military, economic, and political ties to the Soviet Union.

The previously repressed tensions with Ethiopia reemerged in the mid-1970s. Taking advantage of the instability resulting from the overthrow of the Ethiopian Emperor in 1975, Somalia invaded the contested Ogaden area. Soviet support shifted to the Ethiopians, and the two-year Ogaden War resulted in multiple military setbacks for the Somali forces and their eventual withdrawal from the region. Somalia turned to the West for support and entered into agreements with the United States that granted limited access to military facilities in Somalia. By the end of the decade, internal support for Barre began to wane.

Although the government mounted a serious effort to discourage and deemphasize clan and tribal identities, opposition to Barre was linked to clan association. Dissatisfaction with the regime emerged, especially in the north where the Issaq clan was foremost. An all-out civil war developed during the1980's between Barre's forces and those of the Issaq dominated Somali National Movement (SNM) with its power base in the former British Somaliland capital of Hargeisa.

Armed opposition to the Barre regime spread from the north to the central and southern regions, and he remained in control only in the Mogadishu area. The anti-regime forces continued to grow in strength and support, and in January 1991 Barre, fled into

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1. For a more detailed examination of the massive human rights abuses of the Barre regime see Africa Watch Committee, *Somalia: A Government at War with It Own People,* (New York: Africa Watch Committee, 1990).

exile, leaving Somalia without a functioning government.[2] The stage for a humanitarian crisis was set.

These few paragraphs provide the background necessary to enable a better understanding of the systemic conditions in Somalia post 1991. However, any examinations of a system must consider the environment and existing state of the system. Hence, prior to an examination of actions and their effects, I will address the conditions, specifically the systems of power within Somalia.

A Representational System of Systems Analysis

I contend that during the Somalia operation the United Nations and United States, in some instances, utilized the principles of a system of systems analysis in the selection of actions. In order to support this supposition, and to illustrate the methodology further, I will present the framework for a system of systems analysis in 1992-1995 Somalia. The steps presented in Chapter V are: (1) Identify the essential elements within each system; (2) determine the essential sub-elements; (3) designate nodes; (4) examine nodes for node-to-node linkages; and, (5) assign linkages between nodes. Again, a complete analysis is beyond the scope of this effort and I will provide no more than illustrative examples. I will present only a brief representation of the analysis for each of the Political, Economic, Military, and Social (PEMS) Areas, and narrow the focus to the selection of only a very few nodes.

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2. See U.S. Department of State, "Background Note: Somalia," April 2005, http://www.state.gov/r/pa/ei/bgn/2863.htm (accessed 5 April 2005) for a condensed recent political history of Somalia. For a description of the evolution of Somalia through the pre- and post-colonial periods to its collapse into a stateless society, see Maria H. Brons, *Society, Security, Sovereignty and the State in Somalia: From Statelessness to Statelessness?* (Utrecht, Netherlands: International Books, 2001), 2439-42, provides a more detailed introductory survey with a good depiction of the political movements and their clan linkages.

A fully developed analysis would be an immense effort requiring myriad research assets, people, sources, and knowledge management tools. Hence, the objective here is to provide only the minimum amount of information to "fill in the blanks" with actual data into the framework presented in Chapter V. Consequently, the nodes selected for further analysis and development will be limited to those that were actually acted upon during the conflict.

Somalia presents a challenge to conducting analysis from a systems perspective. As will be illustrated in this section, only the social system was relatively well developed and it was unstable due to the pressures the Barre regime placed upon it and years of internal warfare. However, if the construct is applicable, even to a limited extent, to a collapsed state such as Somalia, then its relevance to assessments of more structured and developed systems becomes evident. With that premise established, I will now present the representational system of systems analysis.

Essential Elements of the Systems

Political. A U.S. Department of State study provides a severe but illuminating analysis of the Somali political system in 1992. Under the heading of "Government," the assessment states "None," and continues, "Somalia has had no functioning national government since the United Somali Conference (USC) ousted the regime of Maj. Gen. Mohamed Siad "Barre" in January 1991."[3] What once was the Somali state no longer existed—Somalia had simply *collapsed.* This condition is more severe than the common depiction of a *failed* state, where a central government is functioning but is exceptionally

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3. U.S. Department of State, "Background Note: Somalia," 2. Additionally, under the headings of "Political Parties and Legal System," the evaluation is "none functioning."

weak and ineffective. Lyons and Samatar contend, "State collapse occurs when structure, authority, legitimate power, law and political order fall apart, leaving behind a civil society that lacks the ability to rebound to fill the vacuum."[4] This vacuum must somehow be filled. In the case of Somalia, in the absence of any legitimate authority, power went to those with the weapons. While there was some minimal organization based on clan affiliation, the contending factions were in many cases little more than armed thugs, who were bereft of a cause beyond their own financial gain.

The connections between the clans, regions, and weakly structured political movements are important to any analysis of the political system. The clans, which had coexisted in relative harmony for centuries, but whose influence was undermined during the period of scientific socialism, emerged as the nucleus of the major armed struggles. Opposition to the Barre regime had been based on three political groups that had clan identification as their foundation: *Issaq*, the Somali National Movement (SNM); *Hawiye*, the United Somali Congress (USC); and, *Ogadeni*, the Somali Patriotic Movement (SPM). Although temporarily allied against a common foe, "These three movements loathed each other almost as they did Barre."[5] Alice Bettis Hashim contends that a key to understanding the system is that the alliances are formed "between clans and sub-clans especially as they are required by the weaker groups."[6] Hence, the means to

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4. Terrence Lyons and Ahmed I. Samatar, *Somalia: State Collapse, Multilateral Intervention, and Strategies for Political Reconstruction* (Washington: The Brookings Institution, 1995)., 1.

5. Samuel M. Makinda, *Seeking Peace from Chaos: Humanitarian Intervention in Somalia* (Boulder, CO: Lynne Reinner Publishers, Inc, 1993), 13, contends that while clan rivalry was important, the presence of large quantities of arms—a legacy of the cold war rivalries between the U.S. and U.S.S.R.—exacerbated the situation.

6. Alice Bettis Hashim, *The Fallen State: Dissonance, Dictatorship and Death in Somalia* (New York: University Press of America, 1997), 36. Important to the study of this crisis is that the elements of these alliances most commonly band together in order to meet an external threat.

understanding the political system of Somalia resides in knowledge of the political movements and their relationship to the clans.

By 1992, the United Somali Congress (USC), which had seized control of Mogadishu the year earlier, had split into two major factions: the Aideed led Somali National Alliance (SNA); and the Somali Salvation Alliance, headed by Ali Mahdi. The struggle for power between these two factions was to represent the principal source of armed conflict in Somalia.

The connections between the clans, the geographic regions where its members are concentrated, the predominant associated political movements, and the key individuals are important to the analysis. For example, rival political movement leaders (nodes) may share allegiance to the same clan. Knowledge of these relationships enhances the ability to determine the possible effects of actions. Table 5 presents some of the clan, region, political movement, and node relationships.

The clans themselves are not unified and homogenous; rather they are comprised of multiple subdivisions down to the tribe and family level, and conflicts can arise within the clans. Although they were members of the same Hawiye clan, Aideed's militias were primarily from the Ahabir Gedir sub-clan, while Mahdi's were from the Abgal sub-clan. Hence, awareness of identity must go beyond mere clan affiliation.

Assessments of the political systems of most nations would include the structure and functioning of organizations within that system. The lack of a functioning political system in Somalia during the period under examination results in the need to consider the leadership of the armed bands, commonly referred to as warlords, as the most important political nodes.

Table 5. Somali Clan Relationship Examples

Clan	Region	Movement	Node
Hawiye	Mogadishu	Somali National Alliance	Ali Mahdi Mohamed
		Somali Salvation Alliance	Mohamed Farah Aideed
Rahanwein	South	Somali Democratic Alliance	Mohamed Farah Abdullah
Ogadeni	West	Somali Patriotic Movement	Omar Jess
			General Siad "Morgan"
Issaq	Northwest	Somali National Movement	Abdi Warsemeh Isar
		United Somali Front	Abd ar-Rahman Dualeh Ali
	Central/Northeast	Somali Salvation Democratic Front	Mohamed Abshir Musse

Economic. Somalia in 1992 possessed a basic subsistence economy with minimal foreign trade. Historically, its principal exports have been agricultural products, primarily livestock. Due to natural and man-made disasters, its primary import remained food. Most European trade was with the former colonial power, Italy, while Yemen and the United Arab Emirates were its major partners in limited regional trade. During the cold war years both the U.S. and USSR improved deepwater port facilities at Berbera, although these fell into disrepair in the ensuing period. There is no railroad system, and the 2,600 kilometers of all-weather roads had deteriorated due to lack of maintenance.[7]

By 1992, Somalia was almost completely dependent upon foreign assistance. Internally, the looting and resale of food shipments became a primary element of the economy. Militias and gangs of drug-hyped teenagers, *mooryan,* roamed the country in

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7. *Europa World Yearbook 1992,* (London: Europa Publications, Inc. 1993), 2439-47.

armed trucks known as *technicals*.[8] Protection became a service industry, with gangs

hiring themselves out to relief agencies to preclude the "defenders" from confiscating the

supplies.

Without the means to provide even a basic level of subsistence for the population,

the single-most important element in the Somali economy in 1992 was the internationally

donated relief supplies and the non-governmental and private volunteer organizations that

provided them. The nodes were the port and storage facilities and the lines of

communication to those desperately in need of the supplies. These are nodes because an

action taken to influence them is likely to have an impact on the overall system. For

example, warlord control of the port facilities severely degraded the flow of relief

supplies with the consequence of severe disruptions to the economic system.

Military: During the early years of independence, Somalia possessed one of the

stronger militaries in the region. The Somali National Army combined British and Italian

training and traditions with modern Soviet equipment. However, its defeat in the Ogaden

War with Ethiopia weakened its support among the general Somali populace. With the

overthrow of Barre, the Somali National Army disintegrated into multiple independent

bands and for all practical purposes, ceased to exist. By late 1992, there were no state

controlled Somali armed forces. Without a state apparatus possessing a monopoly on

violence, individual militias became the de facto military force of Somalia.

Although loose allegiance to the leadership existed, the paramilitary units in many

instances were no more than undisciplined gangs of roving bandits. This condition

complicates the identification of specific nodes. While estimates are inaccurate and the

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8. The name derived from the status of the gangs as "technical assistants" to the relief efforts. Heavy weapons were fitted to jeeps, land rovers and small trucks, which became primitive fighting vehicles.

numbers wide-ranging, General Morgan reportedly could employ over 1,000 former

Somali National Army troops in his militia. Estimates of the forces loyal to Omar Jess

were "several thousand strong."[9] An illustration of some of the connections between clan

affiliation, political movements, and the major belligerents is provided in Figure 16.
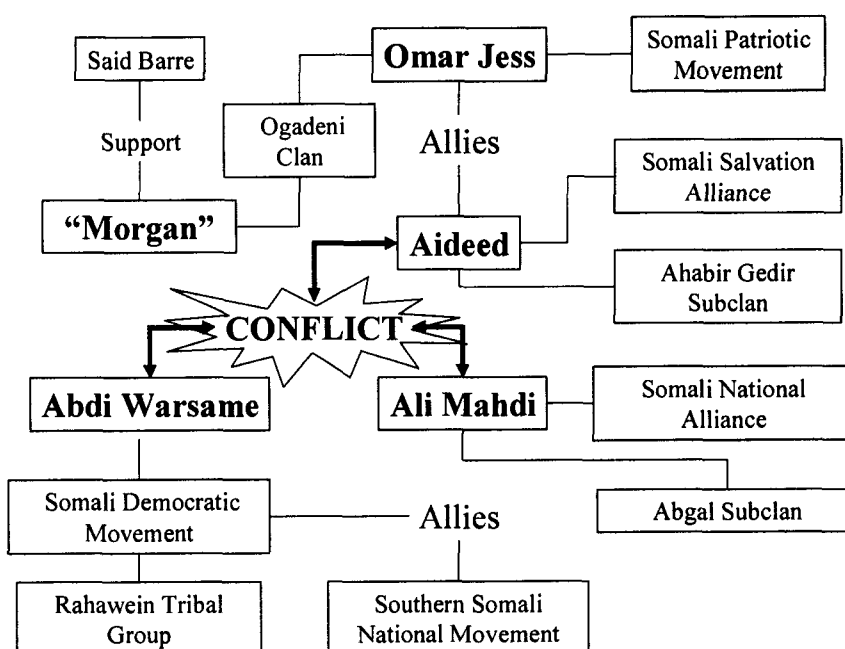
Figure 16. Key Belligerents' Clan and Political Movement Linkages

The UN and coalition commanders considered Aideed himself, who claimed more

than 30,000 troops, to be a primary node and went to exceptional lengths to kill or

capture him. Ali Mahdi, as a powerful militia leader and principal antagonist of Aideed,

would also be considered a node within the military system.

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9. John L. Hirsch and Robert B. Oakley, *Somalia and Operation Restore Hope: Reflections on Peacemaking and Peacekeeping* (Washington: United States Institute of Peace Press, 1995), 76.

The principal protagonists were Aideed, Abdi Warsame, and Ali Mahdi. Morgan was connected to Jess through a previous military and political relationship; Morgan and Jess were related due to their Ogadeni clan allegiance; hence, the second order connection to Aideed. The relationships become complex because Aideed opposes Barre, who supports Morgan. Even in this simplified illustration the difficulty in predicting the secondary effects of actions is significant.

Social. The people who have occupied Somalia since the first century A.D. are ethnically homogeneous. Unique to that part of the continent, Somalia is the only nation in sub-Saharan Africa with a solitary ethnic group. Adherence to Islam and a common language are the primary forces that join the inhabitants; the vast majority (85 per cent) being Somali and Sunni Muslim. Traditionally, this has been a relatively benign brand of Islam. Exceptions are radical Islamic groups such as the al-Tabliq and Al Ittihad who are among the main non-clan based groups in Somalia.[10] The Somali Nationalist Islamic Front (NIF) reportedly received support, including funding and weapons, from Iran and Sudan, but their impact proved minimal.[11]

Most inhabitants are pastoral nomads, with perceptible distinctions between the majority rural population and the urban dwellers. Overall literacy is 24 per cent, concentrated mainly in Mogadishu. Although relatively uniform, Somali society is not static and has been described as "flexible and rich in variety."[12] The social formations are characterized by "the intermeshing of economic, production, political life, and culture."[13]

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10. U.S. Department of State, "Background Note: Somalia," 26. Al-Itthad was the more vocal of the two in advocating the use of violence to achieve their common goal of the establishment of an Islamic state.
11. Hirsch and Oakley, *Somalia and Operation Restore Hope*, 84. Religious links between northern Somalia and Sudan have existed for centuries. 85.
12. Brons, *Society, Security, Sovereignty and the State in Somalia*, 33.
13. Lyons and Samatar, *Somalia*, 8.

In Somalia, the boundaries between the systems of power are exceptionally porous. "Clan affiliation is interwoven with social, economic, and political life of the Somali."[14] Hence, isolation of the political from the social is not possible.

"For generations, the single-most important factor in Somali society has been the clan."[15] Stevenson asserts, that clans "are not for the most part, religiously or ethnically based," and that they "would only band together if the equilibrium among nomadic enclaves was disrupted."[16] The clans make up the largest element of categorization; however, the multiple sub-clans, tribes, and families are the primary groups that define one's identity. Another important element of Somali society is the pan-Somali code of *heer*, which is a binding influence that emphasizes "the values of interdependence and inclusiveness and thus formed the basis for social order."[17] The clan/sub-clan/tribe family connections are complex. Figure 17 depicts the clan relationships and connections extant in 1992.

Since the social interactions in Somalia are so closely linked to clan, sub-clan and tribal identity, an understanding of these relationships is critical to any assessment. It is this complex and intricate set of clan, tribe, and family relationships that makes an understanding of Somali so difficult, and so necessary. Nodes that could be included in the social system would be clan and religious leaders such as Aideed, Ali Mahdi, and Mohamed Abshir Musse. I have discussed the first two earlier. Musse is a node due to his earlier anti-communist stance. As "a leader in the northeast part of the country, he headed

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14. Brons, *Society, Security, Sovereignty and the State in Somalia,* 98

15. Makinda, *Seeking Peace from Chaos,* 18.

16. Jonathon Stevenson, "Hope Restored in Somalia," *Foreign Policy* 91 (Summer 93), 142.

17. Lyons and Samatar, *Somalia,* 10, contend that *heer* did not eliminate strife but provided a means of dealing with disputes and conflicts. Hashim, *Fallen State,* 35, describes *heer* as "social order arranged through social contracts," and that its meaning equates to "agreement, compact, contract or bilateral treaty."

armed forces against Islamic fundamentalists in factional fighting there more than a

decade ago and worked with U.S. officials in setting up nonpolitical police forces in his

region and in Mogadishu in 1992 and 1993."[18]
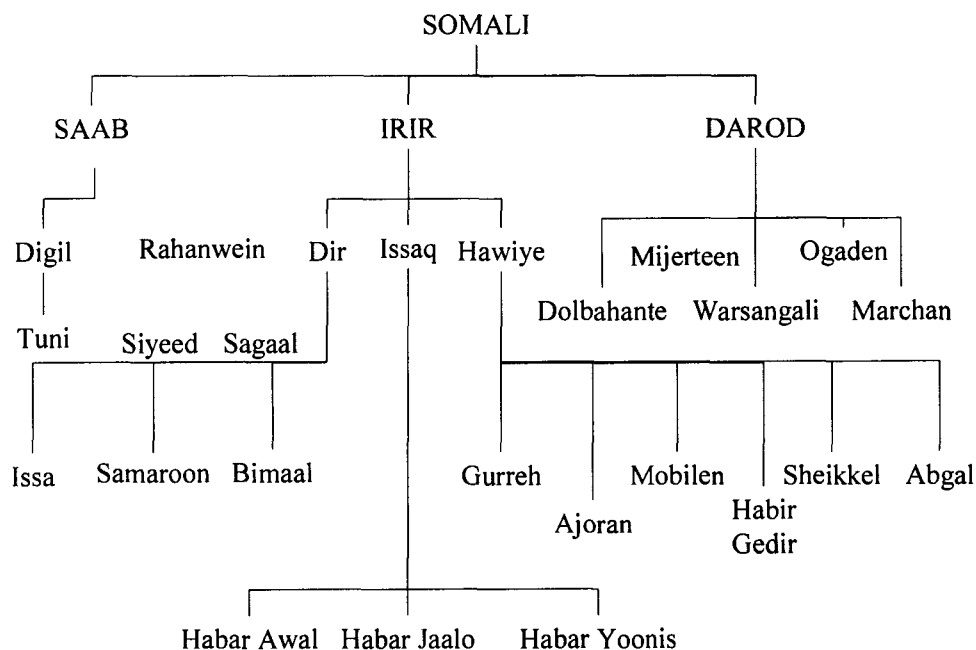
Figure 17. Genealogical Chart of Somalia[19]

Due to the extent to which clan relationships affect all of the systems of power in

Somalia, the analysis must include consideration of interactions across system

boundaries. These linkages are a key element of the system of systems construct.

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18. George Jr. Lardner, "Former Somali General Told to Leave U.S.," *Washington Post*, March 17, 2003.

19. Chart reproduced from ibid., 9.

Node Linkages – The System of Systems

The diagrams that depict the overlap between the systems presented earlier used ovals of equal size to illustrate the overall system relationships. However, in the case of Somalia, the economic and military systems are relatively weak and undeveloped, and the political and social systems are nearly identical. Therefore, Figure 18 provides a more accurate portrayal of the relative importance and overlap of the four systems of power.

Figure 18. Systems of Power in Somalia 1992

While all four systems are interrelated, the nearly non-existent economic aspect and the diffuse and unstructured military are less of a factor in the analysis than the closely intertwined political and social systems. However, it is equally important to consider the linkages across systems. This is complicated in Somalia due to the lack of an economic

infrastructure, and an organized government with a loyal military. Additionally, individual nodes, such as Aideed, could reside in multiple areas
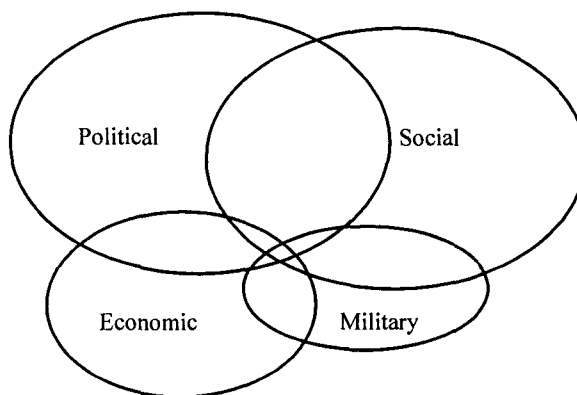
A principal task of the analyst is to determine these linkages across systems. For example, militias routinely hired themselves out to private volunteer organizations to protect the relief supplies. In this case, a warlord, such as Omar Jess, could be linked to a relief organization, like *Medecins sans Frontiere*. Many of the warlords had connections to political movements, e.g., Mahdi and the Northern Somali Alliance.

The intent of this very brief excursion is to present only some illustrative examples of a system of systems analysis to enhance understanding of the principles of the construct. As a further step toward this objective, I will present additional examples from the intervention. This first requires establishing the proximate causes for the crisis and the decision to intervene.

The Impetus for Intervention

The collapse of the Barre regime "created a vacuum of legitimate institutions that was filled in different ways in different regions."[20] Gangs of armed teenagers, whose primary motivation was looting and banditry rather than allegiance to any political dogma or charismatic leader, filled this void. The competition between groups seeking the limited booty available in this impoverished collapsed state resulted in armed conflicts, primarily between factions of the United Somali Congress (USC). Faction leaders reemerged and exploited the previously repressed clan linkages and rivalries.

Followers of Ali Mahdi Mohamed battled with those of General Mohamed Farah Aideed in Mogadishu where a de facto boundary between their areas of influence

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20. Lyons and Samatar, *Somalia*, 21.

materialized despite the lack of a formal agreement on a line of demarcation. Between November 1991 and the following February, battles virtually destroyed the remaining infrastructure of Mogadishu and produced the human tragedy of thousands of civilian deaths and many more refugees. Outside the capital city, conflicts erupted between two factions within the Ogandeni Somali Patriotic Movement, one led by Colonel Omar Jess, and the other by General Siad Hersi "Morgan." Although fighting was less evident in the north, armed elements of the Somali National Movement (SNM) supported the establishment of a secessionist Republic of Somaliland in the territory of the former British Somaliland.

Aideed's forces progressively gained the upper hand by late 1991. The near continuous fighting and the resulting inability to distribute relief supplies had been responsible for civilian deaths and injuries in the tens of thousands. Recognizing his inferior military position, Ali Mahdi appealed to the United Nations, which imposed an arms embargo in January 1992 and dispatched an envoy. However, the primary objective of establishing an agreement for a ceasefire was not attained.

Subsequently, delegates to a conference convened by the Organization of African Unity, the League of Arab States, and the Organization of the Islamic Conferences appealed for an armistice in order to contend with the increasing humanitarian crisis. The principal rival factions eventually joined the conference and agreed to the terms of the ceasefire in March. The following month, the United Nations Security Council (UNSC) directed the establishment of a United Nations Operation in Somalia (UNOSOM) to monitor the agreement.[21]

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21. This UN presence was manifested in a 50-strong observer mission. The UNSC (Resolution 751, 24 April 1992) also agreed in principle to send a security force to protect UN personnel and supplies at the

UN Secretary General Boutros Boutros-Ghali dispatched Algerian diplomat

Mohamed Sahnoun as his Special Representative. Through proactive engagement with

the warring parties and an excellent understanding of the Somali culture and political

concerns and aspirations, Sahnoun was able to broker an agreement to deploy a 500 man

security force to protect the relief supplies that were arriving in Somalia but were not

being delivered to their intended recipients due to continuous looting by armed gangs.

Despite these notable successes, his criticism of UN and national efforts resulted in

Sahnoun's replacement with Iraqi diplomat Ismat Kittani. It was not until September that

500 lightly armed Pakistani troops who represented the military component of UNOSOM

arrived in Somalia. Aideed successfully prevented this force from conducting its mission;

the Pakistani troops essentially never ventured from their barracks while the human

tragedy around them grew. By November nearly 350,000 (out of an estimated total

population of six million) Somalis had perished due to malnutrition during that year.[22]

In late 1992, Barre reemerged from exile and attempted to retake the capital.

Aideeds' forces successfully countered this offensive and eventually drove Barre's forces

from the country. The cost of this conflict was an ever-increasing level of human

suffering, exacerbated by disease and famine, described by one U.S. official as "the

greatest humanitarian emergency in the world."[23] The heartrending images of starving

children and an international community apparently powerless to alleviate the suffering

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port of Mogadishu and to escort supplies to their planned eventual destinations. This required the agreement of both parties; however, Aideed subsequently refused to accept the presence of additional foreign military personnel. See Makinda, *Seeking Peace from Chaos*, 13, esp. 59-82, and *Europa Yearbook 1992*, (London: Europa Publications, 1993), 2440-42 for more detailed presentation of the events leading to the UN actions.

22. Precise figures are elusive. The International Committee of the Red Cross estimated that by the end of 1992 over one million Somalis had perished since the beginnings of the conflict. See Stevenson, "Hope Restored in Somalia," 138-39.

23. Lyons and Samatar, *Somalia*, 30.

was ubiquitous in the Western media and served to awaken the consciences of the audiences. This awareness generated appeals to "do something."

Although he had recently lost his bid for reelection, U.S. President George H.W. Bush met with his National Security Council to explore means of dealing with the increasingly visible crisis. This resulted in an American proposal to Boutros-Ghali that became the key provision of United Nations Security Council Resolution (UNSCR) 794. The important specification was the authorization to use "all necessary means to establish as soon as possible a secure environment for relief operations in Somalia."[24] The manner in which these actions were undertaken provides the foundation of this case study.

This examination continues from the brief history provided earlier in the chapter and will commence with the adoption of UNSCR 794 on 3 December 1992. The resolution expressed alarm at the deterioration of the humanitarian situation in Somalia and responded to urgent calls "for the international community to take measures to ensure the delivery of humanitarian assistance to Somalia."[25] John Hirsch and Robert Oakley contend that the impetus for additional U.S. involvement came from three major sources: (1) the media; (2) international humanitarian relief organizations; and, (3) Congress.[26]

Somalia had become an issue during the 1992 presidential campaign, with the Democrats denouncing the failure of the Bush administration to take effective action. Direct U.S. involvement had begun in August during Operation Provide Relief, which supported humanitarian assistance efforts with logistics assets, primarily airlift.

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24. Action authorized under provisions of Chapter VII (Enforcement) of the UN Charter. Text of Resolution provided in Appendix A of Hirsch and Oakley, *Somalia and Operation Restore Hope*, 180.

25. U.S. Congress, House of Representatives, Committee on Foreign Affairs, *Markup on S.J. Res. 45 Authorizing the Use of Force in Somalia*, 23 May 1993, Appendix 3.

26. Hirsh and Oakley, *Somalia and Operation Restore Hope*, 35. See Chapter 3, esp. 35-47 for a more detailed examination of the events leading to the decision to intervene militarily. The authors observe a near complete turnaround of the DOD position in the last months of the year.

Lamentably, due to the interception of the food and medicine by the warlords and bandits, this effort was not successful in getting the supplies to the starving masses that needed it. Jeffrey Clark contends that by November, "80 percent of relief goods in Somalia were being looted and famine was claiming in excess of a thousand victims a day."[27] Hence, security for the movement of these supplies became a primary objective requiring a significantly different force, one that would be combat-capable.

Despite the overwhelming conventional military victory in Iraq in 1991, the senior Department of Defense leadership was reluctant to become engaged in operations without a clear objective, an overwhelming force, and a strategy for withdrawal. However, with pressure on the administration for action steadily increasing, these concerns were overcome, and Operation Restore Hope began on 8 December 1992 under the organizational structure of a multinational, but U.S. led, Unified Task Force (UNITAF).

The critical lesson, which UN and American decision-makers understood by varied degrees, is that the military conflict could not be adequately addressed without an understanding of the social systems at play. The section that follows will examine the events that directly led to the intervention and how those who implemented the policies used the knowledge of the interaction of systems in planning and executing the operation.

U.S. Objectives

The U.S. view of the mission was to establish a secure environment to enable the safe and efficient movement of relief supplies to the intended areas of Somalia. The longer-term objective was an eventual handover to UN forces. Boustros-Ghali had a more

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27. Jeffrey Clark, "Debacle in Somalia," *Foreign Affairs* 72 (Winter 1993): 114.

extensive mission in mind for the UNITAF, including disarmament of the belligerents. These dissimilar views of overall objectives between the UN and U.S. were never completely resolved and led to multiple difficulties with the operation.

UNSCR 794 called for establishment of "a secure environment for relief operations in Somalia." The wording was sufficiently vague to allow for multiple interpretations of the limits of the authorized activities. Brune observes three points of cardinal importance in the objectives: (1) place Somalia's heavy weapons under international control and disarm the irregular forces; (2) establish a secure environment throughout Somalia; and, (3) assure "close cooperation between UN and UNITAF *before* the U.S. transferred responsibility to UN peacekeepers."[28]

In the U.S. view, American participation would be temporary, with the role of U.S. combat forces to establish this safe environment so that the relieving UN elements could continue the protection of the relief efforts. These limited objectives were attained. However, the inability to continue the protection throughout the country once the UNITAF was withdrawn led to the overall failures of the mission. Cooperation may have existed, but was proven insufficient.

Somali Political Objectives

A general long-term objective was the quest for a greater Somalia, i.e., unification of all Somali-inhabited territories in the Horn of Africa.[29] However, this goal was deferred while the battles over who would control Somalia itself were fought. For Aideed and Ali Mahdi, the objective was to enhance their own personal power. Aideed, a former

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28. Lester H. Brune, *The United States and Post-Cold War Interventions: Bush and Clinton in Somalia, Haiti and Bosnia 1992-1998* (Claremont, CA: Regina Books, 1998), 19 and 23.
29. Brons, *Society, Security, Sovereignty and the State in Somalia*, 30.

ambassador to India who had been instrumental in the overthrow of Barre, believed that he had a legitimate claim to the leading role in the future of Somalia. Aideed held the greatest power, but not enough to dominate his opponents. For him, international military involvement, which could alter the balance, was not desirable.

The reverse held true for Ali Mahdi who needed foreign troops to keep Aideed's forces from crushing his own. The lesser warlords, e.g., Jess, Morgan, Abdi Warsame, et al, were not powerful enough on their own, but would attach themselves through alliances to one side or the other depending upon how the fortunes of battle evolved. While the objectives of the various belligerents varied, personal aggrandizement of political and economic power for their factions remained the key objectives.

Effects of the Coercive Actions

The initial U.S. forces landed on 9 December with larger contingents arriving by both air and sea within a few weeks. The landings were unopposed largely due to UN brokered agreements between Aideed and Ali Mahdi who seemed to welcome an opportunity for a hiatus in the near continuous fighting between their followers in Mogadishu. The U.S. achieved its precept of overwhelming force. The American Army contingent of the UNITAF alone included nearly 10,000 troops of the 10th Mountain Division, including infantry, aviation, artillery, and support units. Coalition elements brought the total force available to 38,000 representing 23 different nations.[30] This force quickly achieved mission success with Somali heavy weapons moved into cantonment areas or removed from the city.

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30. Richard W. Stewart, *The United States Army in Somalia, Center of Military History Pub 70-81-1* (Washington: U.S. Army Center of Military History, 1994), 10. This included large contingents from Italy, France, Canada, Belgium, Morocco, Australia, and Pakistan.

The military was effectively conducting their operations, which included psychological and civil affairs activities aimed at influencing elements of the social system. This activity displayed the use of knowledge of the connections between system elements in Somalia. That is, utilization of alternate actions to achieve the same effect. The psychological operations effort included publication of a newspaper (*Royo*--the truth) and establishment of a radio broadcast station. Concurrently, Ambassador Robert Oakley continued to conduct negotiations with Aideed and Ali Mahdi. This coordination between the military and diplomatic actions contributed greatly to the success of the mission.

By late December, the military contingent, which included a U.S. Marine Expeditionary Unit and Special Operations Forces, moved out of Mogadishu into the countryside. Military forces effectively executed the plan and attained their primary objectives. They also expeditiously and efficiently completed the principal humanitarian mission. While precise measurements of effectiveness are not possible, Brune claims that UNITAF saved 100,000 lives between January and May 1993.[31]

Crocker agrees that the military mission was successfully completed and that "UNITAF's accomplishments far exceeded the simple, publicly discussed goal of creating a 'secure environment for humanitarian relief.'"[32] A U.S. Army history claims: "Despite some setbacks and incidents, Operation RESTORE HOPE succeeded in its goal of bringing an end to mass starvation."[33] However, at the end of the UNITAF mandate there was still no effectively operating government, police, or national military in Somalia. Although reduced in number and scope, incidents of violence continued, as well

31. Brune, *United States and Post-Cold War Interventions*, 23.
32. Chester A Crocker, "The Lessons of Somalia: Not Everything Went Wrong," *Foreign Affairs* (May/June 1995), 4. The author is a former assistant secretary of state.
33. Stewart, *United States Army in Somalia*, 14. Capitalization of operation in original.

as the threats to the international assistance efforts. Despite these dangerous conditions, the goal of a transition to a UN force became politically imperative and establishment of the relieving force, designated United Nations Operation in Somalia II (UNOSOM II), became the most urgent task.

On 26 March 1993, the Security Council approved Resolution 814, which broadened the mandate of the previous efforts. In addition to the tasking to establish a safe and secure environment, UNSCR 814 called for disarmament of the warring militias, seizing unauthorized small arms, continuing mine-clearing, and assisting in repatriation of refugees in Somalia.[34] The plan was for an operation in four phases: (1) the transition of operational control from UNITAF; (2) the effective deployment and consolidation of UN operational control throughout Somalia and the border regions; (3) the reduction of UNOSOM II military activity and assistance to civil authorities in exercising greater responsibility; and, (4) the redeployment or reduction of UNOSOM force.[35] Retired U.S. Navy Admiral Jonathon Howe was appointed the new Special Representative for Somalia, and Turkish Lieutenant-General Cervik Bir assumed command of UNOSOM II.

The coercive actions were employed in multiple areas. In an attempt to disrupt incitement of the population against the UN forces, the military carried out operations to preclude propaganda broadcasts from the Aideed controlled Radio Mogadishu. Again, UN planners employed alternative actions to achieve the effect of weakening Aideed. In addition to the military activities, diplomatic efforts continued.

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34. United Nations Department of Public Information, "United Nations Operation in Somalia II," Updated 21 March 1997, http://www.un.org/Depts/DPKP/Missions/unosom2b.htm (accessed 5 April 2005). The resolution text includes a mandate to "maintain control of the heavy weapons of the organized factions which would have been brought under international control," and "seizing the small arms of all unauthorized armed elements." The paper acknowledges that "UNITAF had a positive impact on the security situation in Somalia and on the effective delivery of humanitarian assistance" (ibid., 2).

35. United Nations, "United Nation Operations in Somalia II," 3.

A Conference on National Reconciliation in Somalia, which included

representatives of 15 Somali political movements, produced an agreement on

disarmament, reconstruction, settlement of disputes and mechanisms for transition to a

Somali controlled authority.[36] However, in the Somali culture, agreements are not

necessarily considered to be permanent arrangements, and incidents of violence

increased. The most serious of these was on 5 June, when 26 Pakistani troops were killed

in urban battles with forces, which were allegedly controlled by Aideed.

The reaction was UNSCR 837, which strongly condemned the attacks and

directed apprehension of the perpetrators.[37] After an investigation that implicated Aideed

in the killings of 5 June, Howe directed the UNOSOM commander to capture Aideed,

offering a $25,000 reward. These incidents resulted in an alteration of the interpretation

of UNOSOM's objectives. The protection of humanitarian assistance mission had now

evolved into a manhunt.

While not under the command of UNOSOM, the U.S. maintained a Quick

Reaction Force to support the UN operation as needed. In August, the U.S. established a

Joint Special Operations Task Force (JSOTF), designated Task Force Ranger, with the

mission of capturing Aideed. American military actions, which included the use of attack

helicopters, resulted in civilian casualties and increasing popular support for Aideed.

After one incident, crowds angered by the U.S. actions killed four western journalists.

On 3 October, Task Force Ranger elements commenced an operation intended to

capture two of Aideed's key lieutenants. This resulted in the capture of twenty-four

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36. At the core of the agreement was a 74-member Transitional National Council (TNC) that "would be the bridge to a long term political solution." Hirsch and Oakley, *Somalia and Operation Restore Hope*, 98.

37. The resolution directed a more aggressive stance toward those responsible for the attacks and a request for more personnel and equipment. See ibid., Appendix F for the complete text of the resolution.

Somalis, and as preparations were being made to move them via truck convoy, a rocket-propelled grenade (RPG) downed a MH-60 Blackhawk helicopter. In the ensuing rescue attempt, 18 American soldiers were killed, and television audiences across the world watched in horror as the soldiers' bodies were mutilated and dragged through the streets of Mogadishu. This event was to be "a watershed in U.S. involvement in Somalia."[38]

Three days later President Clinton directed the cessation of all military operations, except those required for self-defense, and the withdrawal of U.S. forces from Somalia no later than 31 March 1994.[39] Additionally, he dispatched Ambassador Oakley to broker a peace settlement. On 9 October, the United Somali Congress/Somali National Alliance (Aideed's faction) announced its intention to cease military operations against UNOSOM. Even though, tensions remained, the situation became generally quiet.

Security Council resolutions in October and November established a Commission of Inquiry to investigate the attacks on UNOSOM personnel and extended the mandate for UNOSOM II until 31 May 1994.[40] Despite some achievements in humanitarian relief, Somalia remained without a functioning government, national army, police force, or judiciary. Diplomatic efforts continued, and Aideed and a diverse *Group of 12* agreed to a Declaration of National Resolution in March 1994.[41]

UNOSOM forces subsequently reduced to approximately 22,000, and the mandate further extended to October 1994. However, it became apparent that only the

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38. See Stewart, *United States Army in Somalia*, esp. 15-23 for a more detailed account of the military operations and command relationships. The following two chapters will address how this event influenced the reaction to subsequent interventions.

39. Bill Clinton, "Somalia: Our Troops Will Leave by March 31, 1994," *Vital Speeches of the Day*, 1 November 1993. Speech delivered over national television on 7 October 1993.

40. UNSCRs 885, 814 and 837. See Walter Clarke and Jeffrey Herbst, "Somalia and the Future of Humanitarian Intervention," in *Learning from Somalia*, ed. Walter Clarke and Jeffrey Herbst (Boulder, CO: Westview Press, 1995), Appendix A, for an extensive compilation of UN resolutions related to the Somalia intervention.

41. The Group of 12 included the smaller factions and generally supported Ali Mahdi against Aideed.

Somalis could resolve the situation. UNSCR 954 extended UNOSOM for a final period until 31 March 1995. This had a positive effect on getting the warring Somali factions to negotiate, and on 21 February 1995, Aideed and Ali Mahdi signed a peace agreement. As the date for UN troop withdrawal approached, relief agencies were advised to evacuate their staffs, and UNOSOM officially ended on 28 March 1995. Initially deployed to preclude a humanitarian disaster, the safe extraction of the UN force had become its primary goal.

Were the overall objectives of the intervention attained? James L. Woods contends that the UNITAF phase at least, "ended famine within a few weeks, saved hundreds of thousands of lives" and "constituted an incredible achievement."[42] Additionally, Woods argues that the intervention brought to Somalia some limited hope for a future where the factions could work together to rebuild the nation. A less optimistic commentator observed, "After the deaths of more than 100 UN peacekeepers here— including 36 Americans—Somalia is as unstable and devoid of hope as at any time since it collapsed into anarchy in January 1991."[43]

While even the most generous and positively biased observers do not assign a high degree of success to the Somalia intervention, the debate over why it failed is an engrossing topic, and it has been and will continue to be a topic for discussion and debate. However, the numerous issues of international humanitarian interventions and nation building are beyond the scope of this project. Hence, the focus will remain on the effects of actions.

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42. James L Woods, "Decisionmaking During Operations in Somalia," in *Learning from Somalia*, ed. Walter Clarke and Jeffrey Herbst (Boulder, CO: Westview Press, 1995), 166. Woods was Deputy Assistant Secretary of Defense for African Affairs from December 1986 to April 1994.
43. Keith B. Richburg, "Somalia Slips Back into Bloodshed," *Washington Post*, 4 September 1994.

The Secondary Effects

With the deployment of the UNITAF, the humanitarian relief situation improved dramatically. The military actions achieved the planned effects and attained the primary objectives. However, UN and U.S. actions taken during this period, as well as during the UNOSOM missions, inevitably produced multiple secondary effects. Some of these supported the overall objectives. Croker asserts that Somalia is better off than it was prior to the intervention in that it "knocked a hideously costly stalemated clan war off dead center and opened the field for local initiatives.[44] The intervention also contributed to the ability of the smaller factions to emerge as a political entity as evidenced in the establishment of the Transitional National Conference. Although cessation of fighting was a primary objective, the inclusive nature of the UN sponsored talks in Addis Ababa in December 1993 also provided at least the structure for participation by non-militia groups.

Despite the best of intentions, the secondary effects of actions at times ran counter to the overall objectives. Although projected as a purely humanitarian mission, Aideed and others portrayed the international mandate as a quasi-UN trusteeship and the military forces as an occupation army. This perception reawakened Somali pride as an independent nation.[45] The relative ease with which UNITAF completed it missions "helped produce a slide toward a modern version of trusteeship over an ex-colonial territory, triggering a violent backlash by a powerful Somali faction."[46]

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44. Crocker, "Lessons of Somalia," 3.
45. Brons, *Society, Security, Sovereignty and the State in Somalia*, 235, contends that the "overall record of the UN is poor," and that the UN forces provoked additional violence and added another dimension to the conflict. She also cites criticisms that the UN did not adequately use the advice and counsel of the Somali population.
46. Crocker, "Lessons of Somalia," 4.

The key nodes in the conflict were the dominant clan leaders. The establishment of negotiations and cooperation were the aim of the initial actions. This later turned into a hostile relationship. The focus on the two major belligerents, Aideed and Ali Mahdi, bestowed on them the aura of Somalia's internationally recognized and legitimate rulers. The result was that efforts to control and manipulate their behavior had the unintended effect of strengthening their position relative to the other factions. When UN officials treated the leaders of gangs of criminals as rightful representatives of the people of Somalia, it enhanced the prestige of the warlords at the expense of legitimate political and social entities.

The food and medical supplies at staging sites in Mogadishu were nodes. This is because they represented the major economic activity in the country during this period as well as the major factor in preventing an even more acute humanitarian disaster. One supposition was that giving the provisions to those who were stealing them anyway would cause the commodities to become so plentiful that the value would drop and consequently reduce the incentive to steal the supplies. This method proved to be ineffective when the roving bandits merely hoarded the supplies and kept their value at a high level.

The unstructured conduct of much of the disarmament activity resulted in "perverse and unintended consequences" [that] "reduced the ability of individuals to defend themselves without offering them an alternative means to defend themselves."[47] Hence, the weaker factions and non-militia figures were incapable or wary of asserting their authority. The disarming of factions loyal to Jess also caused the strengthening of the forces of Morgan and led to the fall of Kismayu. Lyons and Samatar contend, "All

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47. Lyons and Samatar, *Somalia*, 42.

parties agreed that an institutionalized Somali order was needed, but they differed on the roles the militia leaders would play."[48]

Finally, and most importantly, the intervention itself altered the systems of Somalia. Clarke and Herbst observe, "When U.S. troops intervened in December 1992 to stop the theft of food, they immediately disrupted the entire political economy of Somalia."[49] The system became dependent upon the UN troops for it to operate. With the removal of the now essential element of the system, the system again collapsed. The ancillary consequences of actions are a key element of this study. Table 6 provides some examples of unintended secondary effects that ran counter to stated U.S. objectives.

Table 6. Unintended Secondary Effects

Node	Intended Effect	Secondary Effect	Comment
Radio Mogadishu	Disrupted anti-UNOSOM propaganda	Attack on UN troops	24 Pakistanis killed
Aideed HQ	Captured fighters	Killing on non-combatants	Mob murders four journalists
Aideed	Captured	Inceased popular support	
Omar Jess	Disarmed	Morgan's forces strengthened	Kismayu falls
Relief supplies	Reduced value	Bandits rewarded	Food supplies hoarded

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48. Ibid., 54.

49. Clarke and Herbst, "Somalia and the Future of Humanitarian Intervention, in *Learning from Somalia*," 242. Patrick Gilkes, "From Peacekeeping to Peace Enforcement: The Somalia Precedent," *Middle East Report,* November-December 1993, 23, cites a report that "increasingly, Somalis regarded UNOSOM as another faction and Admiral Howe as another warlord."

Summation

In this chapter, I inserted examples of the systems, subsystems, elements, and nodes of Somalia in the early 1990's into the structure of the methodology presented in Chapter V. The objective was not to provide a full system of systems analysis, but rather to illustrate further the steps presented earlier with examples as a means of enhanced understanding of the construct. However, it is clear that this intervention was not planned and executed using a system effects approach.

The Somalia operation was not replete with notable successes. The intervention provides examples of some utilization of various elements of the proposed system of systems construct. Examination of the record of the intercession indicates that there were instances of the use of principles of the overall approach. Additionally, there were several occurrences where an understanding of the systems enabled amplification of the effects of actions, discovery of alternative actions, or recognition of potential secondary effects. However, it is clear that uses of the principles of the construct were infrequent, unstructured, and incidental.

However, the few examples of the utilization of an understanding of the political, economic, military, and social systems, their elements, and the connections between entities, contributed to the more effective and efficient achievement of the stated objectives of the operation. There is not sufficient empirical evidence to prove this contention or to establish causation as well as correlation. However, the record indicates that more progress toward attainment of objectives occurred when those with the best understanding of the system and it elements were responsible for the key decisions. I will provide a few illustrative examples.

Due to their familiarity with Somali culture and history extensive, experience in the region, and remarkable diplomatic skills, Robert Oakley and Mohamed Sahnoun were particularly adept and exploiting this knowledge. Sahnoun understood the importance of the clans and their ability to dilute national power, and he "aimed to put the clan system to work for Somalia."[50] Oakley also recognized the need for alternative security structures. He wanted U.S. forces to become "more deeply engaged in assisting the reestablishing of the police, prisons, and judiciary" and believed that unless these were in place, a successful U.S. withdrawal would not be possible.[51]

Both Sahnoun and Oakley understood the importance of the clans in Somali society and how any attempts to alter system behavior required engagement of clan leadership. They were proactive in attempts to influence the key nodes, i.e., Aideed and Ali Mahdi. However, this focus on only two factions is one of the more common and valid criticisms of the nature of the engagement. Renowned anthropologist I. M. Lewis concludes that UN and U.S. did not pay "sufficient attention to genuinely representative local leadership."[52] The focus on these two entities, at the expense of other elements of the social and political systems, may have had the unintended effect of strengthening their position within the Somali system. When the international forces and agencies withdrew, there were no alternatives to fill the vacuum of power.

A limited appreciation of the phenomenon of secondary effects is also apparent. Crocker identifies attempts to confront the major warlords without making them national heroes, establishment of police and government functions coincident with disarmament

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50. Stevenson, "Hope Restored in Somalia," 146.
51. Lyons and Samatar, *Somalia*, 42.
52. I. M. Lewis, "Misunderstanding the Somali Crisis," *Anthropology Today* 9, no. 4 (August 1993), 2.

and "pushing the military factions toward a locally led political process."[53] An earlier

section of this chapter provided multiple instances of when planners were not able or did

not attempt to anticipate or consider the secondary effects of actions. However,

identification of instances of the successful use of the principles of the approach were

extremely limited, and consequently the accrued benefits were minimal. There were some

successes, particularly during the brief period of the UNITAF deployment, the

psychological operations effort being one notable example.

The evidence leads to the conclusion that the interventions of 1992-95 were only

marginally successful in influencing the systems of power in Somalia to conform to

stated international objectives. At the time of this writing, nearly ten years after the

withdrawal of the last UNOSOM forces, the state of the systems in Somalia remains

similar the systems in 1995. The U.S. Central Intelligence Agency observes, "Numerous

warlords and factions are still fighting for control of the capital city as well as for other

southern regions." [54] The postulated reasons for the failures are diverse and have been the

topic of extensive debate.

Jeffrey Clark places much of the blame on the years of neglect of Somalia by the

international community and a lack of professional capability in UN humanitarian

agencies, as well as a general ineptitude on the part of the UN leadership.[55] Oakley

concludes that the U.S. and UN "overreached when they expanded their original

mandate—without making it possible to carry out."[56] Others claim that while the overall

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53. Crocker, "Lessons of Somalia," 4. He observes that these tasks were "undertakings of the highest order of delicacy in a militarized and fragmented society like Somalia's."

54. CIA Factbook, http://www.cia.gov/cia/publications/factbook/geos/so.pdf (accessed 25 April 2005). The assessment adds, "Suspicion of Somali links with global terrorism further complicates the picture."

55. Clark, "Debacle in Somalia," 3-4. Also critical of U.S policy he describes Washington's response to the crisis as "schizophrenic."

56. Hirsch and Oakley, Somalia and Operation Restore Hope, xi.

policy decisions were flawed, given additional time they may have succeeded. Instead, it was the lack of consistency and political will stay the course and help rebuild the systems of Somalia that were the main contributors to the calamity. Crocker argues that the military intervention changed the local balance of power and strengthened other elements of Somali society, but did little to ensure that this alteration survived the departure of the UN forces.[57]

While the reasons for the failures of the intervention are multiple and myriad, among these is the failure of the UN and U.S to understand the adversary and the environment. Brune argues that neither Bush nor Powell understood the "vital connection between Somalia's political anarchy and the attainment of success of the 'humanitarian' mission."[58] Although Brune's supposition is debatable, it is apparent that if some degree of understanding of the interrelationships between entities in Somali society existed, the use of this knowledge was not optimized.

As related in the introduction to this chapter, the exceptionally weak systems in Somalia make this a challenging scenario for application of the methodology. However, I have used it to illustrate how the construct may be applied even in situations where the systems are undeveloped and unstructured. I do not argue that employment of the system of system construct during the UNOSOM missions in itself would have produced a stable, self-functioning Somalia. The reasons for the failures are complex and varied and extend far beyond the assessment of Somali systems of power in the post-Barre era. Even the most highly developed, complete and sophisticated analysis will not compensate for poor policy decision-making processes. Rather, the intent is to illustrate the process and

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57. Crocker, "Lessons of Somalia," 8.
58. Brune, *United States and Post-Cold War Interventions*, 19.

to identify cases of the utilization of some elements of the system of systems construct in dealing with this crisis. When employed, they enhanced the potential for successful attainment of the overall objectives. The extension of that supposition is that additional use of the construct could improve the decision-making process. The additional case studies that follow will support that contention.

CHAPTER VII

KOSOVO 1999

When viewed across the broad and tragic landscape of Balkan history, the 78 day-long aerial operation undertaken by member nations of the NATO alliance is a relatively minor incident in the unfortunate history of the region. The ethno-religious conflicts are centuries old, and attempts at the establishment of national identities and homelands have been essentially continuous over the past several hundred years. However, this most recent confrontation presents a case study relevant to this examination in that it can provide several examples of coercive actions taken to achieve alliance objectives by influencing the systems of national power of an adversary.

The Kosovo intervention also is notable for multiple additional reasons. First, it represented the initial use of sustained military combat actions by the then 50-year-old North Atlantic alliance. Secondly, the stated principal rationale for the action was not self-defense of the member nations; nor was it designed to preclude state aggression against a third party. Lastly, it represented the use of force against a sovereign nation to deter alleged repression of a minority population within its own sovereign borders, i.e., the humanitarian crisis resulting from Serb killing and expulsion of the majority ethnic Albanian population in the province of Kosovo.

Even several years after the conflict, debate abounds as to the outcome. Senior U.S. and North Atlantic Treaty Organization (NATO) officials have described the operation officially as an "overwhelming success," while others evaluated it as "just shy

of a full-blown policy fiasco."[1] While all these factors make this intervention a fascinating case study across a wide range of topics, the element most critical to this demonstration is the means of coercion utilized and the analysis of the way in which the planners and implementers of these actions employed a holistic, systems approach to the adversary.

The purpose of this chapter is illustration of the methodology—not a complete system of systems analysis of the Federal Republic of Yugoslavia (FRY) in early 1999.[2] I can provide only a small sampling. Since this analysis is dependent upon unclassified information that has been made available to the general public, the data set is limited. The assessment relies primarily on publicly released NATO targeting data and official Serbian claims. Most of these were made while the conflict was ongoing, and hence, the accuracy of these sources is subject to challenge. This imperfect data is supplemented by limited independent analysis. However, adequate information is available with which to reconstruct the essential rationale for and effects resulting from the actions taken.

Although precise knowledge of the actions employed against the selected nodes and detailed awareness of the influence on the target would improve the analysis, the lack of such exactitude is not a major disadvantage to this study. Any exhaustive Battle Damage Assessments remain classified at the time of this writing.[3] However, the performance of individual weapon systems, effectiveness of tactics, and the number of

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1. Success claimed in U.S Department of Defense, "Kosovo/Operation Allied Force After-Action Report." Report to Congress, 31 January 2000), xvii, http://www.defenselink.mil/pubs/kaar02072000.pdf (accessed 14 January 2005). Other official releases from the U.S. and NATO mirror this assertion. For an opposing view, see, Ted Galen Carpenter, in *NATO's Empty Victory* ed. Ted Galen Carpenter (Washington, DC: The Cato Institute, 2000), 1.

2. I use the terms FRY and Yugoslavia interchangeably in the text.

3. For example, Headquarters United States Air Force, "The Air War over Serbia: Aerospace Power in Operation Allied Force," (1 April 2000) remains classified, although excerpts of the findings have been selectively released. The available selections suggest that the report contains more than battle damage assessments, and that it also addresses the overall effects generated by the actions.

tanks and bridges destroyed are only ancillary to this effort. I focus on the macro effects of actions.

Documentation regarding NATO objectives and, through extension, desired effects is generally available. However, many assumptions as to the objectives of the Serbian side must be gleaned from official press releases and reports. Additionally, some of the illustrations are also dependent upon press reports, the accuracy of which is difficult to ascertain. Until the declassification of official records, these provide the best available information and insights. Again, this condition does not seriously degrade an analysis whose intent is to provide a demonstration of the use of a systems approach to the analysis of national power.

The degree of achievement of objectives is important to this discussion. In some cases, the attainment is relatively clear, even if the precise cause is less obvious. Debate continues as to why Milosevic decided to agree to terms when he did. I will not propose definitive answers to that question here, although the results of detailed analysis by others will be included where appropriate. The Kosovo intervention has been, and continues to be, the subject of immense interest, discussion, and debate. There is no intent to conduct a comprehensive analysis of that campaign. Only a very few examples will be presented with the objective of providing illustrations of the previously presented methodology.

With the presentation of the outline, objectives, and boundaries of this chapter completed, I may now conduct the presentation of the background to the conflict and the motivation for the subsequent intervention.

The Impetus for Intervention

Ethnicity and history provide the principle causes of the crisis that led to the

conflict. Multiple studies have examined the complex chronicle of the diverse peoples of

this region, and there is no intention to reproduce those efforts here. Similarly, others

have addressed the development of the proximate conditions for the conflict in the years

immediately preceding the operation, and this segment will include only the bare

minimum of background required to put the conflict into perspective and for the

understanding of the sections to follow.[4] My intent is to provide a foundation on the

political and social environment, which emerged from centuries of tumultuous events,

and set the stage for the crisis in the spring of 1999.

Ethnicity is the most often cited basis for the conflict. The principal population

groupings in the area, Albanians and Serbs, differ along religious, ethnic, and language

lines. The Albanians in Kosovo are probably descended from the Illyrian tribes and are

primarily Sunni Muslims; the Serbs are Slavic and mostly eastern Orthodox.[5] The

Albanians represented the indigenous population, but in the era following the fall of the

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4. Noel Malcolm, *Kosovo: A Short History* (New York: New York University Press, 1998) provides an excellent background primer. See also Julie A. Mertus, *Kosovo: How Myths and Truths Started a War* (Berkeley: University of California Press, 1999) for an appreciation of the complexities and impact of history on current events in the region. The Independent International Commission on Kosovo, *Kosovo Report* (New York: Oxford University Press, 2000), 33-64, provides a good summary of later events. See also Zidas Daskalovski, "Claims to Kosovo; Nationalism and Self-Determination," in *Understanding the War in Kosovo*, ed. Florian Bieber and Zidas Daskalovski (Portland, OR: Frank Cass Publishers, 2003), and Dejan Guzina, "Kosovo or Kosova - Could It Be Both," also in *Understanding the War in Kosovo*, ed. Florian Bieber and Zidas Daskalovski (Portland, OR: Frank Cass Publishers, 2003) for a concise history of the region addressing both the Albanian and Serbian perspectives. Daskalovski provides a valuable examination of the competing claims to the territory while Guzina examines the majority-minority relationships in Kosovo.

5. In future references, ethnic Albanians residing in Kosovo will be referred to as Kosovar Albanians or *Kosovars* to distinguish them from their ethnic brethren living in the state of Albania. See also Susan Woodward, *Balkan Tragedy: Chaos and Dissolution* (Washington, DC: Brookings Institution Press, 1995), esp. 47-81, for more extensive background information of the cultural and economic aspects of the region. In 1999, the Federal Republic of Yugoslavia (FRY) was comprised of Montenegro and Serbia, which included the provinces of Vojvodina and Kosovo, and included multiple nationalities. The major protagonists were the Kosovars and the political leadership of the province of Serbia. I use the more common name *Kosovo* to describe the province, but it is synonymous with the Albanian version, *Kosova*.

Roman Empire, Slavs migrated to the area, and by the 14th century, the territory of

Kosovo became a religious and cultural center of the Balkan Slavs. Although living in

geographic proximity for centuries, the ethnic and cultural distinctions between the Serb

and Albanian populations in the region provided an unstable mixture that only needed a

catalyst to explode into violence. That force was Serbian nationalism.

The area came under Ottoman Turk control after the epic battle of Kosovo-Polje

in 1389--a defeat for the Serbs, but often described as a "mystical event" in their history.

"The story of the battle of Kosovo has become a totem or talisman of Serbian identity, so

that this event has a status unlike that of anything else in the history of the Serbs."[6]

Hence, the value of the land to the Serbs cannot be determined from purely economic or

political analyses.

Due in part to the brutal Turkish administration of the area, the many Orthodox

Serbs emigrated from present day Kosovo to more hospitable regions coincident with the

arrival of additional Islamic Albanians into the territory. In the post-World War I

settlements, the newly created Kingdom of Serbs, Croats and Slovenes was assigned

control of Kosovo despite the presence of an estimated half-million ethnic Albanians in

the region.

The immediate post World War II years and emergence of the uniting policies of

the Tito era saw containment of the demands for full independence by the majority

Albanians in Kosovo (hereinafter, Kosovars), reduced ethnic tensions, and a gradual

increase in self-rule for the region. An autonomous status within the Serbian Republic

was achieved in 1963, and in 1974, the official ties to Serbia were removed and Kosovo

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6. Malcolm, *Kosovo*, 58. It was at a rally commemorating the 600th anniversary of the battle that Slobodan Milosevic achieved increased national prominence.

became an autonomous federal republic within Yugoslavia. With the death of Tito in 1980, and as the nation dissolved in a series of nationalist conflicts, the Kosovars continued their demands for full independence. By this time a combination of a disparity in birthrates in favor of the Kosovars and continued emigration of Serbs from Kosovo resulted in additional rationale for a Kosovo free of Serb control. However, in 1989, the new Serbian president Slobodan Milosevic revoked the autonomous status and fully integrated Kosovo into Serbia.[7]

Kosovar countermoves included the establishment of a shadow government that advocated a political settlement. However, by 1996, elements that were more radical formed what became known as the Kosovo Liberation Army, and attacks against Serb security forces in Kosovo ensued.[8] Sporadic violence evolved into open conflict, with official NATO sources alleging that Serb security forces killed 1,500 Kosovar Albanians in 1998.[9] The situation deteriorated, achieved increasing international attention, and subsequently UNSCR 1160 imposed an arms embargo on the entire country. The Contact Group for the Former Yugoslavia imposed further sanctions and threatened Milosevic

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7. This step required amendments to the existing constitution. On 23 March 1989, the Assembly of Kosovo voted to accept the changes, the majority of the Albanian delegates abstained. Despite the lack of the required two-thirds majority, the amendments were declared to have passed. Population figures can only be estimated due to the lack of an inclusive census since 1981, but estimates are that in 1991 of the approximate 2,000,000 residents of Kosovo 85-90% were Kosovars, and only 5-10% Serbs. See "International Criminal Tribunal for the Former Yugoslavia," Indictment Case No. It-99-37, 24 May 1999, http://www.un.org/icty/indictment/English/mil-ii990524e.htm (accessed 13 February 2005).

8. With its roots in the Levizja Popullare e Kosoves (LPK) Party, the KLA (in Albanian, Ushtria Clirimtare E Kosoves (UCK) began as a small, poorly equipped and financed resistance movement. They were, not surprisingly, regarded as a terrorist organization by the FRY government. References to FRY security forces include primarily the Yugoslav Army, Vojska Jugoslavskaya (VJ); and the Interior Ministry Forces, Ministerstvo Unuprasnif Poslava (MUP).

9. North Atlantic Treaty Organization, "NATO's Role in Relation to the Conflict in Kosovo," http://www.nato.int/kosovo/history.htm (accessed 14 January 2005).

with military action unless the repression of the Kosovars receded.[10] In September 1998,

UNHCR 1199 called for a cease-fire and, *inter alia*, the cessation of the repression of

civilians and the establishment of a war crime tribunal.[11]

The situation had deteriorated sufficiently that by the following month NATO

threatened air strikes against the Federal Republic of Yugoslavia (FRY), and only last

minute personal diplomacy appeared to prevent the actual launch of weapons. Through

discussions between Serbian government officials and representatives of NATO and the

Organization for Security and Cooperation in Europe (OSCE) an agreement was reached

that provided for a partial withdrawal of Serbian forces from Kosovo, limits on future

deployments, and establishment of a 2000 member, unarmed Kosovo Verification

Mission (KVM)[12]

Although it is perilous to assign a specific event as the trigger for a conflict, the

killing of 40 plus Kosovars near the village of Racak by Serb security forces on 15

January 1999 is regarded a seminal event in the path toward military action. A direct

result was the North Atlantic Council authorizing the Secretary General to conduct air

attacks against Serbia if the Serbs continued to refuse to conduct negotiations with

representatives of the Kosovar population. As the crisis was steadily worsening, an

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10. The Contact Group was established in 1992; members were France, Germany, Italy, Russia, the U.K., and U.S., with representatives from the European Union (EU) and European Commission (EC). Russia elected not to participate in this round of sanctions.

11. Invoking Chapter VII of the UN Charter the resolution restated the proscription of external support for the belligerents and addressed the estimated 230,000 persons who had been displaced from their homes.

12. UNSCR 1203 supported this action as well as NATO's intention to establish an extraction force in Macedonia to be used if KVM personnel were threatened, and an air verification mission over Kosovo to complement the OSCE mission on the ground. United Nations Security Council, "UNSCR 1203," http://www.nato.int/kosovo/docu/u981024a.htm (accessed 21 January 2005). The KVM proved unsuccessful as members remained powerless to prevent Serb atrocities, and the KVM was eventually pulled out on 20 March 1999.

international peace mission was organized in the Paris suburb of Rambouillet. The talks

commenced on 7 February.

Milosevic's motivation and attitude toward the Rambouillet consultations are

subject to question. Some view his participation as a means of buying time to better

prepare for his planned intensification of ethnic cleansing efforts (Operation Horseshoe

(Potkova).[13] The initial negotiations were conducted from 6 until 23 February without

agreement, and reconvened in Paris on 15 March.[14] The Kosovar representatives agreed

to the proposal; Milosevic would not. The unacceptable portions for the Serbs were the

requirements for them to accept the deployment of a NATO-led military peacekeeping

force anywhere within the Federal Republic of Yugoslavia (FRY), and the provision that

a referendum, held within three years, would decide the province's future sovereignty.

Milosevic viewed these as incompatible with the sovereignty of Yugoslavia and

subsequently rejected both conditions.[15]

The refusal of Milosevic to sign the agreement became the proximate (sufficient)

conditions for war. Last-minute efforts to induce Milosevic to comply failed, and during

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13. Benjamin S. Lambeth, NATO's *Air War for Kosovo* (Santa Monica, CA: RAND, 2001), 9, uses the near simultaneous launching of the Serb offensive, using heavy artillery and armor, in the central region near Drenica as evidence.

14. Christopher Layne, "Miscalculations and Blunders Lead to War," in *NATO's Empty Victory*, ed. Ted Galen Carpenter (Washington, DC: The Cato Institute, 2000), 16, disagrees with the characterization of the meetings as "negotiations." In his view, "Belgrade was presented with an ultimatum and given the choice of signing or being bombed. See also Elizabeth Allen Dauphinee, "Rambouillet: A Critical (Re) Assessment," in *Understanding the War in Kosovo*, ed. Florian Bieber and Zidas Daskalovski (Portland, OR: Frank Cass Publishers, 2003). She contends that the agreement was "fundamentally flawed from its outset" (ibid., 117). Among its failings was its inability to reconcile the two contradictory principles of sovereignty and human rights

15. The preponderance of observations tends to agree with this analysis. Stephen T. Hosner, *Why Milosevic Decided to Settle When He Did* (Santa Monica, CA: RAND, 2001), 12-15, contends that Milosevic believed that accepting these terms would endanger his hold on power since they would be unacceptable to the majority of the Serbian populace. See Annex 3 of Independent International Commission on Kosovo, *Kosovo Report*, for a summary of the proposed agreement. Full text is also available at http://www.usip.org/library/pa/kosovo/kosovo_rambtoc.pdf (accessed 13 February 2005). Annex 1 provides documentation of human rights abuses that led to the conflict.

the evening of 24 March, NATO commenced Operation Allied Force with the launch of cruise missiles. Planners were told to expect a very brief air operation. This optimism was not to be realized. It was only after the death and destruction of a nearly three-month long air campaign that Milosevic agreed to NATO's demands.

The actions taken by NATO to achieve its objectives are the focus of this examination. Therefore, with at least a cursory description of the conditions and environment now having been presented, the next step is to consider the objectives of the protagonists.

NATO Political Objectives

The condition and direction of the NATO Alliance in 1999 is important to this discussion. The stated primary purpose of NATO is "to safeguard the freedom and security of all its members by political and military means in accordance with the principles of the United Nations Charter."[16] The realist rationale for establishment of the organization was to formalize the European-North American relationship and to establish a mechanism for defense as a counter to any military aggression expected to come from the Soviet Union. With the collapse of the Soviet Union and the resulting evaporation of the principal threat, the political and military leadership struggled with the question of the rationale for continuation of the arrangement.

As the Alliance was about to integrate three former Warsaw Pact nations as new members, the events of March-June 1999 presented a largely unanticipated exercise of

16. North Atlantic Treaty Organization, NATO Handbook (Brussels: NATO Office of Information and Press, 1998), 23.

the experience and military doctrine developed over the 50-year history of NATO.[17] The

stated objectives of NATO in the Kosovo crisis were only very loosely connected to the

raison d'être for existence of the alliance. These were:

A verifiable stop to all military action and the immediate ending of violence and

repression

The withdrawal from Kosovo of the military police and paramilitary forces

The stationing in Kosovo of an international military presence; the unconditional and safe

return of all refugees and displaced persons and unhindered access to them by

humanitarian aid organizations; and, the establishment of a political framework

agreement for Kosovo on the basis of the Rambouillet Accords, in conformity with

international law and the Charter of the United Nations[18] The connection to the

Rambouillet Accords suggests that this fifth objective would be unacceptable to the

Serbs.

In a post-conflict joint testimony, the senior American civilian and uniformed

military officials asserted that NATO had "strong interests at stake: (1) Serb aggression

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17. The Czech Republic, Hungary and Poland were fully incorporated into the Alliance on 12 March 1999, 12 days before the bombings commenced.

18. North Atlantic Treaty Organization, *NATO's Role in Relation to the Conflict in Kosovo.* Statement of the Extraordinary Meeting of the North Atlantic Council held at NATO HQ on 12 April 1999 and reaffirmed by Heads of State and Government in Washington on 23 April 1999. The US objectives were similar. President Clinton included: 1. Demonstrate the seriousness of NATO's opposition to aggressions and its support for peace; 2. Deter Milosevic from continuing and escalating his attacks on helpless civilians by imposing a price for those attacks; and, 3. If necessary, damage Serbia's capacity to wage war against Kosovo in the future by seriously diminishing its military capabilities. See Bill Clinton, "Statement of President Clinton on Kosovo 24 March 1999," White House, Office of Press Secretary, http://www.mthoyoke.edu/ acad/intrel/bombkos.htm (accessed 13 February 2005). A NATO press release contended, "The crisis in Kosovo represents a fundamental challenge to the values of democracy, human rights and the rule of law." North Atlantic Treaty Organization, "The Situation in and around Kosovo," Statement Issued at the Extraordinary Ministerial Meeting of the North Atlantic Council Held at NATO Headquarters," http://www.nato.int/docu/ pr/1999/p99-051e.htm (accessed 14 January 2005).. A senior U.S. officer essentially duplicated the NATO list, but added a "creation of a Kosovar autonomy within Yugoslavia." U.S. Congress, House of Representatives, Committee on Armed Services. *Performance of the B2 Bomber in the Kosovo Air Campaign, Hearing before the Military Procurement Subcommittee,* Statement of Lt. Gen. Marvin R. Esmond, 106 Cong., 1st sess., 30 June 1999, http://www.house.gov/hasc/testimony/ 106thcongress/99-10-19esmond.pdf (accessed 14 January 2005).

in Kosovo threatened peace throughout the Balkans; (2) Belgrade's repression of Kosovo created a humanitarian crisis; and, (3) Milosevic's conduct leading up to Operation Allied Force directly challenged the credibility of NATO."[19] Hence, in the NATO view, the conflict was far more than an internal Yugoslav matter; it had widespread implications for the future, which they could not simply ignore.

Serbian Political Objectives

It is difficult to separate the personal aspirations of Milosevic from the national objectives of Serbia. He was an authoritative ruler, but did not possess unconstrained dictatorial powers. Hence, his continuation in authority was a personal objective that was not necessarily a national aspiration. However, a trait common to most nation states is that they will resist actions by external powers to become involved in domestic affairs. The level of support for Milosevic notwithstanding, the perception that outside powers were attempting to wrest away a piece of sovereign Serb territory was reason enough to resist.[20] The preservation of Kosovo therefore was considered a legitimate national objective.

Barry Posen argues, "Serbia had a hierarchy of objectives."[21] Chief among these was to preserve freedom of action to conduct unrestricted operations against the KLA, in Kosovo. Other Serbian objectives included the maintenance of Russian political support;

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19. U.S. Congress, Senate. Committee on Armed Services, *Joint Statement on the Kosovo After-Action Review, Hearing Before the Committee on Armed Services*. Testimony of William S. Cohen and General Henry H. Shelton, 106th Cong., 1st sess., 14 October 1999, http://www.dod.mil/releases/1999/b10141999_bt478-99.html (accessed 6 January 2005).

20. Barry Posen, "The War for Kosovo," *International Security* 24, no. 4 (Spring 2000): 43, observed, "For every Serb who was willing to fight for Kosovo for religious or historic reasons associated with the province, there were probably several others willing to go to war on the principle that nobody takes their land without a fight.

21. Ibid., 45.

and gaining time for further eviction of Albanians from Kosovo. The personal objective of Milosevic was to maintain and enhance his own political and economic power base. Therefore, not all the objectives of NATO and Milosevic were irreconcilable. The ending of the repression and violence against the Kosovars was incompatible with the Serb objective of freedom of action within their own sovereign territory. An independent Kosovo was never a stated NATO objective. However, the Serbs considered as unacceptable the stationing in Kosovo of an international military presence. At the onset of the conflict, the removal of Milosevic was not a stated objective; however, his subsequent indictment for war crimes made this an implied goal. Although, Milosevic rejected the Rambouillet framework, most provisions were probably negotiable. However, the stipulation for the presence of foreign forces in Kosovo was considered incompatible with Serbian sovereignty. A change in behavior, not regime change and establishment of an independent state for the Kosovars, was NATO's overall goal.

Despite the potential for a negotiated settlement, when the preferred diplomatic efforts failed, military options became the primary vehicle to induce this desired change in behavior. The manner in which military and other actions were applied during the conflict is the central element in this chapter and will be addressed. However, since the illustration of the principles of a system of systems analysis in the selection of actions is the premise of this study, I will provide a brief depiction of such an examination.

A Representational System of Systems Analysis

I contend that in some instances during the Kosovo operation NATO utilized the principles of a system of systems analysis in their selection of actions. In order to support

this supposition, and to illustrate further the methodology, I will present the framework

for a system of systems analysis in Yugoslavia in 1999. The steps presented in Chapter V

are: (1) Identify the essential elements within each system; (2) determine the essential

sub-elements; (3) designate nodes; (4) examine nodes for node-to-node linkages; and, (5)

assign linkages between nodes. As with the previous chapter, a complete analysis is

beyond the scope of this effort, and I provide only illustrative examples.

Essential Elements of the Systems

Political. While there is no intent here to provide more than a cursory

examination of the political structure that existed at the time of the intervention, a brief

overview is justified in that it provides some exposure to the complexities of that system.

The Federal Republic of Yugoslavia (FRY) was formed as self-proclaimed successor to

the Socialist Federal Republic of Yugoslavia on 11 April 1992. From a structural

perspective the FRY consists of two republics, Serbia (including its two provinces

Vojvodina and Kosovo) and Montenegro. In 1999, it consisted of three branches:

Executive—President (chief of state), Prime Minister (head of government), Council of

Ministers (cabinet); *Legislative*—Serbia and Montenegro Union Parliament; and

Judicial—Federal Court and Constitutional Court. Multiple political parties existed,

many drawn along regional and ethnic lines, e.g., Alliance of Vojvodina Hungarians

(SVM) and Socialist People's Party of Montenegro. The predominant organizations were

the Serbian Radical Party (SNP), Socialist Party of Serbia (SPS—former Communist

Party), and the Yugoslav United Left (JUL).[22] However, structure provides only a part of

the analysis, and as stated earlier, function is the critical area for consideration.

Although the constitution provides that Yugoslavia is "based on the rule of law

and recognizes and guarantees human rights and liberties," in reality it was an

authoritarian regime with its core within the executive branch. By 1999, Yugoslavia was

beset with poverty, ethnic violence, and an authoritarian political system, due in most part

to a decade of warfare. Additionally, the legacy from the Tito years of a strong central

government and power concentrated in one individual gave to the president a degree of

power far in excess of the constitutional provisions. Therefore, the sub-element selected

for examination is the executive branch; an obvious choice for designation as a node is

the President, and member of the SPS, Slobodan Milosevic.[23]

The strength of the system was the connection between the regime and intense

Serbian nationality. Milosevic had skillfully exploited the deeply rooted but suppressed

sense of Serbian identity and nationalism. However, this was insufficient to preserve his

hold on power; accordingly, he needed additional support mechanisms. This included

establishment of ties with commercial and political entities throughout Yugoslavia. The

critical vulnerability of the system was the need for the ruling party to form coalitions to

maintain power, complicated by the existence of quasi-independent provinces. Therefore,

the political and economic patronage of the senior government leadership becomes an

area upon which to focus the analysis.

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22. *Europa World Yearbook 1999* (London: Europa Publications, Inc., 1999), 3962-65.

23. Information consolidated from multiple sources including ibid., 3956-70. Materials for an analysis of the political system are immense. Available analyst resources and time limit the depth of the research, not the amount of information. While open sources can provide the foundation for the analysis, determination of node-to-node linkages will require multiple additional sources, including classified information. Importantly, while determination of structure may be readily attainable, function of the system is more difficult and complex and requires a must more intense level of analysis.

Economic. Many considered Yugoslavia the most reformed socialist economy, although Serbia and Montenegro had a gross domestic product (GDP) below the Yugoslav national average in the late 1980's.[24] However, due to a near continuous series of armed conflicts, by 1998 the economy was a shambles, with essentially no foreign trade and continued hyperinflation of the dinar. Unemployment was approximately 30 per cent, and the overall economy was operating at around half of the 1989 level. GDP was approximately $24 billion in purchasing parity with a per capita income of around $2,300.[25] In early 1999 only around 37 per cent of the Yugoslav economy was produced in the private sector, and only 31 per cent of the population employed in the private cooperative and mixed sector.[26] The economy rated among the ten most corrupt in the world, and estimates of the black or gray economy ranged from 30-50 per cent of GDP. The post-Tito privatization effort resulted in concentration of these financial interests in the hands of economic and political elites.

Industry, mainly petrochemical, metallurgy, automobile manufacture, and electronics, comprised the largest part of the economy. Ferrous and nonferrous mining was a significant portion of the sector, while agriculture was primarily for internal consumption. Major exports were machinery and transportation equipment, as well as some raw materials. Imports included finished materials and products and some

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24. Serbia itself was one of the more highly developed economies within the FRY. For perspective, the FRY was on the level of Turkey in purchasing power parity.

25. Anthony H. Cordesman, *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo* (Westport, CT: Praeger, 2001), 169. Due to the current fluctuations and the gray and black economies, a wide range of economic figures for this period has been published.

26. Milica Uvalic, "Kosovo's Economy," *Southeast Europe and Black Sea Studies* 1, no. 1 (Summer 2000), 12. He notes that "Some 75 state owned enterprises, which are among the largest and most profitable firms and represent 35 per cent of the economy" were excluded from privatization or to be privatized within a special government program.

agricultural commodities, although Yugoslavia was a net importer of food.[27] Hence, the essential sub-elements would be heavy industry, metallurgy, mining, and agriculture. For illustration, I will utilize the heavy manufacturing sector.

A strength of the economic system related to its ability to withstand attacks was its dispersed infrastructure and its relative self sufficiency in meeting basic needs. Additionally, its limited production capability had ties to other fragile economies in the region that would be affected by any strikes against facilities in Yugoslavia.[28] A key vulnerability of any industrial production is the availability of fuel, raw materials, and electrical power. Consequently, petroleum product refining and distribution are critical sub-elements of the economic system, and these will be further developed. Automobile production was a large part of this sector. In the search for nodes, the Zastava automobile plant at Kragujevac would likely appear. The plant, with an estimated 24,000 employees, produced over 14,000 cars per year.[29] The concentration of wealth in the hands of an oligarchy also presents vulnerability appropriate for exploitation.

Military. The military forces consisted of the Yugoslav Army (VJ) and the paramilitary Interior Police (MUP). The MUP were lightly armed, and under the command of the Ministry of the Interior. Regular army personnel numbered over 110,000, with 1,200 tanks and armored fighting vehicles, and over 1,400 artillery pieces.

27. *Europa World Yearbook 1999*, 3958-61. Reliable foreign trade data is likewise elusive, but imports were believed to significantly exceed exports. Regardless of the lack of precise data, most analyses indicate a very fragile economy that is susceptible to external influence.

28. The steel industries of Romania, Slovakia and the Czech Republic all had connections to that of Serbia. Christian Kohl, "Cost of War: $350m to Steelmakers," *American Metal Market*, 20 May 1999, 2. Steel production in the FRY was in decline prior to the NATO operation.

29. An additional 40,000 subcontractors were put out of work. See also, Deyan Anastasijeic, "Nation Builders: Western Leaders Want to Help Balkans Move from Self-Destruction to Reconstruction," *Time International* August 1999, 30-33.

Anti-air systems were the primary threat to the NATO air campaign and consisted mainly of SA-2 (S-75 Dvina or Guideline), 24 fire units, SA-3 (Perchora-M or Goa, 24 fire units), and SA-6 (2K12 Kvadrat or Gainful, 16 fire units) surface to air missiles. SA-9 and SA13 tactical systems, man portable systems, and air defense guns augmented the strategic systems.[30] A redundant command and control system that included landlines supported these. Serb air forces consisted of an estimated 240 combat aircraft, including MIG-21 and MIG-29 interceptors. The Serb air defense system was most effective against targets at low altitudes, i.e., less than 15,000 feet.[31]

The major ground elements in and near Kosovo were the VJ Third Army, supported by the First and Second Army units. These were primary highly mobile forces that operated in small combined arms battle groups. The forces were coordinated through a command and control system with multiple redundancies.[32] Led by a cadre of professional officers, and originally designed for a mission of making a Soviet invasion as painful as possible, Serb forces were capable of enduring attacks from a superior force without breaking. Their military infrastructure was hardened, camouflaged and dispersed.[33]

The key vulnerability of the Serb military was the clear mismatch when compared to the overwhelming force that the NATO Alliance could employ. The forces on the ground in Kosovo and their ability to maneuver and conduct their operations against the

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30. Cordesman, *Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, 197-98.
31. Bruce R Nardulli et al., *Disjointed War: Military Operations in Kosovo, 1999* (Santa Monica, CA: RAND Arroyo Center, 2002), 28.
32. At the beginning of 1999 the commander of the 3rd Army was Colonel General Samardzic and the Commander of the Pristina Corps was General Nebojsa Pavkovic. Personal loyalty to Milosevic was a factor in promotions and obtaining senior military positions. For a more extensive listing see, "Operations in Kosovo: Yugoslav Order of Battle," *Janes Defence Weekly,* 1 April 1999, 5. For a more comprehensive assessment of FRY military forces see, Cordesman, *Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, 191-241.
33. Lambeth, *NATO's Air War for Kosovo*, 17-21.

Kosovars were an essential sub-element. Additionally, the ability of the Serb air defense system to protect those ground forces and the command and control and logistics support were essential sub-elements of the military system. Therefore, specific nodes were air defense command and control facilities, air defense radars, airfields and fuel and massed ammunition supplies.

Social. The population of Yugoslavia in 1999 was just over 10 million, with all but 600,000 living within Serbia or its provinces (including Kosovo). Serbs comprised 62 per cent of the population with Albanians being the largest minority group (16.5 per cent). The culture of Serbia is inexorably intertwined with the complex and often tragic history of the region.[34] A displayed willingness to stand up to both the West and the Soviet Union, and to steer its own course during the cold war was emblematic of this independent spirit. Serb nationalism was a primary factor and strength of the social system.[35] Therefore, the loyalties and connections of the general Serb populace to the central government and the political leadership was an essential element of the social system. Additionally, as illustrated earlier, Serbs regarded Kosovo with an almost mystical importance.

Religion also is a factor in Serb society. Most of the ethnic Serbs were at least nominally Christian, with the Eastern Orthodox Church containing the primary denominations. The Serbian Orthodox Church has always been a major component of

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34. *Europa World Yearbook 1999*, 3967-71. The amount of published material on the culture and social systems of the FRY is immense. Among the most relevant studies is Woodward, *Balkan Tragedy*. She notes the differences between the "rural culture, based on obligations to kin, intergenerational transfer of knowledge, and the social influence of the clergy," and the culture of the cities. She contends that socialism reinforced this cultural divide (ibid., 238).

35. "Serbian roots are in Kosovo, and everything that is connected to the Serbs throughout the past centuries is there. Every Serb is intimately connected to it." Public Broadcasting Service, "Interview with Commander of the Yugoslav 3rd Army, Gen. Nebojsa Pavkovic," http://www.pbs.org/wgbh/pages/frontline/shows/kosovo/interviews/pavkovic.html (accessed 6 January 2005).

Serb society, both in a cultural and religious sense. The Church had survived Ottoman regimes and the atheistic communism of the Tito era. The Church top-level leadership maintained the position that Kosovo must be an integral part of Serbia. Milosevic was eager to associate with the Church hierarchy, however due in part to his communist legacy, the level of support for him personally varied.

Information, its means and manner of distribution, and the sources from which the general population could obtain it, were critical to nurturing and reinforcement of this nationalist culture. The media was largely and increasingly government controlled. The Belgrade published newspaper *Politika,* represented a primary print source, and Radiotelevizija Srbije (RTS) the primary broadcast media. Both would be considered to be nodes. The vulnerability was the central government's ability to broadcast its own message, while concurrently denying the populace access to alternative versions of conditions and events from abroad.

I have presented in a few pages a very cursory analysis of the political, economic, military and social (PEMS) systems, some of their essential elements and sub-elements, and a sampling of nodes. A fully developed systems of systems analysis would use this type of approach, but would require a far greater depth of analysis and would produce a larger set of nodes. Additionally, a much more highly developed and detailed knowledge on these nodes would be required. For illustration, Table 7 presents a further depiction of potential nodes in the 1999 FRY. Some of these nodes will be used in subsequent examples.

While the level of analysis provided thus far can be of some value to the decision maker, it falls short in providing the advantages that a completed system of systems

analysis could offer. More specifically, an understanding of the connections between

nodes within and across the PEMS systems could contribute to (1) amplification of the

effects of actions; (2) indication of possible undesired effects; and, (3) recognition of

alternative actions. The objectives requires examining potential linkages between nodes.

Table 7. Sampling of Nodes by PEMS Area

PEMS System	Elements	Sub-Elements	Nodes
Political	Executive	Senior leadership	Slobodan Milosevic
	Political Parties	Socialist Party of Serbia	Belgrade Headquarters
		Yugoslav United Left (JUL)	Mila Markovic
	Ministries	Ministry of Interior	MUP Headquarters at Kula Milicija
Economic	Manufacturing	Automobiles	Zastava Plant Complex
		Steel	Steel Works Sartid
		Construction equipment	14 Octobar factory at Krusavec
	Communications	Serbia Telecom	Relay site near Srbobran
	Banking		National Bank of Yugoslavia
	Petroleum Refining		Petrochemicals at Pancevo
	Utilities	Electric Power	Belgrade Transformer Yard
	Transportation infrastructure	Bridges	Danube Bridge near Novi Sad
		Ports	Fuel terminals at Bar
Military	Air Defense	Anti-air missile force	SA-3 Battalion near Batajinica
	Command and Control		Belgrade Air Defense Center
	Aviation	Interceptor force	Obvra Military airfield
	Logistics/Re-supply	Diesel Fuel	Storage site at Srbobran
Social	Media	Television	RTS Studios Belgrade FM-TV RADREL Mt. Avala
		Print	Politika
	Religion		Bishop Artemije

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Node Linkages – The System of Systems

Many of the linkages within military systems are readily apparent, and planners routinely have utilized this type of analysis. For example, ground forces must be supplied and sustained. Therefore, provision and replacement of equipment, weapons, fuel, food, water, and personnel are critical to military operations. Recognizing this, an adversary will use the connections between manufacturing, storage, and transportation facilities in their overall planning. Hence, the means of supply, including the lines of communication into an area, will be attacked.

Bridges, railroad lines, road intersections, storage sites and the enablers of transport, e.g., diesel fuel, are often targeted as well as the forces in the field themselves. Similarly, the effectiveness of an interceptor aircraft is severely degraded if the target detection and command and control facilities are not functioning. For example, the effectiveness of the SA-3 battalion near Batajinica would be affected by actions taken against its related command and control facilities. The premise is that if the desired effect is degrading the capability of the surface to air missiles, then this may be achieved through indirect attack on the related elements of the command and control system. The multiplier effect is that removal of the command and control may also influence other air defense facilities. Hence, targets such the integrated air defense system (IADS) related radar site at Urosevac were attacked with the intent of amplifying the effect of the weapons deployed beyond the target itself.

Similarly, in economic systems, the sources of power and fuel for a facility may be determined and the connections between nodes established. For example, assume that the Zastava auto plant is dependent upon the Sartid steel works for materials. Both of

these are affected by any changes to the facilities that produce power e.g., the Kolubara

Power Plant, to the steel complex. Hence, any disruption of electrical power production

will be likely to produce cascading effects. Any dependence on supply presents

vulnerabilities and opportunities for indirect actions to achieve influences on another

node. Not all the nodes will be within the geographic boundaries of the nation being

assessed. In a global economy, some of these connections will extend beyond national

borders.

The connection is not always apparent when multiple systems are involved. In the

Yugoslav political system the connections between the leadership of the

Socialist Party of Serbia (SPS) and Yugoslav United Left (JUL) are not difficult to

ascertain, since in this instance they were Slobodan Milosevic and Mila Markovic—

husband and wife. Political connections to financial interests are often intentionally

concealed and are normally difficult to establish. Political support is often a perishable

commodity, and connections between political and social nodes are often transient and

dependent upon events. Perception becomes reality, and nodes that promulgate

information are critical to influencing opinion and political support.

A depiction of a complete set of nodes and their connections in the 1999

Yugoslavia is well beyond the scope of this effort. It also is unnecessary in order to

adequately present selected examples to demonstrate the proposed methodology. The

supposition that needs support is that the principles of a system of systems analysis were

utilized in the NATO operations against Yugoslavia, albeit not overtly. Therefore, an

efficient and appropriate means of completing this objective is to select specific instances

where NATO planners utilized the existence of nodal connections. This first requires a

revisit of the political objectives and how the military objectives were developed to support these goals.

<u>Military Objectives</u>

Not surprisingly, the U.S. and NATO objectives for the use of force were closely aligned. These were stated succinctly as the *Three D's*:

1. *Demonstrate* the seriousness of NATO's opposition to Belgrade's aggression in the Balkans

2. *Deter* Milosevic from continuing and escalating his attacks on helpless civilians and create conditions to reverse his ethnic cleansing, and

3. *Damage* Serbia's capacity to wage war against Kosovo in the future or spread war to neighbors by diminishing or degrading its ability to wage military operations.[36]

The actions required to achieve the second and third objectives likely would result in attainment of the first. Therefore, the measures conducted by NATO in pursuit of those last two goals will be the focus of further analysis. The military objectives of Milosevic were relatively simple, i.e., to withstand the limited bombing offensive and to wait for the NATO nations to become frustrated and abandon the military strategy. This would result in presentation of more favorable terms during future negotiations.[37]

Determination of primacy among NATO's objectives was, and continues to be, a topic of discussion and debate. The NATO Supreme Allied Commander Europe

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36. U.S. Congress, Senate. Committee on Armed Services. "Joint Statement on the Kosovo After-Action Review. The attacks would be conducted in five phases: Phase 0 – deployment of assets into theater; Phase 1 – establish air superiority over Kosovo and degrade command and control over the whole of the FRY; Phase 2 would attack military targets in Kosovo and those FRY forces south of 44 deg; Phase 3 would expand air operations against a wider range of targets; and Phase 4 would redeploy as required. U.S. Department of Defense, "Kosovo/Operation Allied Force After-Action Report," 8, refers to a Limited Air Response option that was later incorporated into Phase 1 of the air campaign.

37. Hosner, *Why Milosevic Decided to Settle When He Did*, 19-34. The author contends that Milosevic may have expected a much more limited campaign and that he believed that the NATO nations would not be able to maintain cohesion through a more expanded conflict.

(SACEUR), U.S. Army General Wesley Clark, believed that the Serb forces operating in

Kosovo were the center of gravity and should be the primary target of the campaign

(Objective 2 preeminent). The operational air commander of NATO air forces in the

region, U.S. Air Force Lieutenant General Michael Short, did not share this view. He

believed that attacking critical infrastructure within Serbia itself was the preferred

strategy (Objective 3 most important). Although actions taken at times served both

objectives, they more frequently did not. The air campaign was based on the phases

depicted in Figure 19.
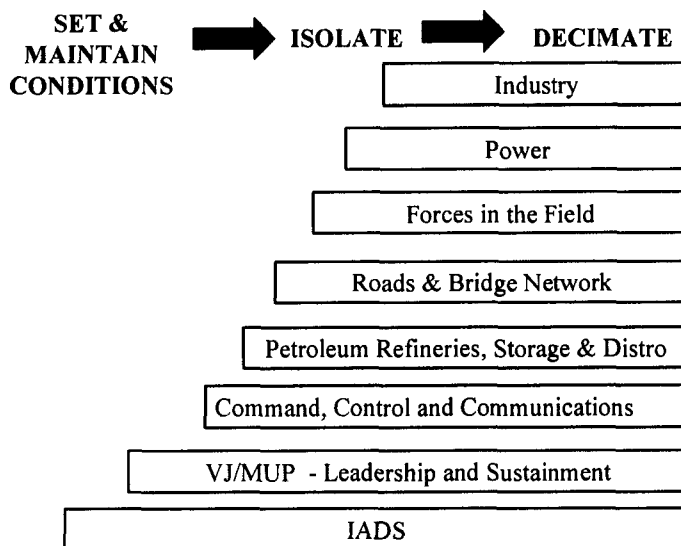
Figure 19. Allied Force Campaign Plan[38]

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38. Depiction adapted from U. S. Department of Defense, "29 April 1999 US DOD Press Briefing," http://www.defenselink.mil/news/Apr1999/990429-J-0000K-001.jpg (accessed 22 February 2005). Industry and power were not included in the DOD slide. Those blocks were labeled "Classified." Cordesman, *Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, 23, inserts these under *Decimate* in his adaptation of the slide. Although depicted as a timeline from left to right, there is no clear delineation between phases, e.g., some power facilities were attacked during the initial days of the campaign if they were determined to be linked to military nodes.

The Set and Maintain Conditions phase focuses on the Integrated Air Defense

System (IADS) and the ability to command and control the VJ (military) and MUP

(paramilitary) forces in the field. The isolation of those forces required additional strikes

against command and control facilities, but also required attacks on vital infrastructure.

Since many of these entities in the Decimate Phase were dual-use, i.e., utilized by both

the military and civilian sectors, the effect of attacks on these nodes influenced multiple

PEMS areas.

When the air operations commenced on 24 March, engagement of fixed targets

was limited to IAD sites and military command and control (C2) facilities. Despite the

focus on VJ/MUP related targets, the first week of the campaign witnessed strikes against

some power transmission facilities, and other not primarily military targets such as the

civilian airfield at Batajnica.[39] Attacks were concentrated on targets that could be

described as nodes within the military system, with choke points and strategic

marshalling areas getting special emphasis. These targets were engaged with great

precision and the weapons performed largely as intended. However, the successes in this

endeavor did not appear to attain the stated objective.

Despite the admitted failure to achieve the prime objective, subsequent actions

continued to focus primarily on influencing the Serb forces in the field, although this

objective included attacks on dual use infrastructure such as bridges and petroleum

refining facilities. Coincident with the NATO Summit in Washington on 23 April, the

target list was enlarged to include strategic targets, including industrial, media, and

infrastructure sites. The shift was to concentrate on what had become characterized as

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39. The first day targets were classified as 42% forces on the ground; 21% air defense; and, 15% command and control. U.S. Department of Defense, "DOD News Briefing 21 May 1999," http://www.defeselink.mil/news/May1999/990521-J0000k-002.jpg (accessed 22 February 2005).

"the four pillars of Milosevic's power—the political machine, the media, the security forces, and the economic system.[40] Since strikes on the dispersed VJ forces were not successful, subsequent attacks now, "concentrated instead on second-order effects by going after bases, supplies, petroleum, oil, and lubricants (POL)."[41] With this redirection of strategy, the utilization of the principles of a system of systems approach was more evident. To further support this premise, and continuing with the PEMS construct, examples will be provided from each of the non-military systems.

Political. Since the paramount political node was Milosevic himself, and his ability to maintain his position as President, NATO's concentration was on him and the nodes related to his power base. However, a direct approach was not possible. NATO consistently and unequivocally asserted that the elimination of Milosevic was not a objective: "We are not targeting Milosevic," a spokesman claimed, although he admitted that they were "certainly targeting what makes him what he is."[42] Therefore, operations were directed at the nodes linked to him. These would be both internal and external to Yugoslavia.

A RAND study contends that Milosevic thought that he could exploit Russia's support for Yugoslavia.[43] This was based on the unwavering backing that Yugoslav delegation had receive from the Russians at Rambouillet and the historical and cultural connections between the two Slav nations. The subsequent actions of NATO support this

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40. Lambeth, *NATO's Air War for Kosovo*, 39. These equate to the PEMS systems proposed here.
41. Ibid., 29.
42. A NATO spokesperson added: "We will go after the brain as much as we go after the fingertips." Jamie Shea, "Press Conference NATO HQ, Brussels, 20 April 1999," http://www.nato.int/kosovo/press/p990420.htm (accessed 22 February 2005).
43. Hosner, *Why Milosevic Decided to Settle When He Did*, 33. This assumption was not without justification. Shortly after the bombing commenced the Russian Duma by a vote of 279 to 30, demanded that the Russian government send aid and advisors to the FRY. Posen, "The War for Kosovo,"51, adds that Russia also was motivated by resentment over what was perceived as NATO's long-term efforts to dominate Europe.

contention since a significant effort was made to break or weaken this relationship. The node utilized was the Russian government and its Special Envoy Victor Chernomyrdin who eventually convinced Milosevic that Russia would not come to its aid.[44] The official U.S. report on the conflict contends "the alliance's continuous efforts to engage Russia in diplomacy proved critical to achieving the settlement."[45]

The political isolation of Milosevic was made a priority. On 27 May, The International Criminal Tribunal for the Former Yugoslavia formally charged Milosevic with "Crimes Against Humanity and Violations of the Laws or Customs of War."[46] This significantly assisted in attainment of this NATO objective. The sub-element most influenced by this action was the general populace of Yugoslavia upon whose support the Milosevic regime depended. Additionally, the chance of Milosevic obtaining any external support, even from nations who condemned the NATO actions, was all but eliminated by the indictment. Thus, the political system was influenced primarily through external means, with the discrediting of Milosevic and the deterioration of his political support.

Economic. Attacks against military targets also resulted in effects on the economic system, since many facilities were overtly or covertly dual-use. As a result, destruction or degradation of these facilities produced effects on the economic and social

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44. Despite anti-western sentiments over the bombings, the Russian government became the primary intermediary between NATO and Milosevic. See Carpenter, in *NATO's Empty Victory*, 77-91, for expansion on this peculiar relationship. The author contends that the Kosovo campaign resulted in a marked deterioration in relations between Russia and the West.

45. U.S Department of Defense, "Kosovo/Operation Allied Force After-Action Report, "11. Tim Judah, *Kosovo: War and Revenge* (New Haven, CT: Yale University Press, 2000), 274, provides additional insights and addresses the personal element observing that Chernomyrdin "did not like Milosevic."

46. International Criminal Tribunal for the Former Yugoslavia, "Indictment," 4. Four others were included in the indictment Milosevic was identified as the dominant Serbian political figure exercising *de facto* control of the federal government." Although NATO exercised no direct control over the activities of the tribunal, the timing of the indictment clearly supported NATO objectives. The next day a NATO spokesman declared: "This morning the people of Yugoslavia have woke up to be the first people in history to live under the rule of an indicted war criminal." Jamie Shea, "Press Conference NATO HQ, Brussels, 28 May 1999," http://www.nato.int/kosovo/press/p990528a.htm (accessed 22 February 2005).

systems as well as on the military. Examples from the Kosovo campaign include the Zastava factory in Kragujevac that reportedly produced munitions as well as cars and trucks, the Sloboda industrial unit in Cacak that produced ammunition in addition to its output of vacuum cleaners, and the 14 Oktobar plant at Krusevac that reconditioned tank engines while also producing heavy construction equipment.[47]

Electric power is a commodity with both civilian and military utility. Attacks on fixed power generation infrastructure have a greater impact on the former, since many military facilities have backup systems. By late April, the NATO target list had expanded to include electric power transformers supplying command and control centers near Belgrade. Although making no attempt to conceal the strikes on those targets, the official NATO position was that their intention was to go after the transformers and "edges of the power system," in a manner that would limit irreparable harm to the power infrastructure. This desire to minimize unnecessary permanent damage also influenced the selection of specific weapons. After extensive debate, on 3 May, United States Air Force (USAF) F-117A's deployed BLU114/B's, a formerly highly classified weapon that uses graphite filaments to disrupt electrical power lines, substations, and power generation plants.[48] Attacks on these facilities produced multiple effects, not all limited to the military system. One analyst argues, "it seems logical that NATO attacks on power facilities must have a political and economic impact, and an impact on public opinion."[49]

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47. Steven Erlanger, "Bombing Unites Serb Army as It Debilitates Economy," *The New York Times*, 30 April 1999. An estimated 100,000 people were estimated to be unemployed as a result of the NATO bombing, 15,000 at the Zastava plant alone.

48. Bryan Bender, "US 'Soft Bombs' Prove NATO Point," *Janes Defence Weekly*, 10 May 1999, 13. Other sources refer to this weapon as the CBU-94. See also Nardulli et al., *Disjointed War: Military Operations in Kosovo, 1999*, 38. Most resistance came from the French who were concerned about possible civilian casualties. The RAND analysis concluded that the effect on the civilian population was greater than the impact on the military that had backup generators for their systems.

49. Cordesman, *Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, 181.

Specific connections between the political and economic nodes were at times difficult to ascertain. However, as a NATO spokesman related, "Yugoslavia is a state based on nepotism, as a result it is 'almost impossible' to strike an industrial target without having an effect on Milosevic's cronies or family members."[50] While during the conflict there normally was no acknowledgement of direct targeting of commercial activities connected to the friends and family of Milosevic, some knowledgeable analysts and observers contend that this was a key factor in the ultimate decision for his capitulation.[51] The supposition is that if NATO threatened the basis of their wealth and power, supporters could be turned against the regime. A later study for the U.S. Congress concluded, "Though NATO spokesmen emphasized that all targets had military significance, the air strikes were increasingly targeted against economic and political infrastructure."[52]

Among several economic-political connections postulated are Dragan Tomic, Director of Yugo Petrol; Milan Beko, director of the Zastava automobile plant and a former Minister of Privatization; and, Zivota Kosic, who headed Duvanska Industrija Nis. Additionally, a radio station had been linked to Milosevic's daughter, Marija, and a tobacco factory in Nis was connected to his son, Marko.[53] All these facilities were recipients of NATO ordnance.

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50. Shea, "Press Conference, 20 April 1999." The stated primary purpose of attacks on utilities and industrial facilities was to cause difficulties to the military complex in the FRY.

51. This determination of linkages was reportedly called "Marix" and developed by the CIA. General Clark reportedly denied any knowledge of the operation. Jim Mokhiber, "Why Did Milosevic Give Up?" Public Broadcasting Service, http://www.pbs.org/wgbh/pages/frontline/shows/kosovo/fighting/giveup.htm (accessed 18 February 2005).

52. Paul E. Gallis, "Kosovo: Lessons Learned from Operation Allied Force," (Washington, DC: Congressional Research Service, 19 November 1999). These were determined to be "targets of value to the regime" and intended "to force the political capitulation of Milosevic."

53. Eric Schmitt and Steven Lee Myers, "NATO Said to Focus Raids on Serb Elite's Property," New York Times, 19 April 1999. See also "NATO Strike Targets Milosevic Inner Circle," Financial Times, 21

Social. A key element in Serb culture is nationalism. Milosevic attempted to portray himself as the defender of Serb territory and honor and to translate this role into political power. The Yugoslav media was the major source of information for the Serb populace, and therefore became a likely source of nodes. Both broadcast and print media were essentially state controlled and consequently a source of propaganda for Milosevic. Hence, from the NATO perspective, they became justifiable targets. A notable and contentious episode in the conflict was the 20 April attack on the Socialist Party of Serbia (SPS) Belgrade headquarters, which also was the site of a radio transmitter for Radiotelevizija Srbije (RTS). A senior NATO official, in justifying the attack, argued that the party headquarters was "an integral part of the strategic communications network" that was vital to the control apparatus of the Milosevic regime.[54]

Public opinion in Yugoslavia was considered important enough that President Clinton presented a video address to the Serbian people emphasizing "that the United States and our European allies have no quarrel with the Serbian people," and called upon Serbs to "join with us in seeking an end to the needless and avoidable conflict."[55] In the desire to influence the social system of Yugoslavia, nodes that could influence public opinion became the primary focus of alliance efforts.

April 1999. Pending any future release of currently classified information, the accuracy of these reports cannot be confirmed. However, within the NATO Alliance development of intelligence on financial connections is a sensitive issue.

54. Brig. Gen. Giuseppe Marani, "Press Conference NATO HQ, Brussels, 21 April 2001," http://www.nato.int/ kosovo/press/p990421a (accessed 18 February 2005).A later NATO spokesman declared that Milosevic used television and radio stations "to suppress the truth and are integral to his ability to conduct his brutal campaign." Brig. Gen. Walter Jertz, "Press Conference NATO HQ, Brussels, 23 May 1999," http://www.nato.int/ kosovo/press/p990523a.htm (accessed 18 February 2005).

55. Cable News Network, "Text of President Clinton Videotaped Address to the Serbian People," 26 March 1999, http://www.cnn.com/world/europe/9903/26/clinton.transcript/index.htm (accessed 13 February 2005). Determination of the effect of this broadcast, or even of the number of Serbs who may have viewed it, is problematic. However, the demonstrations in support of the regime immediately following the commencement of the bombing suggest that its impact was minimal.

It is apparent that NATO attempted to achieve its objectives through actions

against a set of nodes designed to influence the behavior of Slobodan Milosevic. These

ranged from high-level external entities to specific military command and control

facilities, industrial plants, and media broadcast sites. The intent was to make Milosevic

and the Serbian people change their behavior in Kosovo or to pay a strategically

significant price for not doing so. Unable to achieve its goals, NATO turned to a

campaign designed to damage Serbia's capacity to expel the Kosovars by degrading

Yugoslavia's ability to wage military operations. The NATO strategy is addressed next.

Effects of the Coercive Actions

Table 8 depicts the categories of targets struck by NATO' aircraft.[56]

Table 8. Categories of Targets Engaged

Category	Total	Destroyed	Damaged
Counter-regime	7	1	6
Electrical power	19	6	9
Petroleum, Oil, Lubricants (POL)	30	13	17
C4I	88	31	33
Bridges and Railroads	68	39	16
Military industry	17	4	10

56. William R Arkin, "Operation Allied Force: The Most Precise Application of Air Power in History," in *War over Kosovo: Politics and Strategy in a Global Age*, ed. Andrew J. Bacevich and Eliot A. Cohen (New York: Columbia University Press, 2001), 22. Attributed to the USAF Air War Over Serbia Study Group information that was made available to the author.

At a post-conflict congressional hearing a senior USAF officer testified that the goal of

Allied Force was to degrade and diminish the Serb-led military. To this end, NATO

aircraft reduced oil-refining capacity to zero; destroyed almost 40% of the FRY military's

fuel supplies and more than two-thirds of Yugoslavia's capability to manufacture

ammunition.[57] Industrial facilities were often dual-use and therefore deemed to be

legitimate targets. The official justification for destruction of the bridges was to cause

"Delays and disruptions in delivery of military equipment, fuel distribution, *and* civilian

staples."[58]

Although many assessments are available, Stephen Hosner effectively captures

the most often stated and best-supported conclusions. He contends that the bombing

campaign generated pressure on Milosevic to compromise; and that most of the impetus

resulted from damages to Serbia's dual-use infrastructure. He further argues, "Attacks on

purely military targets probably did not provide a major source of pressure."[59] Ivo

Daadler and Michael O' Hanlon expand on this conclusion but diverge on the

effectiveness of the actions, asserting, "the military objectives of the bombing campaign

were only indirectly related to the overriding political objectives of achieving a durable

peace."[60] Although the direct attacks on Serb forces did employ some of the elements of

the system of systems approach, e.g., attacks on air defense C2 facilities as a means of

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57. House Committee on Armed Services, U.S. Congress, House of Representatives, Committee on Armed Services. *Performance of the B2 Bomber in the Kosovo Air Campaign,*"32.

58. U.S. Department of Defense, "DOD News Briefing 30 April 1999," http://www.defenselink.mil/news/Apr1999/990430-J-000K-004.html (accessed 13 February 2005). Emphasis added. This represents one of the few acknowledgements of an attempt to interdict supplies to the civilian population. The stated effect of the attacks on these lines of communications included "Significant impact on sustainment and ground operations."

59. Hosner, *Why Milosevic Decided to Settle When He Did,* xvii. He estimates that Milosevic's primary concern was increased bombing. If the campaign lasted beyond the summer months, loss of electric power would have threatened heating of 75% of Serbian homes.

60. Ivo H. Daalder and Michael E. O'Hanlon, *Winning Ugly: NATO's War to Save Kosovo* (Washington, DC: The Brookings Institution, 2000), 210.

degrading the anti-air missile threat, the segment of the conflict analysis most relevant to this study are the effects across political, economic, military, and social (PEMS) boundaries. Once the effort shifted to indirect approaches to influence Milosevic, the use of this construct becomes more apparent. The availability of petroleum products provides one good example.

The limited refining capabilities of Yugoslavia were quickly destroyed, and storage and transport capabilities were gradually being degraded through methodical attacks. As Table 8 indicates, petroleum, oil, and lubricants (POL) targets were a major component of NATO strike plans. However, two factors worked against NATO's objectives. First, VJ and MUP forces in the field required very little gasoline and diesel fuel to operate. Their needs could be met with only a few truckloads per day. Secondly, the air strikes did little to reduce the import of petroleum products into Yugoslavia by land or by sea. The principal seaports of Yugoslavia were Bar and Kotor Bay in Montenegro. Through diplomatic activity imports from neighboring countries were reduced, but smuggling across borders continued. However, despite the effort to further reduce POL supplies, a full embargo and naval blockade were never implemented.

A political node connected to these economic seaport nodes was Montenegrin President Djukanovic. A former ally of Milosevic, he possessed an independent nature and successfully ran against his former mentor's candidate. Although he condemned the NATO bombing, he resisted Serbian pressure and criticized VJ/MUP activities in Kosovo. Recognizing this thorn in the side of Milosevic, NATO provided Montenegro with a temporary security guarantee.[61] Some analysts contend that if NATO had been

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61. Ibid., 128. This guarantee did not protect Montenegro from air strikes. The radar sites at Podgorica and the airfield at Golobovci were hit in the very early days of the conflict.

able to cut off foreign oil supplies as well as destroying the refineries and existing storage facilities, the mobility of FRY forces in Kosovo may have been affected.[62] Hence, a combination of diplomatic, economic, and military efforts was executed, although the effectiveness of the effort is arguable.

Another example related to the strategy of influencing Milosevic though an indirect approach was the action taken against industrial facilities associated with his family and political supporters. Additionally, the European Union took steps to freeze the assets of more than 300 Milosevic supporters who were believed to have funds secreted in European banks. This action followed on to a visa ban intended to keep Milosevic's cronies in Yugoslavia and allowing them to share the dangers and privations resulting from the bombing.[63]

Strikes against electrical power production and its associated nodes had consequences across PEMS areas. The already addressed economic impact was reinforced by the eventual effect on the Serb populace and their support for the regime. While initial air strikes were met with scorn and defiance, the attacks after late April steadily wore down civilian morale. The unemployment resulting from the damage to electrical power facilities exacerbated the already pitiful standard of living in Yugoslavia. While the graphite fiber weapons were intended to minimize permanent damage, the early May attacks knocked out power to an estimated 70 per cent of Yugoslavia.

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62. Ibid., 146. They note that SFOR troops were successful in restricting oil imports from Bosnia. Although lasting longer than both sides had foreseen, the duration of the 78-day conflict did not allow for POL shortages to have a full impact.

63. "War in the Balkans—Leader's Cronies Face Loss of 20m Pounds in Assets," *The Independent-London,* 31 May 1999, 6. Among those FRY government officials identified were Bogoljub Karic, a Minister without Portfolio, and Dusan Simic, the Mayor of Pristina.

By late May, the U.S. claimed that public dissent against Milosevic was growing within Serbia. "Wages are no longer being paid. Fear is mounting. People are beginning to turn against the regime and call it to account."[64] This sampling suggests that NATO was successful in using the knowledge of FRY systems, and the connections between elements within these, to amplify the effects of their actions. However, not all secondary effects were desired or anticipated.

<u>The Unintended Secondary Effects</u>

The examples cited earlier propose instances where the principles of a system of systems analysis allowed NATO planners to amplify the impact of their actions and to consider alternative actions and nodes. However, there were instances where unintended effects also resulted. Chief among these was the increase in VJ/MUP operations during the initial days of the Allied Force. During the initial stages of the bombing campaign the degree of ethnic cleansing activity in Kosovo accelerated. Some observers contend, "air power had little or no impact on the Serb's efforts to expel Kosovars from their homeland."[65] Another independent analysis posits that the NATO actions produced a "temporary and severe worsening of conditions," and that for Kosovars "atrocities were greatly intensified during the period of the NATO military campaign."[66] Herein is the

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64. Linda D Kozaryn, "NATO Air War Stirs Serb Dissent against Milosevic Regime" American Forces Press Service, 20 May 1999, http://www.defenselink.mil/news/May1999/n05201999_9905201.html (accessed 13 February 2005). These assertions by DOD spokespersons were based on "fairly large demonstrations" in three towns in central Serbia.

65. Scott A. Cooper, "Air Power and the Coercive Use of Force," in *Immaculate Warfare*, ed. Stephen D. Wrange (Westport, CT: Praeger, 2003), 6.

66. Independent International Commission on Kosovo, *Kosovo Report*, 163-64. However, the study asserts that the bombing did at least avert the worst fears of ethnic cleansing. Reports suggest that the CIA was aware of the potential for an increase in violence upon commencement of air operations and predicted this outcome might result. Lambeth, *NATO's Air War for Kosovo*, 24.

most evident and intensely debated unintended effect of the conflict. That is, did the actions intended to deter atrocities against the Kosovars actually promote them?

Debate continues with some analysts contending that the Serb operations were preplanned and would have been executed with or without the commencement of Allied Force. They argue that Milosevic expected a short conflict and postulate that Yugoslav strategy was to quickly complete the eviction of the Kosovars and present NATO with a *fait accompli* of a predominantly Serb province. The question of whether NATO should have anticipated such an outcome is valid. A vocal critic of the operation claims that the bombing campaign was "disastrously counterproductive" and that the Clinton administration "failed to foresee the consequence of the initiation of the air campaign."[67]

Collateral damage was an overriding concern of NATO planners, and extraordinary attempts were made to reduce its impact. The inadvertent casualties and destruction inflicted on civilians in the course of military operations was a sensitive issue in Europe, and particularly in Germany where the Green Party held a place in the coalition government. Milosevic was aware of this apprehension and took advantage of opportunities to exploit any civilian deaths or environmental damage. Maintaining alliance unity was an overarching strategic objective; hence, any actions that were perceived as producing an unacceptable degree of collateral damage put achievement of this objective at risk.[68] Despite great care and the unprecedented level of the use of precision weapons, civilian casualties did occur.

The Human Rights Watch estimates that "some 500 Yugoslav civilians are known to have died as a result of NATO actions," but its investigations "found no evidence of

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67. Christopher Layne, "Collateral Damage in Yugoslavia," 51.
68. U.S. Department of Defense, "Kosovo/Operation Allied Force After-Action Report," 7.

war crimes," i.e., the direct targeting of civilians.[69] The extraordinary efforts made by

NATO to minimize collateral damage resulting from their air strikes substantiates the

supposition that planners considered secondary effects when targets were nominated, and

that the political leadership took this into account in the approval process.

Initially, NATO strike operations produced the unintended effect of strengthening Serb

nationalism and internal support for Milosevic. Additionally, the attacks were condemned

by many nations outside the NATO sphere. Although regime change was not a stated

objective, this strengthening of resolve certainly did not contribute to the intent of

altering Serb behavior in Kosovo. However, as the intensity of attacks increased, this

level of internal support waned to a point where Milosevic may have feared that his

power base was endangered.[70]

A desired end state for NATO was peace and stability in the region. However, the

destruction of the Yugoslav economic infrastructure had deleterious impact on

neighboring nations, many of whose economies were weak and unstable. One observer

claims, "NATO's 11-week air war is estimated to have cost the struggling economies of

Yugoslavia's neighbors more than $4.2 billion.[71] This problem was exacerbated by the

massive influx of refugees, mainly in Albania and Macedonia, although NATO's hurried

but effectual establishment of refugee camps suggests that some planners anticipated this

secondary effect.

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69. Human Rights Watch, "Civilian Deaths in the NATO Air Campaign—Summary," http://www.hrw.org/ reports/2000/mnato/natbm200.htm (accessed 22 March 2005). The report is critical of NATO operations strikes against heating plants and bridges that were not on major transportation routes or had no apparent military functions.

70. Byman, Waxman, and Larson, *Air Power as a Coercive Instrument*, 19. They acknowledge that attempts to manipulate the opinion of an adversary population "remains largely beyond the capability of planners and leaders" (ibid., 22).

71. Gary Dempsey, "Headaches in Neighboring Countries," in *NATO's Empty Victory*, ed. Ted Galen Carpenter (Washington, DC: The Cato Institute, 2000), 51 and 59.

The attack on the party headquarters that was collocated with radio and television studios was a prime indicator of NATO's awareness of and concern over secondary effects. Despite their declaration of the building as a legitimate military target, concern over damage, loss of life, and the perception of an attack on the press caused extensive debate and discussion among NATO planners and the political leadership. Table 9 provides a sampling of some of the unintended effects resulting from NATO actions.

Table 9. Unintended Effects of NATO Actions

Node	Intended Effect	Secondary Effect	Comment
Zastava auto plant	Reduce military related production	Civilian population; up to 50,000 unemployed	Increased resolve and support for FRY regime
14 Octobar Factory	Preclude reconditioning of tank engines	Civilian population; up to 7,000 unemployed	Increased resolve and support for FRY regime
RTS Studio	Reduction in Milosevic propaganda	Weakened NATO Alliance; accusations of war crimes	Potential for loss of alliance cohesion and a cessation of operations
MJ/VUJ Forces	Reduction in ethnic cleansing operations	Increase in ethnic cleansing operations	Kosovars displaced after commencement of bombing causing a refugee crisis in neighboring nations.
Steel works	Reduction in war materials	Damage to regional economies	Weakening of NATO international support
Chemical Plant	Reduction in war materials	Environmental damage;	Weakening of NATO international support
MJ/MUJ Forces	Stop ethnic cleansing in Kosovo	Ethnic cleansing in Kosovo	Serb population departs Kosovo

Despite the use of some of the principles of a system of systems analysis some unintended effects still resulted. This is not surprising in that there is no pretense that the adoption of such a construct will eliminate the occurrences of this phenomenon. However, during Allied Force the determination of linkages between nodes within and across the PEMS systems did reveal insights that allowed planners to anticipate and to

mitigate some of the deleterious consequences of unintended secondary effects. In some cases alternative actions were utilized. In others, the unintended effect was anticipated but the decision calculus supported continuing with the strikes on the target and accepting the negative impact. In these situations attempts were made to minimize the expected consequences. The objective of the analysis is understanding and management of secondary effects, not their elimination. In NATO's Kosovo intervention, this benefit was evident, notwithstanding the unstructured and ad hoc manner in which the interrelationships were determined. Hence, the potential value of the adoption of a system of systems construct was revealed.

Summation

This chapter used the 1999 Kosovo conflict to display how elements of a systems approach were utilized to plan and direct the use of coercive force. Although not explicitly conducted using a system of systems approach, the selection of actions by NATO planners provides multiple examples of how a holistic perspective afforded decision-makers with a deeper understanding of how the behavior of an adversary may be influenced. This was accomplished by using the knowledge of connections between nodes to enable the attainment of effects that would be unachievable by direct means.

The lessons of the 1991 Gulf War were utilized in the planning and execution of the actions against military targets. Clearly the relationship between military nodes was understood and exploited. However, the major difference in the overall campaign was the expansion of the use of the principles of the construct to include the other aspects of power, i.e., political, economic, and social. This is a significant difference from earlier

conflicts, including Somalia, where knowledge was compartmentalized, systems were treated independently, and the effects across systems were not adequately addressed. Although not all objectives were attained, most notably NATO's inability to disrupt the VJ/MUP operations in Kosovo, the conflict was brought to a conclusion with most of the alliance's stated goals achieved. A post-conflict study contends that when the initial efforts against the Serb ground forces failed, NATO then "concentrated instead on *second-order effects* by going after bases, supplies, petroleum, oil and lubricants (POL).[72]

The U.S. Department of Defense Report on the operation concludes, "NATO nations employed other economic and political means—enforcing economic sanctions, tightening travel restrictions, freezing financial holdings—that raised the level of anxiety and discontent within Belgrade's power circles.[73] This shift in strategy would not have been possible without consideration of interrelationships between elements of the Yugoslav system of power.

While some of the successes can only be postulated, it is apparent that NATO used the basic principles of the system of systems construct in the conduct of their campaign against Milosevic. The system of systems methodology presents three advantages to the decision-maker. This analysis of Allied Force and related activities displayed instances of all of these.

(1) Amplification of the effects of actions. The decision to concentrate air strikes against command and control nodes, marshalling areas, and storage facilities indicates that the military planners used the concept of node-to-node linkages in their efforts. As

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72. Lambeth, *NATO's Air War for Kosovo*, 29. Emphasis added.
73. U.S Department of Defense, "Kosovo/Operation Allied Force After-Action Report," 11. The assertion was that diplomatic and economic leverage combined with military force were the important factors in bringing the crisis to a close (ibid., 12).

the target list expanded, attacks on industrial facilities had an impact on the economic, political, and social as well as the military system, and the effects on these systems also supported attainment of overall alliance objectives.

(2) Indication of possible undesired effects. Recognizing the consequence of widespread civilian casualties and wanton destruction of economic infrastructure, NATO planners took extraordinary care in the selection of targets and of weapons to minimize the undesired effects of their actions.

(3) Recognition of alternative actions. Precluded from going after "the head of the snake," i.e., Milosevic himself, attempts were made to influence his behavior through indirect means, notably actions that affected the financial interests of his friends and family. Importantly, recognizing that military actions alone would not achieve the overall political objectives, the alliance embarked upon an extensive diplomatic effort, including the use of a Russian envoy.

Daadler and O'Hanlon assert, "when military force is used, military means must relate to political ends."[74] In the conduct of Allied Force NATO decision-makers generally adhered to this guidance, although inconsistently and with debatable results. However, the important insight obtained from this examination of the conflict is that the principles of a system of systems analysis were utilized and that the potential for further development and application of the construct is evident.

Two years after the conclusion of Allied Force, another action would be undertaken, this time in a dramatically different strategic environment. The next chapter will examine American led operations in Afghanistan to further illustrate the extent to

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74. Daalder and O'Hanlon, *Winning Ugly*, 210.

which the use of the principles of a system of systems analysis were utilized and the

benefits that may have accrued.

CHAPTER VIII

AFGHANISTAN 2001

The Somalia and Kosovo case studies provided examples of the use of the principles of a system of systems analysis by the United Nations in Somalia and by members NATO alliance in Operation Allied Force. In several instances, utilization of these tenets resulted in enhanced effectiveness in the attaining of primary desired outcomes and provided a limited level of ability to anticipate secondary effects. The examinations revealed greater utilization of the approach in Kosovo. However, a single case study does not present sufficient justification, nor does it adequately support the contention that the system of systems construct can provide additional tools with which to make the hard choices between alternative courses of action.

I will examine in this chapter a more recent and decidedly different scenario to display instances where the principles of system of systems analysis were applied, and to further illustrate the potential advantages of adoption of the approach. The predominantly U.S. operations against the Taliban regime in Afghanistan in October through December 2001 provides an opportunity to explore the assertion that these principles can be applied under a vastly different set of circumstances in a considerably dissimilar environment.

The confines on the analysis addressed in the Kosovo study also apply here; primarily, the need to depend upon open source unclassified information of undeterminable accuracy and reliability. Additionally, the U.S. operation removed the Taliban from power, denied al Qaeda their base of operations, and established an elected central government in Kabul; however, at the time of this writing, the conflict is not yet

concluded, and the attainment of U.S. political objectives remains incomplete.

Nevertheless, as with the previous study, adequate information is available to determine

that the U.S. political leadership and military planners utilized the principles of a system

of systems analysis to evaluate the possible consequences of actions. This will allow me

to identify and present examples of occasions where their use produced the hypothesized

advantages of the construct.

For illustration and comparison, I will utilize the Kosovo and Afghanistan

operations, since they provide significant dissimilarities, but were executed within two

years of each other.. Table 10 provides a summary of these differences from Kosovo.

Table 10. Comparison of the Systems of Power of Yugoslavia and Afghanistan

System	Yugoslavia 1999	Afghanistan 2001
Political	Internationally recognized government Authoritarian, but democratically elected regime Sophisticated bureaucratic structure Multiple parties Tradition of strong central government	No recognition by international bodies Regime not in complete control of territory Strict Theocracy Unskilled and inexperienced management Active autonomous militias (warlords) Tradition of dispersed political power
Economic	Weak, but functioning economy Industry resource dependent Fixed infrastructure Limited international trade	Subsistence level Bazaar economy Primitive road networks Smuggling/drugs primary foreign trade
Military	Armed Forces loyal to political leadership Modern air defenses Mechanized High level of tactical proficiency	Primary loyalty to tribe and warlord Poorly equipped and supported Limited armor and mechanized units Tradition of shifting allegiances
Social	Western Homogeneous population, predominantly Christian and Slavic (outside Kosovo) High educational and literacy levels	South Asian Islamic Multiple and sizeable ethnic groups Tribal based Extremely low education and literacy levels

More than a function of geography and demographics, the nature of the divergence is especially apparent in comparisons of the adversary's systems of national power.

Several other noteworthy contrasts make Afghanistan a suitable scenario with which to demonstrate the potential for wider application of the construct:

(1) Geography. Afghanistan is land-locked and was hundreds of miles from the nearest U.S. military base. The terrain and primitive road infrastructure provided few viable targets for American airpower. Lack of foliage made troop maneuver susceptible to air attack.

(2) Objective. The goal became regime change, instead of behavior modification.

(3) Adversary. Osama bin Laden and al Qaeda were the threat and hence the primary objective, and provided the justification for the operation. The Taliban government was given the opportunity to avoid American military actions by giving up the terrorists believed to be responsible for the 11 September 2001 attacks on New York and Washington. Once they refused, the defeat of the Taliban forces became a key objective.

(4) Political Environment. The domestic and international conditions post 9/11 enabled the adoption of a set of rules of engagement that would not have been considered before, and were not available to planners in 1999.

(5) Complexity. Although *Balkan* is a term that is utilized as an adjective to describe issues that are deeply intertwined, Afghanistan provided an even more complicated dilemma.[1]

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1. As early military plans were being discussed and analyzed, National Security Advisor Condoleezza Rice was reported to have stated, "We're going to wish this was the Balkans." Bob Woodward, *Bush at War* (New York: Simon and Schuster, 2002), 80. He restates the depiction of Afghanistan as "the fabled deathtrap of invading armies and the graveyard of empires past" (ibid., 168).

Therefore, the removal of the Taliban regime provides a sufficiently dissimilar environment from the previously examined cases through which to examine the use of the system of systems approach. A brief exploration into the relevant background and extant conditions in Afghanistan is warranted prior to identifying specific instances of application of the construct.

By virtue of its geographic location at the crossroads of diverse civilizations, Afghanistan has been invaded throughout its history. The most noteworthy early example was the army led by Alexander the Great that spent over two years fighting its way across the rugged terrain en route to its final conquests in India. Persians, Huns, and Turks followed the Greeks in succeeding centuries. In the 7th century, conquering Arab armies brought Islam along with their cavalry. Genghis Khan's Mongol hordes devastated its cities in the 13th century, and later Tamerlane and Babur also led armies into Afghanistan. The common factor in all these invasions was the ferocious resistance of the warrior inhabitants of the territory. This spirit of independence and combative culture resulting from these invasions remains an important factor in understanding modern Afghanistan.[2]

With advances in the means of maritime exploration and the discovery of the alternatives to the overland routes to India, Afghanistan became less important to East-West trade, and a hiatus in foreign invasions ensued. However, by the 19th century, Afghanistan once again emerged as a factor in world politics, this time as part of the *Great Game* for power and influence in the region between Russia and Great Britain. The

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2. See Larry P. Goodson, *Afghanistan's Endless War: State Failure, Regional Politics and the Rise of the Taliban* (Seattle: University of Washington Press, 2001), esp. 23-53, for a useful condensed history of the region with an emphasis on the impact on current conditions. Victoria Scholfield, *Afghan Frontier: Feuding and Fighting in Central Asia* (New York: Tauris Parke Paperbacks, 2003), likewise provides a valuable history of conflict in the region, particularly the British involvement.

containment of Russia and the protection of their empire in India were the motivators for the British who were to learn that Afghanistan was easy to invade but difficult to conquer. Their strategy, rather effectively employed after their last significant military adventure in 1877, was to use paid surrogates to govern internally, while foreign policy was made in London. Although denied the prize of domination, Russia continuously maintained interest in their neighbor to the south.

The next century brought relative peace but little economic or social progress to Afghanistan, which was less of a nation by Western standards than it was a collection of ethnic groups and tribes only loosely connected to the weak central government. The monarchy, which lasted until 1973, was not enlightened or effective; however, it proved to be adequate in maintaining a degree of internal order. With the end of the British Raj in 1947, Afghanistan gained its independence, but remained under the shadow of the communist superpower to the north—the USSR. Soviet efforts to bring Afghanistan into its orbit were subtler than those employed in Eastern Europe and consisted primarily of economic and technical aid and military assistance. Nevertheless, Afghanistan became increasingly dependent upon this financial support, and although a form of democracy emerged in the 1960's, Soviet cultivation of local communists continued. The Afghan armed forces also became increasingly dependent upon their Soviet suppliers for weapons, parts, and technical training.

In 1973, while the reigning monarch, Zahir Khan, was temporarily away from the country, Mohammad Daoud, who had served as prime minister from 1953-1963, declared himself Head of State, Prime Minister, and Minister of Foreign Affairs of a new Republic of Afghanistan. Although he had the backing of communist elements, Daoud worked

toward weakening ties with the Soviets, and by 1978, he was purging them from government positions. This led to a revolt of mainly communist officers in the Afghan army, a coup d'état, and the establishment of the Democratic Republic of Afghanistan in 1978.

The reform program of the new communist government met with widespread resistance, particularly in the rural areas. Religious traditionalists opposed the forced modernization, since these reforms "struck at the very heart of the socioeconomic structure" of society.[3] The year-old constitution was abolished, The People's Democratic Party of Afghanistan (PDPA) became the only legal party, and relations with the USSR were strengthened. In the spring of 1979, this tension led to uprisings in Herat, which spread rapidly to other parts of the country. Hafizullah Amin assumed the position of prime minister, although Nur Mohammed Taraki remained in the largely powerless role of president.

The Amin regime was a disaster. Terror became the primary means of internal control, and its bungled foreign policy alienated the Soviets as well as the United States. By November, the situation had deteriorated enough so that Soviet planning for direct intervention progressed. On 24 December, with the 105th Airborne Division as the spearhead, the Soviet Union invaded and very quickly occupied Kabul and the major population centers, executed Amin, and set up a puppet regime. Thus began what was to be the long 20th century nightmare in Afghanistan—a trauma that would eventually contribute to the collapse of the Soviet invader's overall system of national power.[4]

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3. Goodson, *Afghanistan's Endless War*, 57.
4. See William Maley, *The Afghanistan Wars* (New York: Palgrave Macmillan, 2002), 27-36, for a more detailed account of the events leading up to the decision for invasion. The author also addresses the

Goodson characterizes the Soviet occupation in stages: (1) National Resistance and Soviet Entrenchment, 1980-1983; (2) Air War, Interdiction, and Destabilization 1983-1986; and, (3) Resistance Gains and Soviet Withdrawals, 1986-1989. The saga of this period in Afghan history provides for a fascinating study, and the sources and explanations for the Soviet failure have been topics of extensive analysis and conjecture that I will not repeat here. The important factor is that the elements of Afghan society that were responsible, largely with American support, for the expulsion of the Soviet military would reemerge in the subsequent U.S. operations against the Taliban.

The leaders of the resistance (Mujahideen, or Holy Warriors, such as Gulbuddin Hekmatyar, Burhanuddin Rabbani, Ahmed Shah Massoud, and Ismail Khan), were to have an influence on Afghanistan long after the Soviets withdrew. By 1983, the change in the Soviet strategy from a focus on controlling the cities and major road connections to attempts at actively confronting the insurgency resulted in an immense migrant problem with a major impact on neighboring nations. An estimated 4 million refugees were now in Pakistan and an additional 2.4 million in Iran.[5]

By early 1985, as Mikhail Gorbachev assumed power in the USSR, an amalgamation of domestic and external factors led to his conclusion that the Soviet Union should seek a means of disengaging from this conflict. Dr. Mohammed Najibullah was installed as president in May 1986, coincident with an attempt at a cease-fire and establishment of a national reconciliation government. Although the Soviet-backed Afghan regime was largely ineffective, the opposition was even more fragmented. After a

impact of other major events ongoing at this time, most notably the U.S.-Iran hostage crisis, leadership changes in the Soviet Union, and the SS-20 IRBM deployment.

5. Goodson, *Afghanistan's Endless Wars*, 64. The Pakistani Inter-Service Intelligence Directorate (ISI), which was to play an important role in the subsequent U.S. operation, began to train and supply mujahideen elements in this timeframe.

series of discussions in Geneva, the beleaguered Soviets agreed to a phased withdrawal, which they completed in February 1989. While the crossing of the border by the last Soviet occupation troops was a momentous event from a geopolitical perspective, sadly it was not to represent the end of the fighting and the tragedy of modern Afghanistan.

The next five years were to witness multiple changes in government with a near continuous shifting of allegiances between the major tribal and ethnic leaders. Having achieved its goal of removal of Soviet forces, the U.S. turned to other matters of foreign policy and left the fate of Afghanistan to the United Nations. Civil war ensued with thousands of civilian casualties resulting from the bombardment of Kabul alone. Hekmatyar and the former communist General Abdul Rashid Dostum formed a temporary alliance in early 1994, but fighting continued. In October Kandahar fell to an obscure band of religious students (Taliban) led by Mullah Mohammed Omar. After a series of failed attempts at a coalition regime, in September 1996 Taliban forces took control of Kabul, captured and publicly executed Najibullah, and declared Afghanistan to be a completely Islamic state.

The rule of the primarily Pashtun Taliban was not to extend throughout the country. An anti-Taliban Council for the Defense of Afghanistan, representing Uzbek and Tajik minorities in the north, emerged. This *Northern Alliance* (also known as the *United Front*) would engage in near continuous battles with the Taliban, which resulted in major population centers changing hands multiple times. Into this morass entered al Qaeda and its founder, Osama bin Laden, who seized the opportunity for a secure geographic base of operations. His organization continued to support the Taliban financially, and their common fundamentalist Islamic perspectives worked to cement the relationship.

Although al Qaeda operatives were successful in assassinating the most viable Northern Alliance leader, Ahmed Shah Mossoud, on 9 September 2001, the events of two days later were to have the most momentous effect on the future of Afghanistan. The American response to the attacks, which launched "The Wars of 9/11," is the focus of this case study.[6]

The Impetus for Intervention

The American military undertook the operation in response to what was judged a direct threat to the United States. Even while the ruins of the World Trade Center were still smoldering, President Bush was considering the options for retaliation. In his now famous remark to workers at the site on 14 September, "the people who knocked these buildings down will hear from all of us soon."[7] Recovering from the initial shock and despair, the targets of the promised retribution, as well as the means of attacking them, were debated within the National Security Council (NSC). Although, al Qaeda and bin Laden were among the first perpetrators considered, the involvement of Iraq and Iran were also suspected. The dilemma presented was that if a non-state actor was responsible, what is the appropriate response with regard to the nation that is providing it with a base of operations?

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6. Simon Serfaty of the Center for Strategic and International Studies and Old Dominion University first introduced this term for actions in reaction to the September 2001 attacks. See Simon Serfaty, "The New Normalcy," *The Washington Quarterly* 25, no. 2 (Spring 2002): 211.

7. Woodward, *Bush at War*, 70. Earlier that day, at the Washington National Cathedral, Bush stated that this conflict will "end in a way, and at an hour of our choosing." At this point, the nature of the beginning of the U.S. response was far from decided. Much of the subsequent summary of the decision-making process is taken from Woodward's narrative, which at the time of this writing is the best available account. Since, the sources of much of his information (some of which he claimed to be highly classified) are not identified, his observations cannot be regarded as purely factual and objective.

Essentially ignored by the U.S. after the Soviet withdrawal, Afghanistan prior to 9/11 was not at the apex of the list; however, several factors kept it among American international concerns. The perceived human rights abuses of the Taliban regime, particularly in its treatment of women, generated nearly universal and unbroken condemnation in the West.

The presence of al Qaeda in Afghanistan was an open secret. After the August 1998 attacks on U.S. embassies in Kenya and Tanzania, the Clinton Administration had lobbed 66 Tomahawk cruise missiles into suspected al Qaeda bases with minimal effect. The disdain within the Bush administration over the feckless futility of this action was to be a factor in subsequent planning. Fortunately, from the U.S. perspective, the U.S. Central Intelligence Agency (CIA) reportedly had multiple assets in Afghanistan attempting to monitor al Qaeda activities and to support Northern Alliance operations against the Taliban regime. These operatives were to be the nucleus of the American effort. However, their use needed to be legitimized.

The United Nations Charter provides for every nation's right of self-defense. However, when this document was drafted and adopted, aggressors were assumed to be other sovereign nations. The emergence of a non-state actor capable of a devastating attack on the world's sole superpower was not envisioned. However, even potent non-state actors cannot defy the laws of physics—*they must physically be somewhere*—and it was indisputable that the regime in Kabul was providing al Qaeda with a geographic base from which to train and deploy its operatives. The U.S. previously had warned the Taliban "that we will hold them responsible for any terrorist acts undertaken by Bin

Laden from Afghanistan."[8] This clear connection between al Qaeda and the Taliban regime was to provide the U.S. with an unambiguous target for retaliation.[9]

International sympathy for the U.S. and support for retaliatory actions was nearly universal. The NATO Ambassadors had taken the unprecedented step of invoking Article V of the North Atlantic Treaty.[10] There was little question that the perpetrators of the mass murder should be punished, the problem was to prevent the actions taken against al Qaeda and their Taliban protectors from being interpreted as attacks against the Afghan people. The Taliban leadership solved this dilemma for the Americans by continuing to support al Qaeda elements within the country and refusing U.S. demands to apprehend and provide them for justice.

On 28 September, Pakistani President Pervez Musharraf dispatched the Director-General of the Inter-Services Intelligence (ISI), Lieutenant General Mahmood Ahmed, to Kabul to attempt without success to get the Taliban to hand over bin Laden.[11] By early October, the Bush Administration had decided that if the Taliban would not give up bin Laden, then the U.S. would remove the Taliban from power. The U.S. demanded that the Taliban "Close terrorist training camps; hand over leaders of the al Qaeda network; and return all foreign nationals, including American citizens, unjustly detained in your

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8. U.S. Congress, Senate, Committee on Foreign Relations. *The Taliban: Engagement or Confrontation, Hearing before the Committee on Foreign Relations,* 106th Cong., 2nd sess., S. Hrg. 106–868, 20 July 2000, Washington, DC: U.S. Government Printing Office, 2001. Statement of The Honorable Karl F. Inderfurth, Assistant Secretary of State for South Asian Affairs.

9. Steven Tanner, *The Wars of the Bushes* (Haverstown, PA: Casemate, 2004), 168, contends that the defiant policy of the Taliban in their support for al Qaeda was fortunate for the U.S. Other nations would have been more willing to rid themselves of al Qaeda or intimidated by the threat of U.S. attack. He notes that if bin Laden were operating across the border in Pakistan the repercussions of the use of American military power would have been decidedly more complex.

10. "The parties agree that an armed attack against one or more of them in Europe or in North America shall be considered to be an attack against them all." North Atlantic Treaty Organization, *NATO Handbook,* 1998), 396.

11. Maley, *Afghanistan Wars,* 260. Ahmed, whose sympathies were with the Taliban, resigned two weeks later and was replaced by a more moderate officer, Eshanul Haq.

country."[12] However, due to the geographic location and limited infrastructure of Afghanistan, the means by which this objective could be achieved were to be remarkably different from previous U.S. military campaigns.

U.S. Objectives

On 7 October, President Bush announced the commencement of combat operations: "These carefully targeted actions are designed to disrupt the use of Afghanistan as a terrorist base of operations, and to attack the military capability of the Taliban regime."[13] Notably, no mention was made of a desired political end state after obtainment of these objectives. The U.S. Secretary of Defense and Chairman of the Joint Chiefs of Staff declared that the objectives of the military actions were:

(1) To make clear to the Taliban leaders and their supporters that harboring terrorists is unacceptable and carries a price

(2) To acquire intelligence to facilitate future operations against al Qaeda and the Taliban regime that harbors the terrorists

(3) To develop relationships with groups in Afghanistan that oppose the Taliban regime and the foreign terrorists that they support

(4) To make it increasingly difficult for the terrorists to use Afghanistan freely as a base of operation

(5) To alter the military balance over time by denying to the Taliban the offensive systems that hamper the progress of the various opposition forces, and

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12. George W. Bush, "Presidential Address to the Nation," White House, Office of the Press Secretary, 7 October 2001, http://www.whitehouse.gov/news/releases/2001/10/20011007-8.htm (accessed 2 March 2005).
13. Ibid.

(6) To provide humanitarian relief to Afghans suffering truly oppressive living conditions under the Taliban regime.[14]

The inclusion of the last objective on this listing indicates that senior decision-makers were considering the social impact of the actions necessary to achieve the other stated goals.

While the military strategy was relatively clear, Woodward reports that Secretary of State Colin Powell and CIA Director George Tenet made repeated efforts within the National Security Council to establish a political strategy.[15] As later events were to demonstrate, this lack of an agreed political course of action was to complicate the post-conflict efforts at establishment of a viable central government.

Taliban Political Objectives

Maley describes the Taliban as, "above all, an anti-modernist movement."[16] He adds that the goal of the Taliban was to seek security and stability and establishment of Islamic Law (Sharia) in a domestically secure and externally strong nation. The near anarchy of the immediate post-Soviet occupation period made security a welcomed goal for most of the populace. However, the strict interpretation of Sharia provided order at the price of near universal ostracism and isolation from the international community.

Despite Taliban efforts to gain United Nations recognition and to occupy the Afghan seat in the General Assembly, their requests were rebuffed six different times between 1996 and 2001. Focused on internal matters and without experience in

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14. U.S. Department of Defense, "Rumsfeld and Myers Briefing on Enduring Freedom," 7 October 2001, http://www.defenselink.mil/transcripts/2001/t10072001_t1007sd.htm (accessed 12 February 2005).
15. Woodward, *Bush at War*. 226.
16. Maley, *Afghanistan Wars*, 232.

international affairs, the diplomatic record of the Taliban regime is a debacle. The proposal for a trans-Afghanistan pipeline to transport natural gas from Turkmenistan to Pakistan gave the Taliban an economic impetus to improve relations with the rest of the world. However, their unwillingness to abate the human rights abuses in enforcement of Sharia and refusal to turn over bin Laden as demanded by a series of United Nations Security Council (UNSC) Resolutions indicated their contempt for international public opinion and the world organization in particular.[17]

The Taliban had no clear objectives except to maintain themselves in power, defeat the resistance in the north, extend their influence throughout the entire country, and t resist any unwanted foreign influence on how they conducted their internal affairs. This last goal, which included the protection of al Qaeda, was to be the principal generator of the American operation. The dilemma presented to American decision-makers was how to influence a regime that had no lawful foreign trade or discernible willingness to moderate its policies in order to be accepted as the legitimate government of Afghanistan. If economic and diplomatic actions were to be utilized, then their application would need to be dramatically different from earlier conflicts, such as in the Balkans. Success in this endeavor would require an understanding of the systems of power of Afghanistan and the Taliban.

A Representational System of Systems Analysis

This cursory examination of Afghanistan from a systems perspective is presented in order to maintain the connection to and focus on the use of the system of systems

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17. UNSCR 1267 of 15 October 1999 and UNSCR 133 of 19 December 2000. The latter added a proscription against any military materials to include technical advice.

construct. As with the previous examinations of Somalia and Yugoslavia, it is intended to be only a representational sampling of the larger analysis that would be required to effectively utilize the methodology.

Essential Elements of the Systems

Political. Although Afghanistan has long been a recognized independent nation despite a series of foreign invasions and varying degrees of external influence, it has also been described as a *country without a state*. While the criteria for statehood is not precisely defined or universally accepted, among the characteristics normally associated with sovereign statehood are: a defined geographic territory, an administrative system, and a monopoly over the use of force.[18]

Clearly, Afghanistan in September 2001 possessed internationally accepted, albeit permeable borders, and the rudiments of an administrative system, although one that was exceptionally weak. The continuing battles with Northern Alliance forces and the existence of powerful warlord militias make the third factor (monopoly of force) debatable. A more accurate depiction is that of Afghanistan as a *failed state*. Noelle-Karami, et al, contend that a key indicator of a failed state is when "tribal, ethnic or religious ties" replace the loyalty previously afforded to the state apparatus.[19] The political order of Afghanistan in 2001 supports this characterization.

Historically, politics in Afghanistan have been characterized by a diverse and decentralized structure. Loyalties are based primarily on language, ethnicity and tribal

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18. Christine Noelle-Karimi, Conrad Schetter, and Reinhard Schlagintweit, *Afghanistan - a Country without a State?* (Frankfurt-Main), Germany: IKO-Verlag fur Interulturelle Komminkation, 2002), 2-3.

19. Ibid., 7. The question of Afghanistan as a failed state is the focus of this edited volume of essays. The authors urge caution in using legitimacy and issues such as democracy and human rights as criteria for determination of failed statehood.

connections, not by any uniting political ideology. The most powerful unifying factor in

Afghan politics has been resistance to foreign domination. Members of the largest ethnic

grouping, the Pashtun, long have been the dominant force in Afghan political affairs. The

Taliban leadership was primarily Durrani Pashtun and was connected to Afghanistan's

most conservative provinces of Kandahar, Hilmand, and Uruzgan. After the Taliban

assumed of control in Kabul, the Taliban's spiritual and political leader, Mullah Omar,

elected to administer from Kandahar in the primarily Pashtun region. Even in non-

Pashtun areas, significant power resided within this group.

Taliban has been described as more of a movement rather than a political

ideology. Sharia, as enforced by the religious police responsible for "The Promotion of

Virtue and the Suppression of Vice," is the most visible manifestation of state power.

This blending of the political and social is an important element in understanding the

overall system. Maley asserts that Taliban ideals were *"the values of the village as*

interpreted by refugee camp dwellers or madrassa students who had typically had no

known normal village life."[20] Taliban power was absolute and directed by Mullah Omar

and an Interim Council of Ministers. The enigmatic and ideologically driven Omar

became isolated and received input from only a small core of advisors, most of whom

possessed the same simplistic and fundamentalist vision of Afghanistan. Without any

structure or administrative experience, meetings of the council were disjointed and

unorganized. This left the appointed governors who administered the 31 provinces of the

country, with a lack of guidance and control.

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20. Maley, *Afghanistan Wars*, 233, emphasis in original. The *madrassi* were fundamentalist schools that produced many of the most fanatical Taliban members. Afghan refugees comprised a sizeable portion, but not the total number of students in these schools.

The internationally recognized Islamic State of Afghanistan, headed by President Burhanuddin Rabbani, controlled only the 10 per cent of Afghanistan not under Taliban authority. Its presiding Council of Ministers included Minister of Defense Abdollah and Minster of Security General Fahim who would play an important role in the campaign to remove the Taliban. This provided a shadow regime upon which to base a new government upon removal of the Taliban.

Pakistan was one of only three nations ever to recognize the Taliban regime.[21] Strong ties existed between the Pakistani intelligence organization (the ISI) and the Taliban. After the 1999 coup that placed Musharraf in power, relations with Pakistan deteriorated. Although officially condemning Taliban excesses and supporting UN sanctions, the ISI reportedly continued to support the Taliban.

Afghanistan was almost completely isolated politically, although they embarked upon some attempts at fostering relations with China. Taliban support for Chechen separatists further deteriorated their relationship with Russia. Already under sanctions from the United Nations and considered a pariah regime, there was little opportunity to further threaten the international standing of the Taliban regime.

Political loyalty in Afghanistan traditionally has been fluid. Changing allegiance based on perceived swings in the power equation or for economic gain are integral parts of the system. There is no tradition of a strong central government or ingrained loyalty to it. This decentralized structure resulted in a lack of critical sub-elements and nodes that could be identified and acted upon.

Although Mullah Omar was the spiritual head of the movement, his bureaucratic skills and control over the regime and government policies were much different from

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21. The others were the United Arab Emirates and Saudi Arabia.

Milosevic's in Yugoslavia. Omar was not dependent upon an electorate and personal popularity. This condition also provided a political strength, i.e., the government was more than a cult of personality around one person. Hence, the vulnerabilities of the political system were limited. Instead of the central government leadership representing the key elements, the key political nodes were to be the leaders of the Northern Alliance, and from outside the country, most notably in Pakistan.

Economic. Even before the latest decades of the continuing warfare, Afghanistan was one of the poorest nations in the world. The destruction and carnage of the Soviet occupation, and the near continuous internal conflict since 1989, resulted in stagnation of an already weak economy and a primitive level of development.[22] The system can be best described as a *bazaar economy*, i.e., one in which "a capitalist free-market economy regulates all economic activities in the absence of state regulation."[23] The inept administration and policies of the Taliban only served to preclude any development. With no industrial base and with hand woven rugs its principal legal export, Afghanistan was a nation in severe economic crisis. Without any experience or expertise in economic affairs, the inept Taliban bureaucrats were not able to control the national currency, and they presided over a criminalized economy, with smuggling of goods across the Pakistani border being Afghanistan's primary source of income.

The other major source of revenue was opium poppy cultivation. An estimated 200,000 Afghan farmers were engaged in poppy growing in 1999, and the government

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22. Average per-capita GDP was less than $300, which includes the drug trade. William Byrd and Christopher Ward, "Drugs and Development in Afghanistan, Social Development Papers: Conflict Prevention and Reconstruction Paper No. 18 December 2004," (New York: The World Bank, 2004), 1.
23. Schetter, in *Afghanistan - a Country without a State?* 110.

did not attempt to conceal their support for this activity.[24] When the Taliban authorities

banned opium poppy production in February 2000, those farmers who had become

dependent upon it as a source of income were left without an alternative source of

livelihood. The effects of the proscription on poppy cultivation were dramatic, with the

United Nations reporting a 91 per cent reduction in acres under cultivation in 2001.[25] Not

surprisingly, the level of popular support for the regime in the poppy producing areas was

affected by this banning of poppy production.

While much of the illegal trans-border activity was beyond the reach or control of

the Taliban, it did represent a sizeable portion of their financial support. Smuggling of

consumer goods, as well as the drug trade had economic benefits for those integrated into

the process; however, it presented enormous suffering for the larger population who was

not engaged in the growing, processing or transport of drugs. Hence, the economy, and

any of its benefits, was in the hands of a few.

The very narrow and weak attempts to attack foreign investment failed due to the

political isolation resulting from the regime's internal policies. As a result, opportunities

for an adversary to negatively affect the Afghan economic system were nearly non-

existent. It was an economy with essentially no strengths and no vulnerabilities.[26] While

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24. *Europa World Yearbook 1999*, 372. UN sources are cited that estimate that 165,000 acres of arable land were under poppy cultivation. The strict code of the Taliban condemns drug abuse, however, the Taliban share of the trade reportedly was 20 per cent of the opium transported out of the country. Estimates vary, but at the acme of Afghan drug production 75-90 per cent of the world heroin supply had its source in Afghan fields.

25. United Nations, International Drug Control Programme, "Annual Poppy Survey 2001," http://www.unodc.org/pdf/afg/report_2001-10-16_1.pdf (accessed 12 February 2005). This resulted in a tenfold increase of the price of dry opium to $300/kg. These UN supply estimates are a function of the estimated land under cultivation. The region was experiencing a drought in the period, which also affected production. See also Byrd and Ward, "Drugs and Development in Afghanistan," for additional detail and statistics on the Afghan drug trade. Looking at the trade from a purely economic viewpoint, they acknowledge benefits as well as costs of the drug economy.

26. In 2003, I participated in a German Bundeswehr sponsored workshop related to the International Security and Assistance Force (ISAF) in Afghanistan. An anthropologist who has spent much of his adult

the number of U.S. actions that could affect the overall economic system was negligible,
this condition made financial incentives (bribes) to individuals a viable means of
influence.

Military. Estimates of the size of the Taliban military forces vary greatly, ranging
from 10,000 to 125,000.[27] Generally, they were lightly armed, with some artillery, no
large armored or mechanized units, and less than 100 tanks of various vintage and states
of repair. Its air force and air defense system were miniscule and woefully impotent
against any modern force. It was a "come as you are force" with little opportunity to
obtain sophisticated weapons from foreign sources, although the region possesses a near
endless supply of small arms and ammunition, much of it produced in home workshop
endeavors.

The advantage held by the Taliban force was in its battle-hardened elements,
ability to fight with minimum sustainment, and religious motivation. The legacy of the
mujahideen gave them a mystique and an aura that they could defeat a modern and
sophisticated military. However, as a primarily Pashtun force, their support in Tajik,
Uzbek, and Hazara areas was minimal. The key characteristic for exploitation was the
tradition of shifting allegiances when the advantage swings to the other side.

Social. A former U.S. Special Envoy to Afghanistan testified, "The Afghan
national identity is a unique, holistic blend of Islam, tribal codes of conduct and Afghan

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life in the country made the observation that if the West devoted decades of time, effort and extensive
funding to the building of its economy, Afghanistan could *rise to the level of a third world nation* in 15-20
years.

27. Michael E. O'Hanlon, "Flawed Masterpiece," *Foreign Affairs* (May-June 2002): 49, and US DOD
press briefings use a range of 50,000 to 60,000. Anthony H. Cordesman, "The Ongoing Lessons of
Afghanistan: Warfighting, Intelligence, Force Transformation and Nation Building" (forthcoming), 6 May
2004 draft, http://www.csis.org (accessed 2 March 2005) cites estimates of up to 125,000 although only
25,000 of these could be considered serious fighters.

nationalism."[28] A diverse society, the largest ethnic groups were the Pashtun (38%), Tajik (25%), and Hazara (19%), with Aimaks, Turkmen, Baluch, and Uzbeks comprising most of the remaining population. The Pashtun, residing primarily in the southern parts of the country historically have been the dominant group. Identity is defined by membership in a *qaum*, which includes "a complexity of affiliations, a network of families or occupations."[29] Goodson believes that it may be "inappropriate to refer to Afghan culture, for Afghanistan is in many ways a society with differing cultures, both overlapping and clashing."[30] Loyalty and group identification normally does not extend beyond family, clan or tribe. Islam is one unifying influence with approximately 84 per cent of the population adherents of the Sunni sect.

The illiteracy rate in Afghanistan was one of the highest in Asia: approximately 70 per cent for males and 85 per cent for females. The near continuous conflict had resulted in an exodus of teachers and the destruction of school buildings. Strict interpretations of Sharia resulted in the closure of all schools for girls in 1998. Taliban attitudes toward women, manifested in the proscription against females working (with few exceptions) outside the home, degraded their popular support.[31] The low literacy rate

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28. U.S. Congress, Senate, Committee on Foreign Relations. *The Taliban: Engagement or Confrontation, Hearing before the Committee on Foreign Relations,* 106th Cong., 2nd sess., S. Hrg. 106–868, 20 July 2000, Washington, DC: U.S. Government Printing Office, 2001. Statement of Peter Tomsen.

29. Library of Congress, "Country Studies, 'Afghanistan,'" http://www.lcweb2.loc.gov/frd/cs/aftoc.html (accessed 2 March 2005). *Qaum* refers to descent groups, extended family or clan and tribal affiliation. Family provides the major economic and social unity in Afghan society. However, years of warfare and the resultant refugee problem have weakened this element. Many Taliban fighters never experienced a normal existence in their tribal homelands.

30. Goodson, *Afghanistan's Endless War,* 27.

31. Noelle-Karimi, Schetter, and Schlagintweit, *Afghanistan,* 98. In this same collection, Heike Bill offers that although the Taliban rules were rigid, they "merely continue long-established cultural and religious conditions" (ibid., 98).

meant that radio was the principal means of communication, especially in the rural areas.[32]

A characteristic of Afghan society that became a primary cause of the intervention was the concept of hospitality. Despite clear evidence of their link to terrorist activities, bin Laden and al Qaeda were considered to be guests in their country and Afghan social mores would not allow for them to be given up to outsiders for justice. The motivation was not entirely altruistic. Bin Laden's substantial financial contributions strengthened the Taliban resistance to surrender him.[33]

A phenomenon that is essential to understanding Afghan society is the role of the leaders of private armies, popularly known as *warlords*. The system provides for support for the state but with the autonomy of the militia leaders intact: "Loyalty is contingent rather than absolute."[34] The warlord culture has long been extant in Afghanistan with tribal armies fighting against invaders when present and against each other when they were not. Notable among these has been Hekmatyar, the Pashtun leader of the fundamentalist Hezb-I-Islami Party; Dostum, an Uzbek; and, Ismail Khan, a Shiite Tajik.

The vulnerabilities of the social system were its ethnically diverse character, the identification with tribe rather than with nation or the Taliban regime, and the tradition of shifting loyalties. The strength was in its centuries-old tradition of resistance to foreign influence and the uniting force that previous invasions had engendered.

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32. Inexpensive transistor radios were abundant in Afghanistan. Radio Kabul became Radio Sharia and represented the most important mode of Taliban propaganda transmission.

33. The Pashtun custom of *melmastia* (hospitality) was the justification for the protection of bin Laden. Omar was quoted, "Even if all the countries of the world unite, we would defend Osama by our blood." Scholfield, *Afghan Frontier*, 343.

34. Maley, *Afghanistan Wars*, 110, asserts that the militias can serve as "a half-way house for those who wish to shift their allegiance, but not completely lose their autonomy."

Table 11 provides an illustration of the overall system of power in Afghanistan using a few examples from each system.

Table 11. Nodes in the Afghan System

System	Elements	Sub-Elements	Nodes
Political	Warlords	Tajiks	Ismail Khan
	External support	Pakistan	Inter-Services Intelligence Directorate (ISI)
Economic	Opium poppy production	Fields under cultivation	Opium refining facilities
	Commercial goods smuggling	Transit routes	Islam Qala
Military	Fielded forces	Anti-air capability	SA-3 radars
	Foreign volunteers	Al Qaeda	Osama bin Laden
Social	Religion	Fundamentalist Islam	Mullah Omar
	Ethnicity	Pashtun	Kandahar
	Tribal Leaders	Warlords	Ismail Khan
			Abdul Sayyaf

Node Linkages – The System of Systems

In Afghanistan the demarcation lines between the political and the social are blurred to a point of near non-existence. All politics is tribal; patronage is a function of ethnicity and clan and family connections. An important connection exists between the Pashtun of Afghanistan and those living across the border in Pakistan. Military and economic support was provided enthusiastically to the Taliban because of the close religious and ethnic connections to the Pakistani intelligence service (ISI) chief, Lieutenant General Ahmed.[35] This linkage was identified and subsequently broken as the

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35. Ibid., 35. The ISI was a key conduit of American military aid to the mujahideen during the Soviet occupation. Its financial support for the Taliban regime was estimated at $10 million by 2000. The spy

U.S. operation unfolded. For illustration, a simple set of linkages is provided in Figure
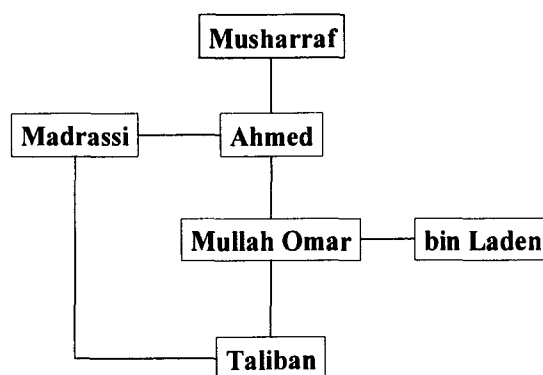
20.

Figure 20. Pakistani-Taliban Connections

Ahmed was clearly a supporter of Mullah Omar as well as the *madrassi* religious schools

that provided a significant number of Taliban fighters. The link between bin Laden and

Omar was well established. With some considerable U.S. pressure, Ahmed was removed

with the effect of breaking the link between the ISI, al Qaeda, and the Taliban.

Even after Musharraf removed Ahmed, thousands of Pakistani Pashtuns were

entering Afghanistan to fight at the side of their ethnic comrades.[36] Religion is

inseparable from the political philosophy of the Taliban, many of whom were influenced

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agency, with an estimated 40,000 operatives was a political force in itself, and the action of Musharraf involved considerable personal risk.

36. Tim McGirk, "Deep Loyalties, Ancient Hatreds," *Time*, 19 November 2001, 53.

by their time in the *madrassi* in Pakistan where an ultra conservative sect of Sunni Islam was preached.

These connections were not limited to Pashtuns who resided on both sides of the Afghan-Pakistani border. Elements of the Northern Alliance also maintained close contact with their ethnic kin across national boundaries; borders that were established during great power struggles without much concern for the ethnicity of the resident populations. One of these, Ismail Khan, was a Shiite and an ethnic Tajik, with his base of power in Herat and ties to the Iranian Revolutionary Guard Corps.

The connections between the drug traffic and other illicit activity were well established. Estimates of Taliban profits from this trade were $75 million. The Pashtun head of the Islamist Hizb-i Islami political party, engineer, warlord, and former Prime Minister Hekmatyar was also linked to the drug trade. Hence, he could be a node in multiple systems. Until their subsequent policy reversal on opium production, Taliban authorities encouraged poppy cultivation, and yield increased steadily since 1996. Most of this trade was through Pashtun regions and across the Pakistani frontier. Pakistan's Interior Minister, Nasrulla Babar, also a Pashtun and a Taliban sympathizer, was less than energetic in reducing this illicit cross border trade.

The illustration provided in Figure 20 is exceptionally simple, including only a few connections. However, the linkages within a complex adaptive system are extensive. I provide Figure 21 for illustration of some additional connections that could have been exploited. At its center is the Tajik-Shiite warlord, Ismail Khan. His connections to the Iranian Revolutionary Guard Corps were well known and reinforced by their common

adherence to the Shia sect of Islam. Khan's power center was in the city of Herat near the
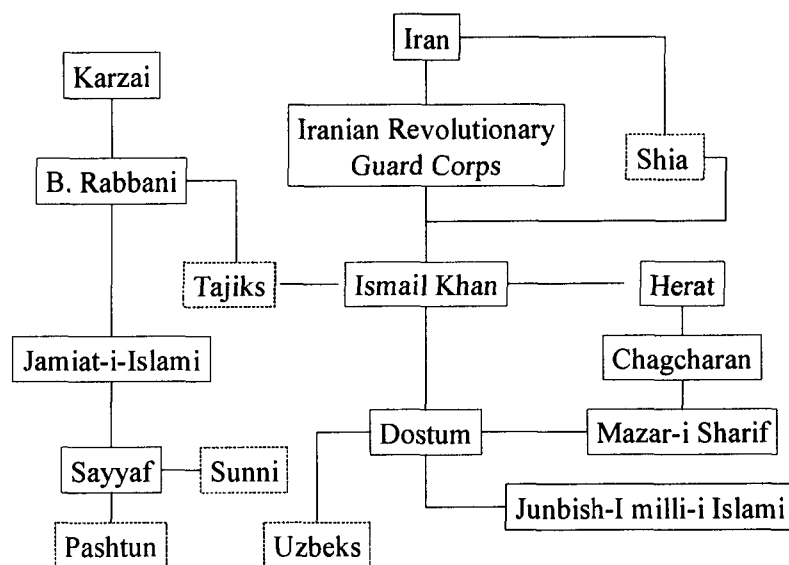
Iranian border.

Figure 21. Warlord Linkages

Khan's connections to General Dostum extended back to their experiences in the

anti-Soviet war. Dostum, an Uzbek, drew his support from the area around Mazar-i

Sharif, which was to become vital as a supply route from Uzbekistan. The node city of

Chacharan became important as a link between Khan's forces in Herat and Dostum's

near Mazar. Khan was also connected through party affiliation to Burnhanuddin Rabbani

who still represented the recognized government of Afghanistan. Through the Jamiat-i-

Islami, Rabbani was connected to the Pashtun, Abdul Sayyaf, who later served under the

interim president Karzai. Sayyaf's forces included many Arabs, and he, unlike most

Afghans, was a member of the strict Wahbabi sect of Islam with connections to Saudi Arabia. [37]

While there is no evidence that U.S. planners overtly used this type of depiction in their planning process, subsequent events indicate that their strategic thinking included recognition of some of these linkages, either to enhance the effects of actions, or to avoid undesirable secondary effects. Since the links between nodes cut across system and national boundaries the key to an understanding of Afghanistan resides in an appreciation of these interrelationships. As I will illustrate in the exploration of U.S. actions that follows, this knowledge was successfully exploited in many instances.

Effects of the Coercive Actions

The primary U.S military objectives were the military collapse of the Taliban; the Northern Alliance in control of the Northern provinces; and, the capture of Osama bin Laden or him on the run.[38] However, even as the initial munitions were being deployed, the official American line was that the military actions were only a part of the overall campaign. On the day the attacks commenced, Donald Rumsfeld opened a press briefing with the statement that the direct overt military force was "to complement the economic, humanitarian, financial and diplomatic activities which are already well underway. The military action is designed to clear the way for sustained, comprehensive, and relentless operations to drive them [the Taliban] out."[39]

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37. Kathy Gannon, "Afghanistan Unbound," *Foreign Affairs* 83, no. 3 (May/June 2004): 35-36. She observes that many of the linkages between warlords existed before the Taliban, and equates many of their ideology as more radical than the Taliban. Many of these warlords are now part of the interim government.
38. Woodward, *Bush at War*, 229.
39. U.S. Department of Defense, "Rumsfeld and Myers Briefing," 7 October 2001.

The pursuit of these objectives included the dropping of more than bombs over Afghanistan. In the same press conference, General Richard B. Meyers described how within hours after the initial arrival of explosive ordnance on Afghan targets, American aircraft commenced dropping of humanitarian supplies including food, blankets, and medicine with the intent of easing the conditions of Afghan refugees.

As the attacks commenced, President Bush stated, "This military action is a part of our campaign against terrorism, another front in a war that has already been joined through diplomacy, intelligence, the freezing of financial assets and the arrests of known terrorists by law enforcement agents in 38 countries."[40] Hence, unlike Kosovo, military coercion was only one element of a comprehensive campaign to influence multiple systems of Taliban and al Qaeda power.

The strategy of the Afghan campaign, subsequently renamed *Enduring Freedom*, reversed the priority of targets used in Allied Force.[41] In Kosovo, the fielded Yugoslav forces were initially viewed as the principal object for attack, and the focus on infrastructure was made later in the conflict. In Afghanistan, the opening targets were the exceptionally limited number of fixed military targets. Although bomb damage assessment (BDA) data remains closely protected, U.S. Department of Defense (DOD) spokesmen claimed that by the second day of the bombing 11 of 12 SA-3 radars, 7 of 8 airfields, one-half of long-range radars and several radio towers had been "damaged."

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40. George W. Bush, "Presidential Address to the Nation, 7 October 7 2001," http://www.whitehouse.gov/news/releases/2001/10/20011007-8 (accessed 2 March 2005).

41. The original designator was *Infinite Justice*; however, this was changed to preclude the unintended effect of weakening international support due to Islamic sensitivities to the U.S. assuming a role normally assigned to the Deity.

Other targets included the al Qaeda Brigade, command facilities, SAM sites and terrorist training camps.[42]

By the end of October, concentration had shifted to "those Taliban forces arrayed against the Northern Alliance." A DOD spokesman briefed reporters: "The focus of the operational efforts included targets involving terrorists in Taliban command and control locations, including bunkers and tunnels, as well as airfield facilities and Taliban military forces that support the opposition forces."[43] Planners soon added caves and potential hideouts for al Qaeda elements to the list of primary targets.

The connections between the anti-Taliban forces and nations in the region, particularly Pakistan, were an early concern of the Bush security advisors. Hence, they did not regard merely substituting the Northern Alliance leadership for the Taliban regime as a prudent course. However, as battlefield events unfolded, it became clear that the U.S. did not control this diverse and complex organization. Accepting this condition, U.S. support for Northern Alliance operations emerged.

The objective of the Northern Alliance forces, now augmented by U.S. military Special Forces and CIA teams, was reported to be the city of Mazar-i Sharif. This was an important node due to its location 35 miles from the Uzbekistan border and the perceived improvement in the ability to supply Northern Alliance troops accrued from taking the objective. The effectiveness of this support increased due to continuous CIA contacts with Northern Alliance elements, and their understanding of key cultural characteristics of Afghan society.

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42. Woodward, *Bush at War*, 213.

43. U.S. Department of Defense, "News Transcript, Rear Adm. John Stufflebeem, Joint Staff, 31 October 2001," http://www.defenselink.mil/transcripts/2001/t10312001.htm (accessed 2 March 2005). The figure for Taliban combat troops was now estimated at 50,000 - 60,000, nearly double the figures used by the NSC a month earlier. The previous day's activities had brought the total number of Human Daily Rations (HDRs) intended for refugees to more than 1 million.

Although it represented an important task, having anti-Taliban forces in control of the major population centers did not necessarily equate to the complete attainment of all U.S. objectives. As major military resistance by Taliban forces ceased, on 11 December, Rumsfeld acknowledged this condition: "It does not end with the fall of Kabul or Kunduz or even Kandahar, or even with the capture of some of the individual Taliban and al Qaeda leaders in Afghanistan."[44] Even with this qualification, the military operation that removed the protectors of al Qaeda in a matter of weeks may be considered to be a notable success. Many pundits expected the Kosovo campaign to last for a few days; others later predicted that removal of the Taliban would take years. Events would prove them wrong.

The important difference between the Kosovo and Afghanistan campaigns was the incorporation in the latter case of more aspects of a systems approach and actions that influenced all elements of Taliban power. Woodward reports that CIA operatives were able to buy the allegiance of warlords who were previously supporting the Taliban regime for approximately $50,000 each. The premise, successfully exploited, was that "you can't buy an Afghan, but you can rent one." Although counter to Western standards and values, this observation indicates an appreciation of the cultural norms of the Afghans. Woodward claims that the CIA expended $70 million in direct cash payments to support the military operations. When compared to the $569,000 price tag of a single Tomahawk missile, the relative cost/benefit ratio is put into perspective.[45] Director

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44. U.S. Department of Defense, News Transcript, "DOD News Briefing - Secretary Rumsfeld and Gen. Myers, 11 December 2001," http://www.defenselink.mil/transcripts/ 2001/t12112001_t1211.htm (accessed 2 March 2005).

45. U.S. Navy cost figure, using 1999 data. U.S. Department of the Navy, Chief of Information, "Tomahawk," http://www.chinfo.navy.mil/navpalib/factfile/misiles/wep-toma.html (accessed 2 March 2005). Approximately 70 were employed in the conflict.

George Tenet and others in the CIA understood that for the Pashtuns, "their allegiances were negotiable in Afghanistan, just like everybody else's in Afghanistan."[46]

The major advantage of the use of the principles of a system of systems approach in Afghanistan resided in the more efficient attainment of objectives and the ability to influence multiple systems. However, some attempts to anticipate the secondary effects of actions were also apparent.

The Secondary Effects

In general, there were fewer deleterious unintended secondary effects in Enduring Freedom than in the Kosovo operation. This was due in part to a better understanding of the systems of power in Afghanistan, which allowed planners to better anticipate the ancillary effects of actions. I will provide a few examples for illustration.

The links between actions to achieve effects in Afghanistan and secondary effects across its geographic boundaries were considered in the development of the overall U.S strategy. The U.S. recognized that events in Afghanistan could not be contained within its geographic borders. Hence, in deference to Pakistani concerns, establishment of the Northern Alliance as the new rulers of Afghanistan intentionally was not an original goal. However, once their military victory became inevitable, an extensive political effort was made toward Pakistan to reassure Musharraf that the takeover by the primarily Tajik and Uzbek Northern Alliance would not be a threat to him. Recognition of the link between the Pakistani intelligence service and the Taliban also resulted in U.S. encouragement for Musharraf to remove his pro-Taliban ISI chief.

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46. Woodward, *Bush at War*, 230.

An unintended result of military action, particularly air and missile attacks, is the effect on the morale and allegiance of the civilian population. The emphasis on providing food and other humanitarian assistance in concert with military activities mitigated the historically fierce Afghan resistance to foreign invaders. Even while the military actions were ongoing, the U.S. Agency for International Development established a "five-point assistance strategy for Afghanistan: reduce death rates; minimize population movements; lower then stabilize food prices; ensure aid reaches those it is intended for; and, begin developmental relief programs."[47] This type of activity, which exploited knowledge of the social and economic systems, allowed the U.S. to weaken the linkage between the Taliban and the general population, and to reduce the impact of the destruction resulting from the air and missile operations.

Despite the increased awareness of the connections between elements in the political, economic, military, and social systems, not all secondary effects were anticipated. Largely for ethnic and religious reasons, the Iranian government had distanced itself from the Taliban regime and established ties with Ismail Khan (a Tajik-Shiite). However, once Northern Alliance forces led by other warlords threatened Mazar-i Sharif, Iran reassessed their allegiance. By 8 November, some U.S. officials believed that the Iranians might have switched sides and gone over to the Taliban.[48]

Another issue was the unintended civilian casualties resulting from attacks on military targets. An extensive study suggests "a level of civilian fatalities in Afghanistan

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47. George W. Bush, "The Global War on Terrorism: The First Hundred Days," (Washington, DC: The Coalition Information Centers, 2002), 16, http://www.whitehouse.gov/news/releases/2001/ 12/ 100dayreport.pdf (accessed 2 March 2005).

48. Woodward, *Bush at War*, 298. The connections between Ismail Khan and the Iranian Revolutionary Guard Corps were well known, however, Iranian fears over the U.S. gaining a foothold in the region took precedence over loyalty to former clients. However, by November, there was little that Iran could do to rescue the Taliban regime.

greater that that experienced in the 1999 Kosovo war."[49] Analysts attribute this to

different objectives, more limited target intelligence, and a more dynamic battlefield with

more synergy between ground and air forces.

U.S. planners recognized that every Afghan non-combatant fatality weakened the

solidarity of the coalition.[50] The use of cluster munitions also had a tragic effect. On

occasion, explosives believed to be humanitarian packages were picked up by hungry

Afghans, with appalling results. Table 12 provides some examples of unintended

secondary effects that ran counter to stated U.S. objectives.

Table 12. Unintended Secondary Effects

Node	Intended effect	Secondary Effect	Comment
Mazar-i Sharif	Removal of Taliban regime	Iranian support for Taliban	Iranian concerns over U.S. foothold
Refugees	Survival/Support	Casualties	Confusion with unexploded ordnance
Mullah Omar	Remove Taliban from power	Increased supply of heroin	Lack of planning for alternatives
		Breakdown of local government	
Ismail Khan	Strengthen for use against Taliban	Post conflict autonomous power	Threat to interim government

Although the Bush security advisors expertly managed the warlords of the

Northern Alliance during the period of active combat, they were less adroit in controlling

49. Carl Conetta, "Operation Enduring Freedom: Why a Higher Rate of Civilian Bombing Casualties," Project of Defense Alternatives, 18 January 2002, 2, http://www.comw.org/pda/0201oef.html (accessed 2 March 2005). He uses sources that estimate that there were 1000-1300 civilian casualties as compared to 500 in Kosovo. This equates to one death for every 12 bombs or missiles expended, compared to one civilian fatality for every 46 bombs dropped in the Balkan campaign (ibid., 6).

50. Michael Griffin, Reaping the Whirlwind: Afghanistan, Al Qa'ida and the Holy War (Sterling,VA: Pluto Press, 2003), 287. These Human Daily Rations (HDRs) were designed to conform to Muslim dietary restrictions.

the post-conflict political situation. Having embellished the power of the warlords, and concurrently removed the existing regime, U.S. actions created a power vacuum that resulted in powerful militias without direct allegiance to any central authority.[51] This resulted in conditions, in some cases, as bad as during the Taliban reign. The Human Rights Watch claimed, "Human Rights abuses in Afghanistan are being committed by gunmen and warlords who were propelled into power by the United States and its coalition partners after the Taliban fell in 2001."[52]

Despite their many undesirable characteristics, the Taliban were relatively successful in dramatically reducing opium production in Afghanistan. Once they departed the scene, drug production almost immediately returned to and subsequently exceeded pre-2000 levels.[53] While some increase in production was expected, the elimination of strict Taliban enforcement and the lack of a viable alternative government once they were removed made opium poppy cultivation an attractive, if not the only option available to Afghan farmers. The U.S. did not establish viable alternatives to it. However, lack of success does not connote lack of attempts. U.S. humanitarian funding for Afghanistan in the October-November 2001 timeframe alone exceeded $250 million.[54]

Ex post facto identification of instances of unintended secondary effects is simple; anticipation during the heat of combat is not. Despite these and other occurrences, the

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51.The existence of private militia has been a primary danger to the interim government in Afghanistan. In September 2004, President Hamid Kharzai was successful in removing Khan as Governor of Herat.

52. Human Rights Watch, "Afghanistan: Warlords Implicated in New Abuses," 29 July 2003 http://www.hrw.org/press/2003/07/afghan072903.htm (accessed 22 March 2005). See also N.C. Aizenman, "Afghan Crime Wave Breeds Nostalgia for Taliban," *Washington Post*, 17 March 2005, http://www.washingtonpost.com/ac2/wp-dyn/a45302-2005mar17 (accessed 22 March 2005).

53. In 2000 an estimated 82,000 hectares were under cultivation. This was reduced to 7,600 in 2001, but rose to 80,000 in 2003 and 131,000 in 2004. United Nations, UN Office on Drugs and Crime, "Summary Finding on Opium Trends in Afghanistan," http://www.unodc.org/pdf/ afghanistan-2005_summary_opium-afghanistan-2005.pdf (accessed 2 March 2005).

54. U.S. Department of State, Fact Sheet, "Summary of U.S. Assistance to the Afghan People since Oct. 1, 2001," 23 November 2001, http://www.state.gov/r/pa/prs/ps/2001/6303).htm (accessed 4 March 2005). Nearly half of these totals were the Defense Department food drops, consisting of over 1,175,000 HDR's.

number of unintended effects of actions appears to be smaller than in the Kosovo operation. Multiple variables exist; however, it is reasonable to conclude that a better understanding of the connections elements within the political and social systems were a factor in this consequence.

Summation

The primary objective of this chapter was to illustrate the application of the principles of a system of systems analysis in a milieu that was significantly different from both Somalia and Kosovo. Somalia and Afghanistan were similar in that they both occurred in failed or collapsed states. Clans and tribes comprise the foundation of both societies; however, Somalia is homogeneous, while Afghan society is diverse. Although separated by only two years, coercive operations in Yugoslavia and Afghanistan were conducted against a dramatically different adversary in a vastly dissimilar geographic and political environment. However, in both cases, decision-makers achieved some of their objectives through an approach that considered the opponent from a holistic perspective. In the Afghan scenario, this utilization was more evident.

As the American offensive military operations concluded and organized Taliban resistance collapsed, President Bush observed: "Our intelligence professionals and special forces have cooperated with battle-friendly Afghan forces—fighters who know the terrain, who know the Taliban, and who understand the local culture."[55] Successes in this phase of Enduring Freedom were due largely to this degree of understanding of the adversary. Linkages beyond the borders were also important. American decision-makers

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55. George W. Bush, "Remarks by the President at the Citadel, South Carolina, 11 December 2001," White House, Office of the Press Secretary, http://www.whitehouse.gov/news/releases/2001/12/20011211-6.htm (accessed 2 March 2005).

recognized Pakistan's Musharraf as a key political node. Severing the connections between the Pashtuns in the Pakistani intelligence service and the predominantly Pashtun Taliban was a critical element in the rapid military victories.

By 11 December, the objectives that were stated two months earlier, i.e., destruction of the Taliban military and the denial of Afghanistan as a base for terrorists were attained. Despite the immense difficulties encountered, the U.S. actions were almost totally successful. O' Hanlon's depiction of Enduring Freedom as "a masterpiece of military creativity and finesse" is supportable by the evidence.[56]

A more complete understanding of the antagonist was a factor in this result. American planners were aware that loyalty in Afghanistan was principally to tribe and clan, rather than to any central government. This appreciation, combined with awareness of the acceptability and tradition of changing sides in a conflict, allowed for expectations that small victories could result in significant advantages as perceptions of the tide of the battle shifted. Although acceptance of bribes to change allegiance could be considered to be treacherous by Western standards, CIA operatives achieved many of their objectives with suitcases of cash instead of cruise missiles. This reduced the potential for harmful secondary effects inherent in kinetic attacks.

The skillful use of American Special Forces embedded within Northern Alliance forces and an expert coordination of air and ground power certainly also contributed to the successes.[57] However, these actions were dependent upon target intelligence and an

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56. O'Hanlon, "Flawed Masterpiece:" 47. He contends that it will be remembered as "one of the greater military successes of the twenty-first century" (ibid., 63).

57. President Bush asserted, "This combination—real-time intelligence, local allied forces, special forces, and precision air power—has really never been used before. The conflict in Afghanistan has taught us more about the future of our military than a decade of blue ribbon panels and think-tank symposiums." See Bush, "Remarks by the President at the Citadel." Steven Biddle, "Afghanistan and the Future of Warfare," *Foreign Affairs* 82, no. 2 (March/April 2003): 32, does not agree with those who assert that the

understanding of the adversary's culture and social interrelationships. Appreciating Afghan sensitivities to foreign troops, Special Forces often donned local apparel and means of transport. The U.S. took advantage of the connections between warlords that existed during the Soviet occupation. The ethnic diversity, suspicions and jealousies among the warlords who made up the Northern Alliance was appreciated, and efforts were made to maintain and strengthen this fragile coalition. The Afghan concept that the "enemy of my enemy is my friend" was appreciated and successfully incorporated into the strategy.

An understanding of the financial support and connections to al Qaeda and the Taliban was recognized and exploited. Treasury Department and Federal Bureau of Investigation efforts to cut off financial support through non-governmental organizations met with some limited success.[58] Therefore, the use of the principles of a system of systems analysis contributed to the successes of the operations that took place between October and December of 2001. However, these objectives were relatively limited in scope.

The primary objective had always been Osama bin Laden "dead or alive." Although denied a geographic base of operations and much of its source of funding, al Qaeda remains an acknowledged threat, and its founder, as well as his protector Mullah Omar, remains at large despite enormous efforts. The merits of going after the key leadership of the Taliban are arguable. Pape does not view decapitation strategies as

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Afghan model represents new way of warfare, Rather he asserts that the war "was much more orthodox, and less revolutionary, than most now believe."

58. Central Intelligence Agency, "Annual Report of the United States Intelligence Community, Support to the War on Terrorism and Homeland Security 2002," http://www.cia.gov/cia/reports/ann_rpt_2002/swtandhs.html (accessed 4 March 2005).

effectual and contends that any attempts to kill Omar proved to be largely ineffective.[59] The question of the broader effect of the killing or capture of bin Laden on the terrorist threat against the United States is equally contentious.

In Afghanistan, the holistic understanding of the adversary and the connections between elements within and across system boundaries contributed to a more efficient campaign at achievement of objectives. However, those objectives were limited to only one phase of the campaign.

President Bush was reportedly frustrated by the lack of an existing plan for Afghanistan. With constant pressure on them, defense officials and Central Command planners, hurriedly built the plan *after* 9/11. An existing assessment of Afghanistan using the system of systems construct could have been useful in commencing the operation sooner. However, the major benefit would have been in the phase that followed the removal of the Taliban.

Despite reluctance of the Bush national security team to use the military in nation building roles, it is clear that the U.S. cannot afford to make the same mistake of disengagement that it did in 1989. Although the use of the system of systems construct provided benefits during the active military campaign, its principles may be even more useful in the more difficult and demanding task of establishing an economically viable, socially diverse, and democratically governed nation of Afghanistan.

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59. Robert Pape, "The True Worth of Air Power," *Foreign Affairs* 83, no. 2 (March/April 2004): 116-17. He concludes that the combining of air and ground power continues to be a winning strategy. Steve Coll, *Ghost Wars* (New York: The Penguin Press, 2004), 287-88, provides an insightful appraisal of the enigmatic Pashtun, Omar, who seems to be an unlikely candidate to lead a radical movement.

CHAPTER IX

CONCLUSIONS

An objective of this study is to determine if a multi-disciplinary approach to
assessments can contribute to a holistic understanding of overall systems of national
power. The product is a process and a methodology framework that provides a tool for
the decision-maker in anticipating the effects of coercive actions. The benefits are an
increased likelihood of attainment of objectives through more efficient application of
coercive power. Additionally, the methodology contributes to an ability to anticipate the
secondary effects resulting from those actions.

I organized this dissertation around three fundamental and interrelated questions:
(1) Can the processes and capabilities through which a nation accomplishes its overall
objectives be considered complex and nonlinear?
(2) Can the principles of nonlinearity that are used to describe and understand physical
systems be applied to non-physical systems? and,
(3) If national systems of power are complex and nonlinear, and if a systems approach is
useful to understanding physical systems, then can the application of the principles
derived from studies in diverse academic disciplines provide a metaphor or model that
could contribute to the understanding of national systems of power?

I have illustrated that national power operates, in both structure and function, as
an open complex system, and that system models developed in mathematics and the
physical sciences provide a paradigm for enhanced understanding of all nonlinear
systems. Subsequently, I concluded that utilization of such an approach provides a

metaphor or model for increased understanding of the systems and the secondary effects of actions taken to influence those systems.

Chapter II introduced concepts of national power and the means that historically have been used to influence it. This required a brief examination of the theoretical foundations, components, and uses of coercion. The contention that nations are likely to continue to exert coercive power is independent of the justification or motivation for the actions. Hence, the moral aspects are not at issue here. Historically, stated rationales have ranged from self-serving conquest and economic dominance, to altruistic peacekeeping and humanitarian relief. While analysis, evaluation, and debate over jus ad bellum and the moral right of nations to intervene in the affairs of others are important considerations in the study of relations between nations, they are not a topic of this inquiry.

The observation most relevant to this study is that the elements of power are not universally fungible; however, they characteristically are interconnected. While constituent parts of power may be isolated and identified, they are invariably linked to others. These multiple connections make the system complex. The important deduction is that the relationships between elements within complex systems of national power are not amenable to linear analysis. Therefore, an improved method of conducting assessments is required.

This realization segued to the examination of nonlinearity, including chaos and complexity theories, which I presented in Chapter III to determine if these approaches had applicability to the task of understanding national systems of power. I illustrated how the integration of perspectives on complexity provides a promising path for further

analysis and concluded that the complex adaptive system provides the most appropriate model upon which to base assessments.

Further progress required an examination of systems theory in order to determine which components could be applied to the task set forth in the hypothesis. In Chapter IV, I described how the sources of national power could be examined and better understood through utilization of a systems approach. However, even if it is insightful, a model is inadequate if it does not provide any practical value to the decision-maker. Therefore, in Chapter V, I proposed a methodology, based on a system of systems construct, which utilizes the applicable components of systems theory in the context of assessments of national power. I contend that employment of this process can provide a means through which a more holistic understanding of the system may be attained, as well as some limited capability to anticipate the secondary effects of actions.

The task of supporting this argument is challenging; empirical data that can provide irrefutable evidence are not available. Accepting that limitation, I relied on an *ex post* illustration of how the fundamentals of the construct were utilized, albeit without the overt recognition or cognizance of the involved decision-makers. However, since these principles have been frequently utilized, an extensive intellectual reach was not required. Knowledge of the adversary has been an element of conflict since the days of Sun Tzu, Genghis Khan, and Alexander the Great.

What is missing, and the contribution that I attempt to make, is the application of commonly held tenets into an organized and coherent methodology that provides a structure and a framework for assessments of national power. This could serve to fill a void in the knowledge base available to decision-makers, and represents the primary

purpose of this undertaking. However, prior to identification of the impact of adoption of the proposed process, a brief recapitulation of the limitations of current approaches and hence the justification for this study is warranted.

Rationalization Revisited

Nations apply power in order to influence the systems of other states. I illustrated that power is comprised of more than a summation of military assets. Hence, a calculus that considers the political, economic, military, and social systems as interrelated elements of an overall system of power is critical to the assessment. Importantly, the overall system of power is different from the sum of the parts. Therefore, a construct that can enhance the level of comprehension of the functioning of that system can contribute to more effective and efficient attainment of objectives. An effective utilization of such an approach requires an understanding of the systems to be acted upon, especially in the interrelationships between elements within and across the systems.

The objective of the process and methodology presented in Chapter V is to provide a tool that could mitigate existing analysis shortfalls. Since there are no examples of overt utilization of the proposed methodology, I relied on an alternative means to demonstrate the potential value of the construct. Using three case studies, I illustrated how elements of the system of systems construct were utilized, albeit not explicitly, in three distinct scenarios. The reasons for the varied degrees of success of these operations are themselves complex, and have been the object of extensive analysis.

In these scenarios, I identified instances of the utilization of the principles of the systems of systems approach, and examples where the decision-maker was provided with

advantages. These benefits were: (1) amplification of the effects of actions; (2) indication of possible secondary effects; and, (3) recognition of alternative actions. The section that follows amalgamates and integrates the previously presented observations in order to illustrate how these advantages were evident in three significantly different scenarios.

Synthesis of The Case Studies

The important conclusion from these case studies is that the principles of the approach are applicable to accomplishment of a wide variety of objectives in diverse geopolitical environments. Each of the interventions, which were examined independently, provided examples where the benefits associated with the system of systems construct were attained. The key principles of the approach are: (1) nations operate as complex adaptive systems; (2) understanding of the structure and functioning of these systems is critical to assessments; and, (3) linkages between entities (actors) within and across systems provides a foundation for a holistic assessment of the potential effect of coercive actions. The particular case studies were selected since they provided a diverse set of illustrations upon which to base the claim of applicability beyond a single intervention. The differences between the three are summarized in Table 13.

From a holistic perspective, and despite the differences across all the systems of power, these cases provide examples of utilization of the basic principles of the system of systems construct. That is, regardless of the type of political organization, extent of industrial development, level of military modernization, and nature of cultural foundation, a basic understanding of the structure and the functions of the systems and the interactions could be extracted. Additionally, the model appears to be appropriate

independent of the organization applying the coercive force—be it the UN, NATO, or a

single nation.

Table 13. Comparison of the Systems of Power

System	Somalia 1992-95	Yugoslavia 1999	Afghanistan 2001
Political	No functioning government Unstable political movements Vision of a Greater Somalia extending beyond current borders	Internationally recognized government Authoritarian, but democratically elected regime Sophisticated bureaucratic structure Multiple parties Tradition of strong central government Separatist movement in Kosovo	No recognition by international bodies Regime not in complete control of territory Strict Theocracy Unskilled and inexperienced management Active autonomous militias (warlords) Tradition of dispersed political power
Economic	Most industry defunct Limited agricultural exports Near total dependence upon foreign assistance Bandit economy	Weak, but functioning economy Industry resource dependent Fixed infrastructure Limited international trade	Subsistence level Bazaar economy Primitive road networks Smuggling and drugs the primary means of foreign trade
Military	Loose loyalty to more powerful warlords Independent armed bands Varied level of connections between military and clan leadership	Armed Forces loyal to political leadership Modern air defenses Mechanized ground forces High level of tactical proficiency	Primary loyalty to tribe and warlord Poorly equipped and supported Limited armor and mechanized units Tradition of shifting allegiances
Social	Single ethnic group Complex clan, tribe and family relationships Primary loyalty based on clan affiliation	Western Homogeneous population, predominantly Christian and Slavic (outside Kosovo) High educational and literacy levels	South Asian Islamic Multiple and sizeable ethnic groups Tribal based Extremely low education and literacy levels

An important characteristic of the system of systems approach is that the methodology has near universal applicability. The foundation of the analysis and the logic behind the process that produces the assessments remains apposite regardless of the type of political structure under examination. The three case studies provided illustrations of the applicability of the methodology to a range of regime types. The Afghanistan study includes a political regime as well as a non-state actor. While the extremes of the political spectrum were not examined in the case studies, there would be no essential difference between the use of the methodology in assessments of a fascist dictatorship or a modern liberal democracy.

This aspect of the methodology provides additional advantages as well as inherent dangers. An examination of a nation's own systems of power would provide valuable insights. Those engaged in the protection of vital infrastructure and broader aspects of homeland security could utilize the tenets of the system of systems approach as an aid in determination of key vulnerabilities. As stated earlier, the construct and principles are amoral and may be applied for the most noble or most iniquitous purposes. The danger is that adversaries could also use the principles of the construct in planning terrorist activities. Due to their dependence on complex information systems, modern and highly developed economic systems are particularly susceptible to outside attack. Hence, industrialized nations fear intrusion into their commercial networks and have applied significant assets to cyber defense.

The primary purpose of the case studies was to illustrate the principles of the system of systems construct by using data from actual operations. The proposed methodology is based on the presumption that the quality of decisions is dependent upon

the level of understanding of the systems and the relationships between elements. However, decisions in a crisis are rarely made in isolation; multiple other imperatives influence the process. Hence, the task is not to evaluate the policy decisions, but rather to demonstrate how use of the principles of the construct contributed to an enhanced level of understanding. Previous chapters explored each of the scenarios in some detail. However, in order to reinforce the assertion of wide applicability, I will provide a summation of the key elements of the cases as they relate to the assessment process.

Somalia

The environment was a collapsed state with non-functioning systems. Somalia itself was not an adversary; there simply was no government to coerce. In this political vacuum, armed bands ranging from organized militia to roving gangs of teenage thieves vied for power. This internal conflict exacerbated the effects of famine resulting in tens of thousands of Somalis dying of disease and hunger. The intervention was designed to confront this humanitarian disaster, sanctioned and sponsored by the largest and most inclusive multinational organization, and carried out by military forces provided by its most powerful member nation. Therefore, it provides an appropriate test to determine if the construct can be applied to attempts to influence the most undeveloped and fragile systems.

The study revealed occasions of recognition of the importance of understanding the systems, and examples of a focus on specific nodes, as well a consideration of possible secondary effects. The close alignment and extensive overlap between the social, political and military systems in Somalia presented challenges, since actions taken to

influence one system invariably produced effects in the others. Characterization of figures such as Aideed and Ali Mahdi as nodes within a single system was problematic since they were key figures in each system. However, it was apparent that they were considered key actors and much of the UN. and U.S. actions were directed at them.

Among the important lessons from this intervention is that when actions are taken to influence a system, the entity taking that action becomes a part of that altered system. Due to the lack of a government in Somalia and the scale of the military and civilian agency presence, the UN. dominated the political, military, and economic systems, significantly altering the means of operation. When the supports were withdrawn, the system, not surprisingly, collapsed.

The efforts of Mohamed Sahnoun and Robert Oakley reflected an appreciation for the Somali social system and its linkages to the political and military systems. However, for a variety of reasons, including the lack of clearly defined objectives and the political will to achieve them, these insights were not fully exploited and the overall objectives of the intervention were not achieved. Their efforts were notable for the consideration of the larger impact of their actions and the recognition that the belligerents could be influenced by means other than direct military confrontation. However, after the departure of Oakley and Sahnoun from the scene and the June 1993 attacks on the Pakistani troops, Aideed transformed from a partner to an antagonist, and attrition of the adversary became a primary UN. objective. The force-on-force operations that followed resulted in casualties beyond what the United States was willing to accept, and led to the almost immediate decision to withdraw from the operation.

Aideed was the military node. He was connected to the populace of Mogadishu. The attacks on Aideed's forces produced the unintended effect of reinforcing his stature and support among the local population. When the actions taken to influence the node (Aideed) changed from persuade, flatter and support to capture or destroy, the secondary effects also changed. This was manifested in the celebrations and mutilations of the bodies of the American soldiers, which was vividly displayed by the American media. Consequently, The Battle of Mogadishu had an impact on the systems of power of the United States, just as it did in Somalia. This illustrates an important consequence of coercive actions. This secondary and unintended effect was to extend into the next operation.

Kosovo

The Kosovo operation was undertaken by the NATO alliance with the objective of precluding the continuation of ethnic cleansing within the borders of a sovereign UN. member nation. Its legal basis was a set of UN. Security Council Resolutions, but the intervention was not organized as a UN. force as in Somalia. The task was to influence the behavior of the political leadership in a relatively modern and developed European nation. The initial and relatively ineffective actions that targeted the Serb ground forces suggest that those directing and planning the campaign did not possess, or failed to optimally utilize, an understanding of the Serb culture, military traditions, and capabilities. Attacks on Serb ground forces in Kosovo were largely unproductive, and may have actually increased the level of violence against the Kosovars. The related

attacks on military infrastructure in Serbia proper had a minimal impact on and contributed little to the attainment of NATO's stated objectives.

As a result of lessons accrued earlier in the decade from the successes achieved in Operation Desert Storm against the Iraqi military, U.S. and allied planners made effective use of the connections between military nodes. The Yugoslav integrated air defense system was expeditiously neutralized, and attacks on logistics and support activities were steadily achieving the desired effect on Serb military capabilities. However, NATO planners did not exploit the linkages between the economic and political systems until later in the conflict. When they eventually utilized it, this knowledge was useful in achievement of the stated objectives.

An advantage of the system of systems construct is identification of alternative actions and the multiplication of the effect of actions. These were realized in the later stages of the bombing campaign. Milosevic was the key decision-maker and therefore a key node to be influenced. However, there were limited means of acting directly against him, so a NATO employed a strategy that exploited knowledge of connections. The destruction of commercial entities controlled by the family and political supporters of Milosevic are claimed to be factors in his eventual capitulation. Actions against economic and social nodes provided alternate paths to the major political node—Milosevic. Another indirect approach was manifested in NATO diplomatic actions to influence an external node, Chernomyrdin, who was able to play an important role in the eventual outcome, due to his connections to Milosevic.

It is apparent that the secondary effects of actions were also a consideration of NATO planners. However, they did not always correctly assess the effect of the bombing

operations on internal support for Milosevic. Nevertheless, it was a consideration. The use of non-explosive devices to disrupt electrical power displayed NATO concerns for permanent impact on the Yugoslav economy, collateral damage, and civilian casualties. The objective also was to minimize the secondary effects on the political systems of the NATO member nations. As asserted earlier, the coercing nation, alliance, or coalition can become a part of the system it is attempting to influence. Additionally, it is possible for these actions to have an influence on the systems of the nation taking the actions.

An unintended secondary effect of the Somalia operation on the U.S. political system emerged in Kosovo. Due in part to the Somalia experience, avoidance of alliance military casualties was a primary consideration of operation planners. U.S. decision-makers appreciated the secondary effects on its political system that resulted from media images of prisoners and mutilated bodies of servicemen. The requirement to conduct aerial bombing from higher altitudes to preclude loss of aircraft and crewmen degraded the ability of NATO tactical aircraft to attack Serb ground forces. Milosevic reportedly believed that NATO distaste for combat casualties would mean that there would be no ground operation to support the air campaign. This confidence allegedly strengthened his resolve. Convinced that he could wait for NATO to tire and become frustrated, he hoped that public opinion in the NATO nations would turn against the military action. As the leader of a complex and adaptive system, he was not passive in this regard and strove to exploit every possible instance of collateral damage and civilian casualties.

Since Kosovo was such a dissimilar environment, and the systems to be influenced were far more complex and developed, it is not possible to declare with a great deal of certainty that the lessons of the failures in Somalia contributed to additional use of

elements of the system of systems construct in Kosovo. However, it is apparent that NATO planners possessed a better understanding of the systems of power in Yugoslavia, that they understood connections between the nodes within and across systems, and that when they exploited this knowledge, objectives were more readily achieved.

Afghanistan

The primarily U.S. operation in Afghanistan utilized a holistic understanding of the system of power in a failed Central Asian state that had been under the economic and political influence of a non-state actor. Decision-makers made use of the knowledge of Afghan culture, the multi-system characterization of the warlords in Afghan society, the fragile state of the economy, and the transitory quality of political and military loyalties. More so than in the previous scenarios, uses of the principles of the system of systems construct were more evident.

Upon initial investigation, the systems of Somalia and Afghanistan appear similar: Islamic, loyalties based on clan and tribe, technologically undeveloped, subsistence economies, low literacy, nomadic populations, and independent militias led by warlords. However, U.S. objectives were dramatically different: feeding the starving masses in Somalia; regime removal in Afghanistan. The major factor was the radically changed security situation in which the Afghan system operated in late 2001. The attacks of 9-11 had radically altered the geo-political environment. Actions that were readily supported in Afghanistan would have been politically unacceptable in the previous scenarios.

The Taliban had not attacked the United States and murdered thousands of its citizens. However, their refusal to apprehend and deliver the perpetrators of the attacks

made them unequivocally an adversary. There was little discussion of influencing their behavior. The fury over the attacks on Washington and New York and the desire for retaliation meant that the objective was the forceful removal of the Taliban. In this respect, the Afghanistan campaign was similar to a war for national survival. Hence, a traditional attrition campaign, employing the overwhelming power of the U.S. military could have been conducted. However, American policy-makers adopted an alternative, effects-based approach.

Selection of the nodes was not difficult; the means to attack them without massive destruction and undesired effects on Afghan society was the limiting factor. Being resource limited in the area proved to be an advantage. Instead of a Gulf War style massive build-up and land invasion preceded by an intense air campaign, the U.S. adopted a different approach. This strategy required an understanding of the Afghan culture, history and its social system to be effectively employed. Fortunately, from the American perspective, this knowledge existed and was effectively exploited. On scene operatives understood the propensity of Afghans to change sides as the fortunes of war shifted. The amplification of effects of turning a single warlord was effectively utilized.

Since the attacks had such widespread support and Afghanistan had very little infrastructure that could be damaged, secondary effects were not as large of a considerations as in Kosovo. While hundreds of Afghan civilians were reportedly killed by the U.S. actions, still fresh images of collapsing skyscrapers made this less of a factor in internal U.S. politics. The major warlords of the Northern Alliance—Rabbani, Ismail Khan and Dostum—were the primary nodes. The action was to support them militarily and economically. This produced the cascading effect of bring lesser warlords and

militias into the anti-Taliban alliance. This also amplified the effects of actions, since small military victories often resulted in massive defections of Taliban supporters.

Exploitation of node-to-node linkages also was not confined to the borders of Afghanistan. The connections between Mullah Omar and the head of the Pakistani Inter-Services Intelligence (ISI) directorate were recognized and acted upon, albeit with indirect effects. The principal node in this case was Pakistani President Musharraf, who replaced the ISI chief and cut the linkages and support to the Taliban. The financial connections between al Qaeda and the Taliban were identified and severed, denying the Taliban leadership of much of their economic base.

I have illustrated that the principles of the system of systems construct were applied in all three scenarios. Over a ten-year period, these principles were utilized more often, and their benefits were increasingly accrued. Their use provided the reward of amplification of the effects of actions, indication of possible secondary effects, and recognition of alternative actions. Post event analysis allows for identification of instances where the approach could have been more extensively and effectively employed.[1] The common element is that in all three cases, objectives may have been more readily achieved through a better understanding of the adversary and the environment. Again, there is nothing radically innovative here; few would refute that contention. The new assertion is that a systematic approach that recognizes the importance of the relationships between entities within and across systems and provides a

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1. These observations are not a critique of the commanders and planners of the operations, who were under significant political pressure and constraints. They were making decisions with the best information available to them, without the benefit of knowing the reactions of the adversaries or the eventual outcome of the campaign.

holistic perspective makes achievement of this requisite understanding an achievable goal.

These case studies focused on the periods when offensive military operations represented the principle coercive actions. When the military aspects of the operation are isolated, the objectives were for the most part attained. Despite the casualties in the Battle of Mogadishu, the UNOSOM and supporting U.S. forces were never in danger of being defeated militarily. Milosevic has been removed and the organized murder and eviction of ethnic Albanians in Kosovo has ceased. The Taliban is no longer in power, its remnants are widely dispersed and Osama bin Laden is a fugitive in hiding.

However, more than ten years after the withdrawal of UNOSOM II, Somalia remains essentially a stateless society, and susceptible to influence by organized terrorist elements. Kosovo is relatively stable, but only due to the presence of a NATO peacekeeping force, six years after the conclusion of the bombing missions. The primary antagonist, Slobodan Milosevic awaits the deliberations of the International Criminal Tribunal for the Former Yugoslavia, but Kosovo has been effectively "cleansed" of its former Serb occupants and the fundamental issues of power in Kosovo remain unsolved. While the Taliban has been removed from power and most al Qaeda operatives are now fugitives without a permanent geographic base, a sizeable U.S. force, in concert with the International Security Assistance Force (ISAF) will remain in Afghanistan for the indefinite future.

In all three cases, the coercive actions taken to influence the systems of the target nation were at least partially successful. However, a common unintended effect was significantly altered systems that needed to be rebuilt. Herein is the greatest potential

benefit of a holistic knowledge of the systems of power. While useful when planning and conducting offensive military actions, the system of systems construct and the proposed methodology may prove to be of more value in the post active combat phases of the operation.

If the system was better understood, different actions may have been taken that could serve to minimize the deleterious secondary effects taken. These extend beyond the offensive military operations phases. For example, if the UN had possessed a better appreciation of the impact of its presence and of abandoning Somalia without a viable political system in place, the strategy and actions may have been different. Similarly, if the potential benefits of actions against economic nodes and their linkages to elements within the political system had been made earlier, the objectives may have been achieved without continued destruction in Kosovo. Identification of shortfalls after the fact is an easy task. The more difficult and important undertaking is attainment of a means to mitigate these reoccurring problems in the future. That is the objective of the next section.

Implications: What Must Be Done?

Appreciation that nations operate as complex adaptive systems, and that the elements that comprise these systems are interrelated, is an important realization. An essential first step is acceptance of the premise that an understanding of the adversary as a holistic system is beneficial. Over the period covered by the case studies, the apparent upward slope of the extent of utilization of the related principles suggests increased recognition of the potential rewards of such an approach. However, since an objective of

this study is to move beyond conceptualization and to provide practical tools for the decision-maker, the challenges to implementation must be considered. Exploitation will require enhanced capabilities, and adaptations in existing organizational structures and policies.

Capabilities

The methodology presented in Chapter V provides a framework. However, when implementation of the process is considered, several practical problems emerge. Chief among these is how to manage the immense trove of required information. That is, how can analysts determine the important interrelationships, and once they do, how can the potentially thousands of linkages be captured and handled to present some practical knowledge to the decision maker?

The importance of information on the adversary is nothing new. Intelligence agencies exist to do this. However, what is still needed is a process that collects, analyzes and synthesizes information across the political, economic, and, and as well as the military systems, and provides the critical holistic view. The problem is more than an ability to collect information. Rather it is the ability to manage the data and to transform it into actionable knowledge.

The use of connections and linkages between entities has been effectively employed in more recent operations. The eventual capture of Saddam Hussein is credited in part to the efforts of two junior intelligence analysts who plotted the connections between the deposed dictator and his family and supporters. This analysis reportedly was conducted using paper notebooks and presented on a handwritten chart.[2] Effective

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2. Farnaz Fassihi, "Two Novice Gumshoes Charted the Capture of Saddam Hussein, *The Wall Street Journal*, 18 December 2003. The depiction of the relationships, which included information on over 300

utilization of the approach will require tools that are more sophisticated. Many of these may already exist, and could be readily adapted for the specific analysis tasks. The rapid pace of software development makes identification of the optimum knowledge management and analysis tools itself a formidable task that will require dedicated and organized effort.

Advances in information technology make the knowledge management dilemma less daunting, but the inherent complications are immense and the difficulty in developing the adequate tools should not be underestimated. Likewise, maintenance and keeping current such a knowledge system is an enormous task. Decision support aids such as modeling and simulation, and structured argumentation tools will be required.

The discussion of systems in Chapter IV identified feedback as a critical element in the understanding of system behavior. A complex adaptive system is continuously responding to stimuli. Among these are the coercive actions taken to influence them. Development of measures of performance (how well the action was accomplished) and measures of effectiveness (how well the objective was accomplished, e.g., did the action have the desired impact on the node and hence the overall system?) is a challenging undertaking. In some cases, the problem is relatively uncomplicated. For example, battle damage assessment using sophisticated intelligence, surveillance, and reconnaissance capabilities may provide with some assurance whether an air attack on a bridge actually destroyed or damaged the node. To a lesser extent, determination of the attainment of the effect, e.g., insurgents unable to move forces from point A to point B is more problematic. In the political and social systems, determination of the effect of actions is

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individuals was credited with leading to a source who eventually provided the precise information that enabled the capture.

exceptionally difficult. Indeed the effect of the bombing of commercial enterprises in Yugoslavia on the behavior of Milosevic is still being debated. Since the process of coercive activity is dynamic, knowledge of the feedback loops within the system is an exceptionally confounding, but mandatory capability. This requirement mandates methods of intelligence collection beyond the abundant imagery and electronic surveillance resources.

Capabilities are comprised of more than equipment; the manner in which human and technology resources are applied is an equally important element. Hence, adaptation in concepts, doctrine, and processes also must be accomplished. The principal raison d'être for applying a system of systems construct to assessments of national power is an enhanced ability to achieve the desired effects that support attainment of overall objectives, as well as to anticipate the secondary effects of those actions. There is less incentive for a new approach if a traditional attrition based model is utilized. A recent trend in security thinking has been a movement toward focus on desired outcomes instead of actions. As part of its transformation efforts, the U.S. military is adopting effects-based operations as the model for future engagements.

This approach is more than a specific concept; rather it is a different way of looking at achievement of objectives. Its antithesis is the attrition paradigm where the primary considerations are actions conducted to destroy or degrade the target—often without a clear connection to the objective to be achieved. The value of effects centric thinking in determination of the potential cascading effects of military actions was demonstrated in the 1991 Gulf War. The classic example was the disruption of electrical power to an entire city through non-kinetic attacks on a very small umber of targets.

The same principles apply to uses of all national power resources, including diplomatic, information, and economic, as well as military assets.

Edward Smith takes this broader view and defines an effect as "a result or impact created by the application of military or other power."[3] Successful use of an effects based approach, where all elements of national power are employed, necessitates a holistic understanding of the adversary's system of power. This will require true integration of information gathering and dissemination procedures. However, as the ordeal of the post 9-11 efforts to develop processes for information sharing among varied intelligence agencies in the U.S. displayed, addressing the organizational and policy issues may be the more intimidating task.

Organization and Policy

Effective utilization of the system of systems construct will require a shift away from current structures for information collection, analysis, and dissemination that focus on individual systems. The common analogy is that of stovepipes, i.e., responsibility for specific information requirements assigned to particular agencies. In the U.S., for example, military, political, and economic collection is accomplished primarily in the Defense, State and Commerce Departments respectively. While suitable for information

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3 . Edward A. Smith, *Effects Based Operations: Applying Network Centric Warfare in Peace, Crisis and War* (Washington DC: DOD Command and Control Research Program, 2002), 111. He considers these efforts to be incomplete and that even after 9-11, U.S. approaches remain focused on "destruction of an opponents physical capacity to make war," and he contends, "it remains attrition based" (ibid., 17). This volume remains the basic text for an introduction to effects based operations. A U.S. DOD strategy document asserts that the goal of effects based operations is not physical attrition of the enemy, but rather "to induce an opponent to or an ally or a neutral to pursue a course of action consistent with our own security interests." U.S. Department of Defense, ""The National Military Strategy of the United States of America," 34.

collection, such structures make synthesizing information into actionable knowledge problematic. Realignment of assets to meet this requirement is already being undertaken.

One of the reoccurring themes from the investigation into intelligence failures arising from the attacks of September 11th is the conclusion that the degree of information sharing and level of coordination between intelligence agencies was inadequate.[4] This problem is exacerbated when working in a multinational context, since the sources of much of the required information are sensitive at the national level. The dilemma goes beyond the willingness to share information. The current structure, where agencies focus on their specific areas and are unwilling or unable to share information will not provide the requisite holistic view of the systems to be acted upon. The ability to share and synthesize information across the systems area is a critical enabler of a system of systems construct. However, increased information sharing, in itself, will not be sufficient for the methodology to be effectively employed.

Development of assessments based on a system of systems construct will require teams of analysts dedicated to the task. Governments will be unable or reluctant to augment the staffing levels of the agencies that will be responsible for the assessments. This will require internal reorganizations and realignment of existing assets between agencies; both tasks are normally painful processes. Effective utilization of the methodology will also require a diverse set of skills and expertise. Anthropologists, sociologists, psychologists, and economists must be incorporated into the process along

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4. Richard A. Best, Jr., "Intelligence Community Reorganization: Potential Effects on DOD Intelligence Agencies," CRS Report for Congress, 6, http://fpc.state.gov/documents/organization/21217.pdf. A goal is the fusing of information across the spectrum to provide a holistic view. "National Intelligence" is the term used for intelligence that is of concern to more than one department or agency and provides the basis for national security policymaking. A U.S. Senate study identifies systematic weaknesses in analyses "compounded by lack of information sharing." U.S. Congress, Senate, Select Committee on Intelligence, "Report on the U.S. Intelligence Community's Prewar Intelligence Assessments on Iraq," 7 July 2004, 108th Cong., 2nd sess., http://intelligence.senate.gov/iraqreport.2.pdf (accessed 1 April 2005).

with the more traditional physicists and military intelligence experts. Importantly,

constant dialogue between analysts must be accomplished. Enhanced communications

technology provides the option of dispersed but networked teams who need not be

physically collocated. In addition to these internal organizational transformations, the

traditional characterization of the objects of assessments must be reconsidered.

I have demonstrated how the system of systems approach can improve the

knowledge available to the decision-maker. While a critical element in the process,

enhanced knowledge is not in itself adequate to guarantee more effective decision-

making. The process through which policy is determined is itself exceptionally complex

and multiple elements may be factors in the ultimate decisions. While the Rational Actor

Model, which uses an analysis of aims and calculations of governments in explaining

decisions, appears to be the major beneficiary of enhanced knowledge of the system to be

influenced, alternate paradigms will also enter into the calculus. Graham Allison and

Philip Zelikow address other explanations, most notably the Government Politics Model.

They argue that there is no decision-making monolith, and that resolutions are the result

of bargaining among players in the governmental hierarchy.[5] Actions result from collages

of multiple interests from actors who focus on different issues.

A holistic understanding of the system can provide benefits regardless of the mix

of decision-making models that influence the process. I described several of these

advantages in the case studies. I also identified instances, notably in Somalia, where

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5. Graham Allison and Philip Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, Second ed. (New York: Addison-Wesley Educational Publishers, Inc., 1999). While the Cuban Missile Crisis provides the single case for illustration, the authors include an excellent presentation of the various models utilized to explain the decision-making process and their relationship to the major themes of international relations theory. For a similarly engaging presentation and application of theory using the 1991 Gulf War see Steven A. Yetiv, *Explaining Foreign Policy: U.S. Decision-Making in the Persian Gulf War* (Baltimore, MD: Johns Hopkins University Press, 2004).

superior knowledge was rendered ineffectual by flawed bureaucratic processes in the UN.

Hence, adoption of a system of systems approach to assessments does not represent the

complete solution. The approach does not solve decision-making pathologies; hence,

significant institutional reform is still required.

One area where organization and policy changes are evident is in the treatment of

entities that are not sovereign nations. Recently, and tragically for the United States, the

need for assessments of non-state actors has been made apparent. Al Qaeda is the

infamous and best-known example. Investigations into the organization have revealed

economic and social as well as military and political elements. In some areas, notably in

international funding, its economic system was as sophisticated and far-reaching as those

of several nations. Al Qaeda may be thought of as conducting its own foreign affairs.

"The role of the al-Qaeda network is apparently one of co-ordinating and supporting

various groups around the world that have a militant Islamist and anti-western agenda. As

a consequence, al-Qaeda has developed a global reach, with cells in up to 50 countries."[6]

Without question, its impact on international security has been as significant as any

nation's in the post cold war era. Due to its basic similarities to a sovereign nation, the

principles of the construct may be applied to al Qaeda as well.

The major difference is ownership of autonomous territory from which to operate.

Nevertheless, even non-state actors must be physically somewhere. As was made clear in

Afghanistan, a powerful non-state entity may be potent enough to dominate an existing

failed or collapsed state. The sizeable differences between non-state actors and sovereign

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6. House of Commons Library, "11 September 2001: the Response," Research Paper 01/72, 85, http://www.parliament.uk (accessed 1 April 2005). The study adds, "Mr. bin Laden and al-Qaeda have a broad ideological base, advocating a pan-Islamic, rather than a pan-Arab, approach. Ties with other groups reportedly cross sectarian lines, bringing together Sunnis in al-Qaeda with Shi'as belonging to Hizbollah in Lebanon."

nations cannot be ignored or discounted. However, the similarities are strong enough so that for purposes of assessments of power the system of systems construct also is appropriate for use when dealing with non-state actors.

The Way Ahead

The stated goal of this dissertation was to determine if a multi-disciplinary approach to assessments could contribute to a holistic understanding of national power. The examination of the principles of non-linearity in mathematics and physical systems resulted in the conclusion that nations (as well as some non-state actors) may be described as operating as complex adaptive systems. Hence, I displayed how a systems approach to assessments is an appropriate basis for development of an enhanced understanding of the functions of system elements as well as the interactions between entities within and across the systems that comprise national power. The proposed methodology provides the framework for a tool to assist decision-makers in understanding the effects of coercive actions.

While I assert this to be a worthwhile contribution, a framework does not in itself provide near-term practical benefits. Therefore, continued investigation into the use of the system of systems construct is needed if progress beyond the existing, and less than adequate, supply of tools available to the decision-maker is to emerge. The opportunities for follow-on research are many and myriad.

I have not provided empirical evidence that adoption of the system of systems construct will enhance decision-making. The case studies identified examples where the principles of the construct were utilized, and may have provided the purported

advantages, specifically the ability to better understand the effects of coercive actions. I

used these to illustrate the potential of the approach in dissimilar environments.

Individually, the examinations were not of sufficient depth to establish causation between

the use of the principles of the construct and better comprehension of system effects. The

analysis also was constrained by the limited amount of information about the decision

process. A dedicated and exhaustive reassessment of the cases when this information is

declassified and made available to researchers would be a valuable enterprise.

I acknowledge the vast scope of the effort that is required to resolve the

considerable organizational issues and knowledge management challenges. However,

while extensive, they are not insurmountable. The ongoing experimentation efforts in the

U.S. and NATO are developing and refining the processes and procedures to implement

the concept.[7] Movement beyond model, to produce capability has been the objective of

ongoing concept development and experimentation efforts. These programs provide the

means of confronting and resolving the practical problems that preclude wide adoption of

the construct.[8]

In conclusion, this analysis and proposed methodology provide a multi-

disciplinary approach to assessments of national power that could provide tangible

enhancements to the decision-making process. Adoption of the construct is required now

because the environment and consequently the nature of coercive power have changed. It

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7. The U.S. efforts center on the Operational Net Assessment (ONA) concept that is a process that "frames our understanding of a potential adversary's political, military, economic, social, information and infrastructure systems." Link analysis, network analysis, and structured argumentation are used to identify critical nods and vulnerabilities. United States Joint Forces Command, "About the Operational Net Assessment (ONA)," http://www.jfcom.mil/abaout/fact_ona.htm (accessed 15 April 2005).

8. The U.S. Joint Forces Command has conducted experimentation with a system of systems construct since mid-2001. Australia, Canada, France, Germany and the U.K. have participated in some of these efforts. NATO's Allied Command Transformation established its own, more limited system of systems experimentation program in 2005.

is possible now due to innovative approaches to military operations and advances in information technology. The framework represents only a necessary first step. Efforts in this area should be continued and expanded. The alternative is to continue to utilize processes and procedures that are inappropriate for assessments of the complex adaptive systems that characterize national power.

REFERENCES

Abbot, Spencer. "Airpower Strategy and the Problem of Coercion." In *Immaculate Warfare*, edited by Stephen D. Wrange. Westport, CT: Praeger, 2003.

Africa Watch Committee. *Somalia: A Government at War with Its Own People*. New York: Africa Watch Committee, 1990.

Aizenman, N.C. "Afghan Crime Wave Breeds Nostalgia for Taliban," *Washington Post*, 17 March 2005. http://www.washingtonpost.com/ac2/wp-dyn/a45302-2005mar17 (accessed 22 March 2005).

Alligood, Kathleen T., Tim D. Sauer, and James A. Yorke. *Chaos: An Introduction to Dynamical Systems*. New York: Springer Verlag New York, Inc., 1996.

Allison, Graham, and Philip Zelikow. *Essence of Decision: Explaining the Cuban Missile Crisis*. Second ed. New York: Addison-Wesley Educational Publishers, Inc., 1999.

Anastasijeic, Deyan. "Nation Builders: Western Leaders Want to Help Balkans Move from Self-Destruction to Reconstruction." *Time International*, August 1999.

Arkin, William R. "Operation Allied Force: The Most Precise Application of Air Power in History." In *War over Kosovo: Politics and Strategy in a Global Age*, edited by Andrew J. Bacevich and Eliot A. Cohen. New York: Columbia University Press, 2001.

Atkins, G. Pope. *Latin America in the International Political System*. Boulder, CO: Westview Press, 1995.

Austriaco, Nicanor. "Causality within Complexity." *The Journal of Interdisciplinary Studies* XI (1999): 141-56.

Axelrod, Robert. *The Complexity of Cooperation*. Princeton, NJ: Princeton University Press, 1997.

Axelrod, Robert, and Michael D. Cohen. *Harnessing Complexity*. New York: The Free Press, 1999.

Baldwin, David A. *Neorealism, Neoliberalism, the Contemporary Debate*. New York: Columbia University Press, 1993.

Bearce, David H. "Economic Sanctions and Neural Networks: Forecasting Effectiveness and Reconsidering Cooperation." In *Political Complexity: Nonlinear Models of Politics*, edited by Diana Richards. Ann Arbor: The University of Michigan Press, 2000.

Beasley, Ryan. "Collective Interpretations: How Problem Representations Aggregate in Foreign Policy Groups." In *Problem Representation in Foreign Policy Decision Making*, edited by Donald A. Sylvan and James F. Voss. Cambridge: Cambridge University Press, 1998.

Beaumont, Roger. *War, Chaos and History*. Westport, CT: Praeger, 1994.

———. *The Nazi's March to Chaos*. Westport, CT: Praeger, 2000.

Bender, Bryan. "US 'Soft Bombs' Prove NATO Point." *Janes Defence Weekly*, 12 May 1999.

Berlinski, David. *On Systems Analysis*. Cambridge, MA: The MIT Press, 1976.

Bertalanffy, Ludwig von. *General Systems Theory*. Revised ed. New York: George Braziller, 1969.

Best, Richard A., Jr. "Intelligence Community Reorganization: Potential Effects on DOD Intelligence Agencies, CRS Report for Congress." http://fpc.state.gov/documents/organization/21217.pdf.

Beyerchen, Alan. "Clausewitz, Nonlinearity, and the Unpredictability of War." *International Security* 17 (Winter 1992-93): 59-101.

———. "Clausewitz, Nonlinearity, and the Importance of Imagery." In *Complexity, Global Politics, and National Security*, edited by David S. Alberts and Thomas J. Czerwinski. Washington, DC: National Defense University, 1997.

Biddle, Stephen. "Afghanistan and the Future of Warfare." *Foreign Affairs* 82, no. 2 (March/April 2003): 31-46.

Bieber, Florian, and Zidas Daskalovski. *Understanding the War in Kosovo*. Portland, OR: Frank Cass Publishers, 2003.

Bolland, Kathleen A., and Charles R. Atherton. "Chaos Theory: An Alternative Approach to Social Work Practice and Research." *Families in Society: The Journal of Contemporary Human Services* 80, no. 4 (July-August 1999): 367-74.

Brons, Maria H. *Society, Security, Sovereignty and the State in Somalia: From Statelessness to Statelessness?* Utrecht, Netherlands: International Books, 2001.

Brune, Lester H. *The United States and Post-Cold War Interventions: Bush and Clinton in Somalia, Haiti and Bosnia 1992-1998*. Claremont, CA: Regina Books, 1998.

Bush, George W. "Presidential Address to the Nation, 7 October 2001," White House, Office of the Press Secretary. http://www.whitehouse.gov/news/releases/2001/10/20011007-8.htm (accessed 2 March 2005).

————. "Remarks by the President at the Citadel, South Carolina, 11 December 2001," White House, Office of the Press Secretary. http://www.whitehouse.gov/news/releases/2001/12/20011211-6.htm (accessed 2 March 2005).

————. "The Global War on Terrorism: The First Hundred Days." Washington, DC: The Coalition Information Centers, 2002. http://www.whitehouse.gov/news/releases/2001/12/100dayreport.pdf (accessed 2 March 2005).

Byman, Daniel, Matthew C. Waxman, and Eric V. Larson. *Air Power as a Coercive Instrument*. Santa Monica, CA: RAND, 1999.

Byrd, William, and Christopher Ward. "Drugs and Development in Afghanistan, Social Development Papers: Conflict Prevention and Reconstruction Paper No. 18 December 2004." New York: The World Bank, 2004.

Byrne, David. *Complexity Theory and the Social Sciences*. New York: Routledge, 1998.

Cable News Network. "Text of President Clinton Videotaped Address to the Serbian People, 26 March 1999." http://www.cnn.com/world/europe/9903/ 26/clinton.transcript/index.htm (accessed 13 February 2005).

Cambel, A. B. *Applied Chaos Theory: A Paradigm for Complexity*. Washington, DC: Academic Press, Inc., 1993.

Carpenter, Ted Galen. *NATO's Empty Victory*. Washington, DC: The Cato Institute, 2000.

Casti, John. *Nonlinear System Theory*. Orlando, FL: Academic Press, Inc., 1985.

Cederman, Lars-Eric. *Emergent Actors in World Politics*. Princeton, NJ: Princeton University Press, 1997.

Central Intelligence Agency. "The CIA Factbook." http://www.cia/publications/factbook (accessed 1 April 2005).

————. "Annual Report of the United States Intelligence Community, Support to the War on Terrorism and Homeland Security 2002." http://www.cia.gov/cia/ reports/Ann_Rpt_2002/swtandhs.html (accessed 4 March 2005).

Clark, Jeffrey. "Debacle in Somalia." *Foreign Affairs* 72, no. 1 (Winter 1993): 109-24.

Clarke, Walter, and Jeffrey Herbst. "Somalia and the Future of Humanitarian Intervention." In *Learning from Somalia*, edited by Walter Clarke and Jeffrey Herbst. Boulder, CO: Westview Press, 1995.

Clinton, Bill. "Somalia: Our Troops Will Leave by March 31, 1994." *Vital Speeches of the Day* 60, no. 2 (1 November 1993): 34-37.

————. "Statement of President Clinton on Kosovo 24 March 1999," White House, Office of Press Secretary, http://wwww.mthoyoke.edu/acad/intrel/bombkos.htm (accessed 13 February 2005).

Cohen, Jack, and Ian Stewart. *The Collapse of Chaos: Discovering Simplicity in a Complex World.* New York: Viking, 1994.

Coll, Steve. *Ghost Wars.* New York: The Penguin Press, 2004.

Conetta, Carl. "Operation Enduring Freedom: Why a Higher Rate of Civilian Bombing Casualties," Project of Defense Alternatives, 18 January 2002. http://www.comw.org/pda/0201oef.html (accessed 2 March 2005).

Cooper, Scott A. "Air Power and the Coercive Use of Force." In *Immaculate Warfare*, edited by Stephen D. Wrange. Westport, CT: Praeger, 2003.

Cordesman, Anthony H. *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo.* Westport, CT: Praeger, 2001.

————. *The War after the War: Strategic Lessons of Iraq and Afghanistan.* Washington: The CSIS Press, 2004.

————. "The Ongoing Lessons of Afghanistan: Warfighting, Intelligence, Force Transformation, and Nation Building." (Forthcoming), 6 May 2004 draft. http://www.csis.org (accessed 2 March 2005).

Coveny, Peter, and Roger Highfield. *Frontiers of Complexity.* New York: Fawcett Columbine, 1995.

Crocker, Chester A. "The Lessons of Somalia: Not Everything Went Wrong." *Foreign Affairs* 74, no. 3 (May/June 1995): 2-9.

Czerwinski, Tom. *Coping with the Bounds: Speculations on Nonlinearity in Military Affairs.* Washington, DC: The National Defense University, Institute for National Strategic Studies, 1998.

Daalder, Ivo H., and Michael E. O'Hanlon. *Winning Ugly: NATO's War to Save Kosovo.* Washington, DC: The Brookings Institution, 2000.

Daskalovski, Zidas. "Claims to Kosovo; Nationalism and Self-Determination." In *Understanding the War in Kosovo*, edited by Florian Bieber and Zidas Daskalovski. Portland, OR: Frank Cass Publishers, 2003.

Dauphinee, Elizabeth Allen. "Rambouillet: A Critical (Re) Assessment." In *Understanding the War in Kosovo*, edited by Florian Bieber and Zidas Daskalovski. Portland, OR: Frank Cass Publishers, 2003.

DeCarlo, Raymond A. *Linear Systems.* Englewood Cliffs, NJ: Prentice-Hall, Inc., 1989.

Defense Technical Information Center. "Joint Publication 3-1, Doctrine for Joint Operations." http://www.dtic.mil/doctrine/jel/new_pubs/jp1_01_1.pdf (accessed 22 March 2005).

Demchak, Chris C. "Complexity and Theory of Networked Militaries." In *The Sources of Military Change*, edited by Theo Farrell and Terry Terriff. Boulder, CO: Lynne Reinner Publishers, 2002.

Dempsey, Gary. "Headaches in Neighboring Countries." In *NATO's Empty Victory*, edited by Ted Galen Carpenter. Washington, DC: The Cato Institute, 2000.

Easton, David. *Varieties of Political Theory*. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1996.

Erlanger, Steven. "Bombing Unites Serb Army as It Debilitates Economy." *The New York Times*, 30 April 1999.

Europa World Yearbook 1992. London: Europa Publications, Inc., 1993.

Europa World Yearbook 1999. London: Europa Publications, Inc., 1999.

Fassihi, Farnaz. "Two Novice Gumshoes Charted the Capture of Saddam Hussein." *The Wall Street Journal*, 18 December 2003.

Faurre, Pierre, and Michel Depeyrot. *Elements of Systems Theory*. New York: North Holland Publishing Company, 1977.

Felker, Edward J. *Airpower, Chaos and Infrastructure: Lords of the Rings*. Maxwell Air Force Base, AL: Air University Press, 1998.

Forrester, Jay W. *Industrial Dynamics*. Cambridge, MA: The MIT Press, 1961.

————. *The Collected Papers of Jay W. Forrester*. Cambridge, MA: Wright-Allen Press, Inc., 1975.

Gallis, Paul E. "Kosovo: Lessons Learned from Operation Allied Force." Washington, DC: Congressional Research Service, 19 November 1999.

Gannon, Kathy. "Afghanistan Unbound." *Foreign Affairs* 83, no. 3 (May-June 2004): 35-46.

Gell-Mann, Murray. *The Quark and the Jaguar*. New York: W H. Freeman and Company, 1994.

————. "The Simple and the Complex." In *Complexity, Global Politics, and National Security*, edited by David S. Alberts and Thomas J. Czerwinski. Washington, DC: National Defense University, 1997.

George, Alexander L. *Forceful Persuasion: Coercive Diplomacy as an Alternative to War*. Washington, DC: United States Institute of Peace, 1991.

————. "Coercive Diplomacy: Definition and Characteristics." In *The Limits of Coercive Diplomacy*, edited by Alexander L. George, Boulder, CO: Westview Press, 1994.

George, Alexander L, David K. Hall, and William E. Simmons. *The Limits of Coercive Diplomacy: Laos, Cuba, Vietnam*. Boston: Little, Brown and Company, 1971.

Gilkes, Patrick. "From Peacekeeping to Peace Enforcement: The Somalia Precedent." *Middle East Report*, November-December 1993.

Gleick, James. *Chaos: Making a New Science*. New York: Viking Penguin Inc., 1987.

Goodson, Larry P. *Afghanistan's Endless War: State Failure, Regional Politics and the Rise of the Taliban*. Seattle: University of Washington Press, 2001.

Griffin, Michael. *Reaping the Whirlwind: Afghanistan, Al Qa'ida and the Holy War*. Sterling,VA: Pluto Press, 2003.

Guttier, Karen, Michael D. Wallace, and Peter Suedfeld. "The Integrative Complexity of American Decision Makers in the Cuban Missile Crisis." *The Journal of Conflict Resolution* 39, no. 4 (December 1995): 321-42.

Guzina, Dejan. "Kosovo or Kosova - Could It Be Both." In *Understanding the War in Kosovo*, edited by Florian Bieber and Zidas Daskalovski. Portland, OR: Frank Cass Publishers, 2003.

Guzzini, Stefan. "Structural Power: The Limits of Neorealist Power Analysis." *International Organization* 47, no. 3 (Summer 1993): 443-78.

Hardin, Garret. "The Cybernetics of Competition." *Perspectives in Biology and Medicine* 7 (Autumn 1963): 79-80.

Hashim, Alice Bettis. *The Fallen State: Dissonance, Dictatorship and Death in Somalia*. New York: University Press of America, 1997.

Hayles, N. Katherine. *Chaos Bound: Orderly Disorder in Contemporary Literature and Science*. Ithaca, NY: Cornell University Press, 1990.

Headquarters United States Air Force. "The Air War over Serbia: Aerospace Power in Operation Allied Force." Washington, DC: 1 April 2000, (unpublished).

Hirsch, John L., and Robert B. Oakley. *Somalia and Operation Restore Hope: Reflections on Peacemaking and Peacekeeping*. Washington, DC: United States Institute of Peace Press, 1995.

Holte, John. *Chaos: The New Science*. Lanham, MD: University Press of America, Inc., 1990.

Hosner, Stephen T. *Why Milosevic Decided to Settle When He Did*. Santa Monica, CA: RAND, 2001.

House of Commons Library. "11 September 2001: The Response," Research Paper 01/72. http://www.parliament.uk (accessed 1 April 2005).

Human Rights Watch. "Civilian Deaths in the NATO Air Campaign - Summary." http://www.hrw.org/ reports/2000/mnato/natbm200.htm (accessed 22 March 2005).

————. "Afghanistan: Warlords Implicated in New Abuses," 29 July 2003. http://www.hrw.org/press/2003/07/afghan072903.htm (accessed 22 March 2005).

Independent International Commission on Kosovo. *Kosovo Report*. New York: Oxford University Press, 2000. http://www.usip.org/library/pa/kosovo/kosovo_rambtoc.pdf (accessed 13 February 2005).

International Criminal Tribunal for the Former Yugoslavia. "Indictment Case No. IT-99-37." 24 May 1999. http://www.un.org/icty/indictment/English/mil-ii990524e.htm (accessed 17 March 2005)

James, Glenn E. *Chaos Theory: The Essentials for Military Applications*. Newport, RI: Naval War College, Center for Naval Warfare Studies, 1996.

Jertz, Walter. "Press Conference NATO HQ, Brussels, 23 May 1999." http://www.nato.int/kosovo/press/p990523a.htm (accessed 18 February 2005).

Jervis, Robert. "Complex Systems: The Role of Interactions." In *Complexity, Global Politics, and National Security*, edited by David S. Alberts and Thomas J. Czerwinski. Washington, DC: National Defense University, 1997.

————. *System Effects*. Princeton, NJ: Princeton University Press, 1997.

————. "Complexity and the Analysis of Political and Social Life." *Political Science Quarterly* 112, no. 4 (Winter 1997-1998): 569-93.

Judah, Tim. *Kosovo: War and Revenge*. New Haven, CT: Yale University Press, 2000.

Kaplan, Morton A. *Macropolitics*. Chicago: Aldine Publishing Company, 1969.

Keohane, Robert O. *Neorealism and Its Critics*. New York: Columbia University Press, 1986.

————. *Power and Governance in a Partially Globalized World*. New York: Routledge, 2002.

Kiel, Douglas L. M. *Managing Chaos and Complexity in Government*. San Francisco: Jossey-Bass Publishers, 1994.

King, Ian T. *Social Science and Complexity*. Huntington, NY: Nova Science Publishers, Inc., 2000.

Knorr, Klaus. *The Power of Nations*. New York: Basic Books, Inc., 1975.

Kohl, Christian. "Cost of War: $350m to Steelmakers." *American Metal Market*, 20 May 1999.

Kozaryn, Linda D. "NATO Air War Stirs Serb Dissent against Milosevic Regime." American Forces Press Service, 20 May 1999, http://www.defenselink.mil/news/May1999/n05201999_9905201.html (accessed 13 February 2005).

Krasner, Steven D. "Regimes and the Limits of Realism: Regimes as Autonomous Variables." *International Organization* 36 no. 2 (Spring 1982): 497-510.

————. "State Power and the Structure of International Trade." In *International Politics*, edited by Robert J. Art and Robert Jervis. Glenview, IL: Scott Foresman and Company, 1985.

Lambeth, Benjamin S. *NATO's Air War for Kosovo*. Santa Monica, CA: RAND, 2001.

Lange, Oskar. *Introduction to Economic Cybernetics*. New York: Pergamon Press, 1970.

Lardner, George Jr. "Former Somali General Told to Leave U.S." *Washington Post*, 17 March 2003.

Layne, Christopher. "Collateral Damage in Yugoslavia." In *NATO's Empty Victory*, edited by Ted Galen Carpenter. Washington, DC: The Cato Institute, 2000.

————. "Miscalculations and Blunders Lead to War." In *NATO's Empty Victory*, edited by Ted Galen Carpenter. Washington, DC: The Cato Institute, 2000.

Lazlo, Ervin. *The Systems View of the World: A Holistic View for Our Time*. Cresskill, NJ: Hampton Press, Inc., 1996.

Legro, Jeffrey W., and Andrew Moravczisik. "Is Anybody Still a Realist?" *International Security* 24, no. 2 (Fall 1999): 5-55.

Levy, David. "Chaos Theory and Strategy: Theory, Application and Managerial Implications." *Strategic Management Journal* 15, Special Issue: Strategy: Search for New Paradigms (Summer 1994): 35-50.

Lewis, I. M. "Misunderstanding the Somali Crisis." *Anthropology Today* 9, no. 4 (August 1993): 1-3.

Library of Congress. "Country Studies, 'Afghanistan.'" http://www.loc.gov/frd/cs/ aftoc.html (accessed 2 March 2005).

Lyons, Terrence, and Ahmed I. Samatar. *Somalia: State Collapse, Multilateral Intervention, and Strategies for Political Reconstruction*. Washington, DC: The Brookings Institution, 1995.

Makinda, Samuel M. *Seeking Peace from Chaos: Humanitarian Intervention in Somalia*. Boulder, CO: Lynne Reinner Publishers, Inc, 1993.

Malcolm, Noel. *Kosovo: A Short History*. New York: New York University Press, 1998.

Maley, William. *The Afghanistan Wars*. New York: Palgrave Macmillan, 2002.

Marani, Giuseppe. "Press Conference NATO HQ, Brussels, 21 April 2001." http://www.nato.int/ kosovo/press/p990421a.htm (accessed 18 February 2005).

McGirk, Tim. "Deep Loyalties, Ancient Hatreds." *Time*, 19 November 2001.

Mearsheimer, John. *The Tragedy of Great Power Politics*. New York: W.W. Norton and Company, Inc, 2000.

Mertus, Julie A. *Kosovo: How Myths and Truths Started a War*. Berkeley: University of California Press, 1999.

Metlay, Daniel. "Social Systems." In *Organized Social Complexity*, edited by Todd R. La Porte. Princeton, NJ: Princeton University Press, 1975.

Mintz, Alex. "Foreign Policy Decisionmaking: Bridging the Gap between the Cognitive Psychology and Rational Actor Schools." In *Decisionmaking in War and Peace*, edited by Nehemia Geva and Alex Mintz. Boulder, CO: Lynne Reinner Publishers, 1997.

Mitleton-Kelly, Eve. *Complex Systems and Evolutionary Perspectives on Systems*, edited by Eve Mitleton-Kelly. Oxford, UK: Elsevier Science LTD, 2003.

Modelski, George. "Evolutionary Paradigm for Global Politics." *International Studies Quarterly* 40, no. 3 (September 1996): 321-43.

Moffat, James. *Complexity Theory and Network Centric Warfare*. Washington, DC: DOD Command and Control Research Program, 2003.

Mokhiber, Jim. "Why Did Milosevic Give Up?" Public Broadcasting Service, http://www.pbs.org/wgbh/pages/frontline/shows/kosovo/fighting/giveup.htm (accessed 18 February 2005).

Morgenthau, Hans J., and Kenneth W. Thompson. *Politics among Nations*. 6th ed. New York: Alfred A. Knopf, 1985.

Mueller, Karl. "The Essence of Coercive Air Power: A Primer for Military Strategists." *Air and Space Power Chronicles*, September 2001.

Nardulli, Bruce R, Walter L. Perry, Bruce Pirnie, John Gordon IV, and John G. McGinn. *Disjointed War: Military Operations in Kosovo, 1999*. Santa Monica, CA: RAND Arroyo Center, 2002.

"NATO Strike Targets Milosevic Inner Circle." *Financial Times*, 21 April 1999.

Nicolis, Gregorire, and Ilya Prigognine. *Exploring Complexity*. New York: W. H. Freeman and Company, 1989.

Noelle-Karimi, Christine, Conrad Schetter, and Reinhard Schlagintweit. *Afghanistan - a Country without a State?* Frankfurt-Main, Germany: IKO-Verlag fur Interulturelle Komminkation, 2002.

North Atlantic Treaty Organization. *NATO Handbook*. Brussels: NATO Office of Information and Press, 1998.

————. "The Situation in and around Kosovo," Statement Issued at the Extraordinary Ministerial Meeting of the North Atlantic Council Held at NATO Headquarters Brussels, on 12th April 1999." http://www.nato.int/docu/pr/1999/p99-051e.htm (accessed 14 January 2005).

————. "NATO's Role in Relation to the Conflict in Kosovo." 15 July 1999. http://www.nato.int/kosovo/history.htm (accessed 14 January 2005).

Nye, Joseph S., Jr. "Soft Power." *Foreign Policy*, Fall 1990.

————. "The Changing Nature of World Power." *Political Science Quarterly* 105, no. 2 (November 1990): 177-92.

————. "Redefining the National Interest." *Foreign Affairs* 78, no. 4 (July/August 1999): 23-35.

————. *The Paradox of American Power*. New York: Oxford University Press, 2002.

————. "The Velvet Hegemon." *Foreign Policy*, May-June 2003.

O'Hanlon, Michael E. "Flawed Masterpiece." *Foreign Affairs* 81 no.3 (May-June 2002): 47-63.

"Operations in Kosovo: Yugoslav Order of Battle." *Janes Defence Weekly*, 1 April 1999.

Overman, E. Sam. "The New Sciences of Administration: Chaos and Quantum Theory." *Public Administration Review* 56, no. 5 (September-October 1996): 487-91.

Owen, Robert C. *Deliberate Force: A Case Study in Effective Air Campaigning*, edited by Robert C. Owen. Maxwell Air Force Base, AL: Air University Press, 2000.

Pape, Robert. *Bombing to Win: Air Power and Coercion in War.* Ithaca, NY: Cornell University Press, 1996.

———. "The True Worth of Air Power." *Foreign Affairs* 83, no. 2 (March/April 2004): 116-30.

Peak, David, and Michael Frame. *Chaos under Control: The Art and Science of Complexity.* New York: W. H. Freeman and Company, 1994.

Pidwirny, Michael. "Fundamentals of Physical Geography." http://www.physicalgeography.net/fundamentals/4b.html (accessed 16 November 2004).

Pietgen, Heinz-Otto. "The Causality Principle: Deterministic Laws and Chaos." In *Chaos: The New Science*, edited by John Holte. Lanham, MD: University Press of America, Inc., 1990.

Posen, Barry. "The War for Kosovo." *International Security* 24, no. 4 (Spring 2000): 39-84.

Public Broadcasting Service. "Interview with Commander of the Yugoslav 3rd Army, Gen. Nebojsa Pavkovic." 29 February 2000, http://www.pbs.org/wgbh/pages/frontline/shows/kosovo/ interviews/pavkovic.html (accessed 6 January 2005).

Rapoport, Anatol. *General Systems Theory: Essential Concepts and Applications.* Cambridge, MA: Abacus Press, 1986).

Richards, Diana. "Nonlinear Dynamics in Games: Convergence and Stability in International Environmental Agreements." In *Political Complexity: Nonlinear Models of Politics*, edited by Diana Richards. Ann Arbor: The University of Michigan Press, 2000.

———. *Political Complexity: Nonlinear Models of Politics.* Ann Arbor: The University of Michigan Press, 2000.

Richburg, Keith B. "Somalia Slips Back into Bloodshed." *Washington Post*, 4 September 1994.

Rihani, Samir. *Complex Systems Theory and Development Practice.* New York: Zed Books Ltd, 2002.

Rosenau, James N. *Linkage Politics*, edited by James N. Rosenau. New York: The Free Press, 1969.

———. *Turbulence in World Politics.* Princeton, NJ: Princeton University Press, 1990.

———. "Many Damn Things Simultaneously: Complexity and Theory in World Affairs." In *Complexity, Global Politics, and National Security*, edited by David

S. Alberts and Thomas J. Czerwinski. Washington, DC: National Defense University, 1997.

Sanders, T. Irene. *Strategic Thinking and the New Science.* New York: The Free Press, 1998.

Saperstein, Alvin. "Chaos: A Model for the Outbreak of War." *Nature,* 24 May 1984.

————. "War and Chaos." *American Scientist* 83, no. 6 (November-December 1995): 548-58.

————. "Complexity, Chaos and National Security Policy: Metaphors or Tools?" In *Complexity, Global Politics, and National Security,* edited by David S. Alberts and Thomas J. Czerwinski. Washington, DC: National Defense University, 1997.

Schelling, Thomas C. "The Diplomacy of Violence." In *International Politics,* edited by Robert J. Art and Robert Jervis. Glenview, IL: Scott Foresman and Company, 1985.

Schmitt, Eric, and Steven Lee Myers. "NATO Said to Focus Raids on Serb Elite's Property." *New York Times,* 19 April 1999.

Scholfield, Victoria. *Afghan Frontier: Feuding and Fighting in Central Asia.* New York: Tauris Parke Paperbacks, 2003.

Serfaty, Simon. "The New Normalcy." *The Washington Quarterly* 25, no. 2 (Spring 2002): 209-19.

Shea, Jamie. "Press Conference NATO HQ, Brussels, 20 April 1999." http://www.nato.int/kosovo/press/p990420.htm (accessed 20 January 2005).

————. "Press Conference NATO HQ, Brussels, 28 May 1999." http://www.nato.int/kosovo/press/p990528a.htm (accessed 22 February 2005).

Simon, H. A. "Near Decomposability and Complexity: How a Mind Resides in a Brain." In *The Mind, the Brain and Complex Adaptive Systems,* edited by Harold. J. Morowitz and Jerome L. Singer. Reading, MA: Addison-Wesley Publishing Company, 1995.

Singer, J. David. "The Global System and Its Sub-Systems: A Developmental View." In *Linkage Politics,* edited by James N. Rosenau. New York: The Free Press, 1969.

Smith, Edward A. *Effects Based Operations: Applying Network Centric Warfare in Peace, Crisis and War.* Washington, DC: DOD Command and Control Research Program, 2002.

Stein, Janice Gross, and David A. Welch. "Rational and Psychological Approaches to the Study of International Conflict: Comparative Strengths and Weaknesses." In

Decisionmaking in War and Peace, edited by Nehemia Geva and Alex Mintz. Boulder, CO: Lynne Reinner Publishers, 1997.

Stevenson, Jonathon. "Hope Restored in Somalia." *Foreign Policy*, Summer 1993.

Stewart, Richard W. *The United States Army in Somalia, Center of Military History Pub 70-81-1*. Washington, DC: U.S. Army Center of Military History, 1994.

Sutherland, John W. *Systems Analysis, Administration and Architecture*. New York: Van Nostrand Reinhold Company, 1975.

Tanner, Steven. *The Wars of the Bushes*. Haverstown, PA: Casemate, 2004.

Treverton, Gregory F. "Emerging Threats to National Security: Testimony Presented to the House of Representatives Permanent Select Committee on Intelligence on 2 February 2005." http://www.rand.org/pubs/testimonies/2005/RAND_CT234.pdf (accessed 5 April 2005).

United Nations. Department of Public Information. "United Nations Operation in Somalia II." 21 March 1997. http://www.un.org/Depts/DPKP/Missions/ unosom2b.htm (accessed 5 April 2005).

————. United Nations International Drug Control Programme. "Annual Poppy Survey 2001." http://www.unodc.org/pdf/afg/report_2001-10-16_1.pdf (accessed 12 February 2005).

————. UN Office on Drugs and Crime, "Summary Finding on Opium Trends in Afghanistan," http://www.unodc.org/pdf/ afghanistan-2005_summary_opium-afghanistan-2005.pdf (accessed 2 March 2005).

United Nations Security Council. "United Nations Security Council Resolution 1203." 24 October 1998. http://www.nato.int/ kosovo/docu/u981024a.htm (accessed 21 January 2005).

U.S. Congress. House of Representatives. Committee on Foreign Affairs. *Markup on S.J. Res. 45 Authorizing the Use of Force in Somalia*, 103rd Cong., 1st sess., 23 May 1993.

U.S. Congress. House of Representatives. Committee on Armed Services. *Performance of the B2 Bomber in the Kosovo Air Campaign, Hearing before the Military Procurement Subcommittee*, Statement of Lt. Gen. Marvin R. Esmond, 106 Cong., 1st sess., 30 June 1999. http://www.house.gov/hasc/testimony/ 106thcongress/99-10-19esmond.pdf (accessed 14 January 2005).

U.S. Congress. Senate. Committee on Armed Services. *Joint Statement on the Kosovo After-Action Review, Hearing Before the Committee on Armed Services*. Testimony of William S. Cohen and General Henry H. Shelton, 106th Cong., 1st

sess., 14 October 1999. http://www.dod.mil/releases/1999/b10141999_bt478-99.html (accessed 6 January 2005).

————. Committee on Foreign Relations. *The Taliban: Engagement or Confrontation, Hearing before the Committee on Foreign Relations.* 106th Cong., 2nd sess., S. Hrg. 106–868, 20 July 2000, Washington, DC: U.S. Government Printing Office, 2001.

————. Select Committee on Intelligence. "Report on the U.S. Intelligence Community's Prewar Intelligence Assessments on Iraq." 108th Cong., 2nd sess., 7 July 2004. http://intelligence.senate.gov/conclusions.pdf (accessed 1 April 2005).

U.S. Department of Defense. "DOD Dictionary." http://www.dtic.mil/doctrine/jel/doddict/data/d/01641.html (accessed 27 September 2004).

————. "29 April 1999 US DOD Press Briefing." http://www.defenselink.mil/news/Apr1999/990429-J-0000K-001.jpg (accessed 22 February 2005).

————. "DOD News Briefing 30 April 1999."http://www.defenselink.mil/news/Apr1999/990430-J-000K-004.html (accessed 13 February 2005).

————. "DOD News Briefing 21 May 1999." http://www.defenselink.mil/news/May1999/990521-J0000k-002.jpg (accessed 22 February 2005).

————. "Kosovo/Operation Allied Force After-Action-Report." Report to Congress. 31 January 2000. http://www.defenselink.mil/pubs/kaar02072000.pdf (accessed 14 January 2005).

————. "Rumsfeld and Myers Briefing on Enduring Freedom, 7 October 2001." http://www.defenselink.mil/transcripts/2001/ t10072001_t1007sd.htm (accessed 12 February 2005).

————. "News Transcript, Rear Adm. John Stufflebeem, Joint Staff, 31 October 2001." http://www.defenselink.mil/transcripts/2001/t10312001_t031.htm (accessed 2 March 2005).

————. "DOD News Briefing - Secretary Rumsfeld and Gen. Myers, 11 December 2001." http://www.defenselink.mil/transcripts/ 2001/ t12112001_t1211.html (accessed 2 March 2005).

————. "The National Military Strategy of the United States of America." http://www.oft.osd.mil/ libray_files/document-297_MT_Strategy/Doc.pdf (accessed 5 April 2005).

U.S. Department of the Navy. Chief of Information. "Tomahawk." http://www.chinfo.navy.mil/navpalib/factfile/misiles/wep-toma.html (accessed 2 March 2005).

U.S. Department of State. "Fact Sheet, Summary of U.S. Assistance to the Afghan People since Oct. 1, 2001." 23 November 2001. http://www.state.gov/r/pa/ prs/ps/2001/6303htm (accessed 4 March 2005).

————. "Background Note: Somalia." April 2005. http://www.state.gov/r/pa/ei/ bgn/2863.htm (accessed 5 April 2005).

U.S. Joint Chiefs of Staff. "*Doctrine for Joint Operations,* Joint Publication 3-1." http://www.dtic.mil/ doctrine/jel/ new_pubs/jp1_01_1.pdf (accessed 1 April 2004).

U.S. Joint Forces Command. "About the Operational Net Assessment (ONA)." http://www.jfcom.mil/abaout/fact_ona.htm (accessed 15 April 2005).

Urry, John. *Global Complexity.* Cambridge, UK: Polity Press, 2003.

Uvalic, Milica. " Kosovo's Economy." *Southeast Europe and Black Sea Studies* 1, no. 1 (Summer 2000): 21-46.

Voss, James F. "On the Representation of Problems: An Information-Processing Approach to Foreign Policy Decision Making." In *Problem Representation in Foreign Policy Decision Making,* edited by Donald A. Sylvan and James F. Voss. Cambridge: Cambridge University Press, 1998.

Waldrop, M. Mitchell. *Complexity: The Emerging Science at the Edge of Order and Chaos.* New York: Simon and Schuster, 1992.

Wallace, Michael D., and Peter Suedfeld. "Leadership in Crisis: The Longevity-Complexity Link." *International Studies Quarterly* 32, no. 4 (December 1988): 439-51.

Waltz, Kenneth N. *Theory of International Politics.* Reading, MA: Addison-Wesley Publishing Company, 1979.

"War in the Balkans—Leader's Cronies Face Loss of 20m Pounds in Assets." *The Independent-London,* 31 May 1999.

Warren, Keith. "New Directions in System Theory: Chaos and Complexity." *Social Work,* July 1998.

Weltman, John J. *Systems Theory in International Relations.* Lexington, MA: Lexington Books, 1973.

Williams, Garnett P. *Chaos Theory Tamed.* Washington, DC: Joseph Henry Press, 1997.

Winner, Langdon. "Organized Social Complexity." edited by Todd R. La Porte. Princeton, NJ: Princeton University Press, 1975.

Woods, James L. "Decisionmaking During Operations in Somalia." In *Learning from Somalia*, edited by Walter Clarke and Jeffrey Herbst. Boulder, CO: Westview Press, 1995.

Woodward, Bob. *Bush at War*. New York: Simon and Schuster, 2002.

Woodward, Susan. *Balkan Tragedy: Chaos and Dissolution*. Washington, DC: Brookings Institution Press, 1995.

Yetiv, Steven A. *Explaining Foreign Policy: U.S. Decision-Making in the Persian Gulf War*. Baltimore, MD: Johns Hopkins University Press, 2004.

Young, Michael D. "Representing Problem Representation." In *Problem Representation in Foreign Policy Decision Making*, edited by Donald A. Sylvan and James F. Voss. Cambridge: Cambridge University Press, 1998.

Zeng, Langche. "Neural Network Models for Political Analysis." In *Political Complexity: Nonlinear Models of Politics*, edited by Diana Richards. Ann Arbor: University of Michigan Press, 2000.

Zinni, Anthony. "A Commander's Reflections." *Proceedings,* 126 no. 7 (July 2000): 34-37.

VITA

George T. Hodermarsky
Graduate Program in International Studies
620 Ballston Arts and Letter Bldg.
Old Dominion University
Norfolk, VA 23529

EDUCATION

Ph.D.   International Studies, Old Dominion University (Candidate, ABD)
M.S.   Education, Old Dominion University
M.S.   National Security and Strategic Studies, U.S. Naval War College
M.S.   Administration, School of Government and Business Administration,
        George Washington University
A.B.   Government, Ohio University

PROFESSIONAL EXPERIENCE

George Hodermarsky is the Experimentation Campaign Contract Program Manager for
NATO's Headquarters Supreme Allied Commander Transformation. He leads a team of
22 Project Managers, Experimenters, Concept Developers, and Analysts in the
formulation and development of operational concepts, and the requisite experimentation
and analysis of related events.

He previously served as Lead Analyst for the United States Joint Forces Command
(USJFCOM) Operational Net Assessment (ONA) System of Systems Analysis (SoSA)
Cell, where he devised, developed and executed the analysis process and assisted in the
development of the ONA database tool.

Prior to that period, he was responsible for organization and execution of seminars,
wargames and workshops related to the development of concepts for long range strategic
planning. Activities included critical positions in USJFCOM Experimentation events.

He retired as a Captain in the United States Navy. His active service included twelve
years in joint or combined commands and as a Joint Specialty Officer, operational
squadron commanding officer, strategic planner, Naval Flight Officer, and intelligence
analyst.