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STUDY PROJECT

WHY WARS END:
AN EXPECTED UTILITY WAR TERMINATION MODEL

BY

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ABSTRACT

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    Although war termination is an essential part of military strategy, the subject has received relatively little attention. Despite a burst of interest spurred by the U.S. experience in Vietnam, there is no generally accepted theory to explain the process of ending a war. Beginning with a discussion of the ways in which wars have ended, this paper reviews a number of theoretical propositions that have been advanced to explain the conditions necessary for two countries at war to cease hostilities. It views war termination as a rational decision process in which the participants weigh the potential gains of continuing the war against risks and costs. This general proposition is developed into a detailed expected utility model in which the probabilities and utilities of possible settlements and the costs of continuing the war are the key variables. A variety of other factors such as public support and mobilization potential that have been suggested as being key factors influencing war termination decisions are then examined. It is concluded that the impact of all relevant factors can be reflected through their effect on the three basic variables of probability, utility and cost. The paper concludes by offering some observations of how the expected utility model could be employed as an analytic framework for developing war termination strategies.

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INTRODUCTION

In ancient times, war was often quite total for the
vanquished. The men were put to death, the women sold into
slavery, the boys castrated, the buildings leveled, and the
countryside eventually repopulated by settlers from the
victorious land.[1] By comparison, the Allies' unconditional
surrender policy in World War II or the onerous terms of the
peace treaty the Germans extracted from Bolshevik Russia during
World War I seem relatively liberal. In more recent years, the
Korean War ended with an armistice that restored the status quo
ante bellum and established a model for "limited war" in the
nuclear age that has profoundly influenced a generation of
American scholars and policy makers. These examples illustrate
the wide variety of ways in which wars have ended. Whether it is
by annihilation, capitulation, peace treaty, or armistice, the
fighting must eventually come to a halt. The nature of the
ending not only defines the "winners" and "losers" but also
shapes the peace that follows.

Purpose

The purpose of this paper is to analyze the process of war
termination and its relation to military strategy. It will
address the how, when and why of the ways in which wars end. It
will review the key scholarly literature on the subject and
attempt to extract theoretical insights into the termination
process. The paper will identify the key factors that drive war

termination decisions and develop a model to describe how these factors are interrelated. It will conclude with a discussion of how the model can be used to provide a framework for analyzing how various courses of action effect the prospects for bringing hostilities to end on favorable terms.

The Study of War Termination

Anyone undertaking a study of war termination will be struck by the number of authors who begin their works by decrying the neglect of this important subject. Typical is this passage from Fred Ikle in the preface to his 1971 book, <u>Every War Must End</u>:

> How are wars brought to an end? Historians, students of military strategy, and experts on foreign affairs have tended to neglect this question. Much attention, by contrast, has been devoted to the question of how wars begin. . . . This imbalance prevails not only among studies of past wars but also in writings on contemporary issues of international conflict . . . Indeed, past neglect of the question of ending wars has contributed directly to its current neglect in military strategy and peacekeeping.[2]

Interestingly, one prominent author, Michael Handel, directly challenges this assertion commenting that, "The literature on the subject of war termination is prodigious, if not overwhelming."[3] In my view, the truth lies somewhere between Handel and Ikle and is largely a function of how broadly one defines the subject.

In its narrowest sense, the study of war termination focuses on the factors that cause hostilities to cease at a particular point in a war and the conditions of the ending. A broader definition would include questions regarding the nature and ultimate success of the cease fire and peace that follows. It could include a study of peace negotiations both from a

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bargaining and an international law perspective as well the entire field of conflict reduction and conflict resolution.

Handel notes that the narrower definition "entertains greater pretensions or hopes of establishing a rigorous, quantitative, scientific and predictive theory explaining how wars end."[4] In contrast, a policy maker concerned with the long term political objective of forging a better peace must look beyond the end of the fighting. This paper will deal primarily with the narrower view of war termination.

The objective of the paper is to develop a theoretical model that explicitly describes that relationship among the factors that govern war termination decisions. By describing the interplay of the military situation with other factors such as the terms of a prospective negotiated settlement, the model will allow the strategist to view military action in a broader context. This is especially important in an era of limited wars, where the goal is to quickly achieve our political objectives and terminate hostilities without having to render the enemy totally defenseless.

THE NATURE OF INTERNATIONAL CONFLICT AND WAR

Unlike the natural sciences, the vast literature devoted to international relations is not consistent in its terminology. In fact, the relative merits of various definitions is often the subject of heated debate. In order to set the stage for the remainder of the paper and avoid unnecessary confusion, I will begin by defining a number of key terms. In addition, I will lay out a conflict model that establishes a framework for thinking about war.

War - A Subset of Conflict

The relations between sovereign nations can be characterized by varying degrees of conflict, competition, coexistence or cooperation.[5] For the purposes of this paper, conflict can be defined as the pursuit of incompatible objectives or goals. The existence of latent or potential conflict is widely recognized in the literature and consists of opposing attitudes needs and values. A nation's perception of a situation, can transform these dispositions into active interests seeking gratification. When these interests are combined with the capability and will to take action, conflict results. International conflict is not necessarily violent. It can be pursued by the use of any of the instruments of national power. The goal of a nation involved in international conflict is to establish a new, more favorable relationship with another nation which reflects a change in the balance of opposing interests, capabilities and will. One form

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of conflict is coercion which can take the form of threats, threatening actions, deprivations or violence.[6] Interstate war is the direct application of military force to coerce another nation.

This view of war and conflict is in line with the Clausewitzian notion of war as an instrument of policy. Although it is by no means universally accepted, it is the basic view held by most researchers who have studied the dynamics of war and is in keeping with the basic tenants of U.S. military doctrine. From this perspective, war can be conceptualized as a bargaining process or a decision mechanism. This line of reasoning is succinctly summarized by Paul Kecskemeti:

> War, in its political meaning, may be described as a decision mechanism invoked by political units pursuing incompatible goals when the difference between them can neither be left in abeyance nor resolved by bargaining or coercive threats. The armed struggle serves to break political deadlocks by putting one side in a dominant coercive position . . . War modifies (or clarifies) the bargaining strength relationship between the parties.[7]

It should be noted that at any one time, two nations may be in active conflict over a number of issues. In addition, there are likely to be an even larger number of latent issues or disputes. Most wars will settle only a limited number of key issues. Other issues and disputes are likely to remain not only unresolved but not even addressed.

A Model of Conflict

One way of visualizing the nature of conflict and war is to construct a linear model which illustrates the progression of a

conflict through a series of stages or phases. Based on the proceeding discussion, such a model might begin with a latent dispute and move through active conflict, war and settlement. Not surprisingly, the international relations literature abounds with such models.[8] One of the most frequently cited is Richard Barringer's four phase model of war which is depicted below:
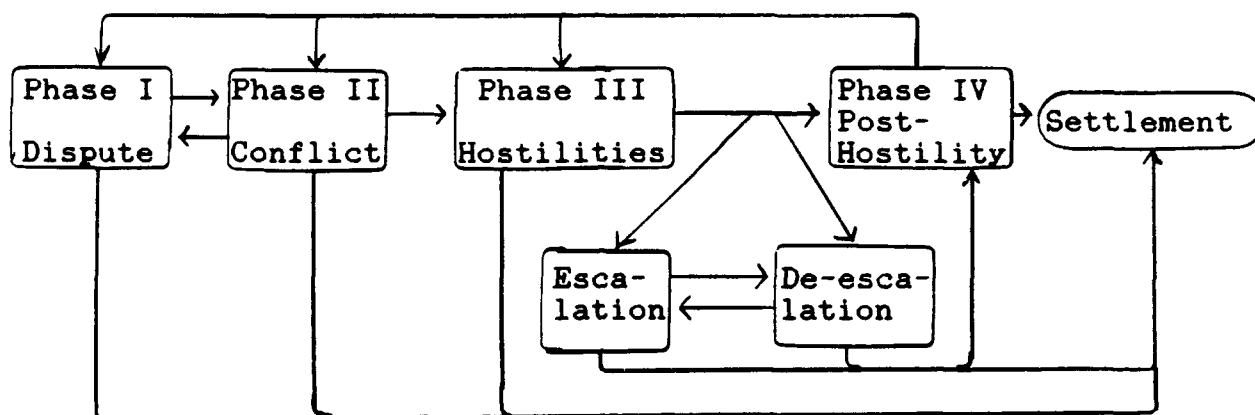
Phase I - Dispute (Non-military) Phase Barringer's model begins with a dispute which arises when "at least one party becomes fully aware of an incompatibility of perceived interests, objectives or future positions."[9] The essence of a dispute is the perception of a grievance that demands increased accommodation by the other party.

Phase II - Conflict (Prehostilities) Phase A dispute becomes a conflict when it is perceived by at least one party in military terms. Manifestations could include arms buildup, troop mobilization or force deployments.[10]

Phase III - Hostilities Phase "Organized and systematic violence is undertaken by the armed force of any party to the dispute as a purposeful instrument of policy."[11] Within this

phase, there may be subphases marked by significant changes in the nature or intensity of fighting, i.e., escalation and de-escalation.

Phase IV - Termination (Posthostilities) Phase Organized hostilities are terminated by all parties. "The dispute is still unresolved and is perceived in military terms by at least one party and could generate renewed hostilities either immediately or after a prolonged period of cease-fire and renewed preparations for combat."[12]

Settlement "The point (rather than phase) at which the underlying dispute between the parties, as presently defined, is itself resolved by some form of accommodation between the parties, annihilation of one or more of them, loss of saliency or other means."[13]

Barringer's model clearly delineates the transition between phases by an observable activity or threshold. Thus the threshold between Phase II and III is the initiation of hostilities and the transition to Phase IV is the termination of hostilities. The various arrows in the graphic indicate possible directions of movement. There is no set or established path. It is possible to move backwards, forwards or in a loop with one exception. Once a conflict enters Phase III Hostilities, it cannot simply return to the conflict stage. It must pass through the termination threshold to either the posthostility phase, which typically might include a cease-fire and negotiations, or it can move directly to settlement which is the final threshold

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marking the end of the conflict life cycle.[14]

The Barringer model was developed as part of an ambitious program to produce an automated data base to classify empirical data on the origins, development and termination of war. While well suited for this purpose, the model has some limitations. It is not really a general conflict model but has been tailored for war and crises with a potential for war. As a result, the parenthetical description of Phase II as "prehostilities" is actually more accurate than calling it conflict. A more inclusive model would make provisions for conflict via noncoercive means such as diplomacy and arbitration as well as for coercion by non-military means such boycotts and embargos. However, given this paper's focus on war termination, the model is adequate.

War Termination and Conflict Resolution

One of the advantages of a conflict model is the ease in which it makes the point that war termination is a necessary but not sufficient condition for the resolution of conflicts that have led to war. Once the conflict leads to hostilities, it must pass through the threshold of war termination to either the posthostiltities phase or directly to settlement. Under ideal conditions, negotiations in the posthostility phase would lead to a stable resolution of the conflict issues based on the new balance of power established by the war. However, in many cases war fails to resolve the underlying dispute. As Janice Gross Stein observed:

. . . termination of hostilities . . . may be the prelude to negotiation of a settlement of the issues in dispute, or to a gradual normalization of the status quo which then acquires legitimacy over time, or it may be used by one or both of the participants as a pause to prepare for renewed hostilities of even greater intensity.[15]

It also makes the point that peace is absence of war but not necessarily the absence of conflict.

The Classification of Wars

Wars can be classified on the basis of the belligerents involved in the struggle (nation states, empires, insurgent groups, etc.); on the basis of the war aims of the participants (conquest, empire, independence, revolution, etc.) or on the basis of the means employed (limited or total; guerrilla, conventional, or nuclear; low, mid, or high-intensity).[16] All are valid classifications and the choice really depends on the nature of a particular discussion. Since the study of war termination is fundamentally concerned with the interaction of the belligerents, a classification scheme based on their identity recommends itself. Although a number of such schemes are in use, I will employ a simple three type classification model developed by Small and Singer:

    (1) Interstate wars in which internationally recognized
        nation states were the belligerents.
    (2) Extra-systemic wars in which only one side is member of
        state system. These would include imperial and
        anti-colonial wars.
    (3) Civil wars which include rebellions and guerrilla wars
        internal to a member of the state system. [17]

Only interstate wars will be discussed in detail. From a parochial perspective, they are the only type in which the United States is likely to be involved as a primary belligerent.

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Types of War Endings

Wars are characterized by the violent interaction of the belligerents. Consequently, it seems appropriate to classify the ways in which wars have ended based on the level of agreement or negotiation required to bring the hostilities to a close. The following table groups war endings into three categories:

    (1) Negotiated Termination
- Cease-fire, armistice or truce
- Formal peace treaty
- Joint political agreement

    (2) Unilaterally Imposed Settlement
- General capitulation
- Unconditional surrender

    (3) No Explicit Agreement
- Extermination or expulsion
- Withdrawal
- Unilateral declaration of victory

The remainder of this section will address each type of ending in turn.

Cease-fire, Armistice or Truce Although these terms are often used interchangeably, international law makes a distinction. A cease-fire refers to a suspension of hostilities in a particular theater of war for a relatively short period (generally a few days) to bury the dead, exchange prisoners, or negotiate a longer peace. Armistice or truce refers to agreement applicable to the entire war, either for a limited time or indefinitely, often to facilitate the negotiation of a permanent peace. If negotiations for peace fail, an armistice can become a de-facto peace as in the case of Korea, Palestine and the Kashmir.[18]

Formal Peace Treaty A treaty of peace is a formal legal instrument professing to establish permanent peace between sovereign states. In international wars with more than two participants, a single treaty may be signed by all belligerents (e.g. the Treaty of Paris which ended the Napoleonic Wars), but the use of several bilateral or multilateral treaties has been more common in the case of large coalition wars such as World War I.[19] Formal treaties were often preceded by an armistice and were negotiated by diplomats at a separate, and often lengthy, peace conference.

Joint Political Agreement These are "contractual engagements between contending parties that are of a bilateral or multilateral nature."[20] This type of agreement "usually stipulates how the conflict will be ended and may indicate how peace will be maintained."[21] An example is the "Agreement on Ending the War and Restoring Peace in Vietnam" which provided for a cease-fire, U.S. troop withdrawal, release of prisoners of war, the restoration of a demarcation line between North and South Vietnam and international truce supervision.[22]

General Capitulation A capitulation is a military agreement in which one side lays down its arms. A capitulation made by military commanders could be rejected by one of the governments if it contained what it judged to be political terms.[23] A general capitulation involving all forces would usually be followed by some political agreement.

Unconditional Surrender Unconditional surrender occurs when

one belligerent has been totally defeated, giving the victor the opportunity to occupy its territory and dictate peace terms. Annexation of territory by the victor is not implied and is considered "legal" only if generally recognized by the international community.[24] Some may argue that even unconditional surrender contains some element of, at least, tacit negotiation. However, the distinction drawn here is that the possibility of the substantive give-and-take that characterizes genuine negotiations is absent. [25] The classic example of this type of ending is the surrender of the Axis powers in World War II.

Extermination/Expulsion In these cases, one side is rendered incapable of continuing the battle either through its destruction as an organized military force (not necessarily to the last man) or expulsion from the country or theater of operations. [28] While fairly common in ancient times and in colonial wars of conquest, it is relatively uncommon in modern interstate wars. While the fate of the ruling regime may well be an issue, the continued existence of the country as a sovereign nation is usually not in doubt. An exception was the Italian annexation of Ethiopia following their war of 1935-36.[27]

Withdrawal Under some circumstances, a war can be terminated simply by the unilateral withdrawal of one of the belligerents. For countries that share common border, this requires the tacit agreement of the other party. China's border wars with India and Vietnam are good examples of this genre. Both cases could be described as modern day punitive expeditions in which China

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demonstrated the credibility of its threats and then withdrew.[28]
An entirely different situation arises in the case of an
extra-territoral power such as the France and its withdrawal from
Mexico in 1867.[29] In this case, a great power simply abandoned
an overseas adventure to cut its losses.

Declaration of Victory In the case of interstate wars in
which hostilities have ceased through surrender or cease-fire and
negotiations have reached an impasse, peace may be made by
unilateral declaration of the victor. For example, after
rejecting the Treaty of Versailles, the United States declared
peace with Germany by Congressional Act in 1921.[30] Many civil
wars end with the death or exile of the former government
leaders. Conversely, defeated guerrillas may simply fade away
into the jungles or mountains. With no organized opposition to
negotiate with, the winner simply declares victory.[31] In such
cases, the declaration is a follow on to extermination/expulsion.

As illustrated by the final discussion, these categories are
not necessarily mutually exclusive. There have often been mixed
ending with more than one mechanism being employed.

Trends In War Endings

Writing in 1916, International Law Professor Coleman
Phillipson characterized treaties of peace as "the more usual
mode of putting an end to hostilities."[32] Although no one could
have know it at the time, a trend toward the formal resolution of
hostilities which had been developing over a period of four
centuries was about to reverse itself. In a seminal 1970

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article, Quincy Wright surveyed the endings of 311 wars during the period 1480 to 1970 and found that the "formalities of traditional international law for beginning, waging, and ending wars" reached a "high point in the first two decades of the twentieth century."[33]

One third of the wars of the sixteenth and seventeenth centuries ended with peace treaties; as did half of those in the eighteenth; two thirds in the nineteenth, and fully six-sevenths of twentieth century wars prior to 1920. Only half of the wars in the inter-war period ended with peace treaties, and no war since the end of World War II had ended in a formal peace treaty as of Wright's 1970 study.[34] Moreover, a quick survey of more recent wars failed to find any peace treaties. For example, the 1973 Arab-Israeli war ended with a armistice, the Flaklands with capitulation and declaration of victory, and the Iran-Iraq and Gulf Wars with cease-fires.

Also in the post-World War II period, only a relatively small number of interstate wars ended with a decisive victory resulting in a general capitulation or unconditional surrender.[35] I could find only four: India's conquest and annexation of Hyderabad in 1948, the Indo-Pakistani war of 1971 in which the Pakistani forces in East Pakistan unconditionally surrendered leading to the formation of Bangladesh, North Vietnam's conquest of South Vietnam in 1975 and the capitulation of the Argentine forces on the Flaklands.

These two trends result in an apparent paradox. Formal peace

treaties have become an anachronism at the same time that
decisive victories consummated by surrender and capitulations
have also declined. The answer lies in three factors.

First, the demise of the formal declarations to begin wars
and peace treaties to end them is partially the result of
changes in the state of international law. The outlawing of
aggressive war by the League of Nations and the United Nations
Charter made hostilities to acquire territory or other political
advantage "illegal". As a result, belligerents have hesitated to
declare war in order to avoid the political onus of being labeled
the aggressor .[36]

In addition, a declaration of war confers a degree of
legitimacy and recognition on the enemy. Consequently, it would
be politically unthinkable for an Arab state that doesn't
recognize Israel's statehood to declare war on it. Likewise,
Iraq's fiction of reclaiming its seventeenth province would have
been shattered if it had declared war on Kuwait.

Second, the international community has become more
interdependent with instant global communications increasing the
awareness of conflicts worldwide. Until recently, the U.S.-
Soviet confrontation created a bipolar world in which most states
had little choice but to be aligned with one side or the other.
As a result, an interstate conflict anywhere could quickly take
on the overtones of a superpower confrontation. The 1973 Yom
Kippur War is the most vivid example of the superpowers
pressuring their allies to terminate a conflict in order to avoid

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the possibility of a direct U.S. - Soviet confrontation.

Third, this period also saw the United Nations and regional organizations taking on an increasingly important role in conferring legitimacy to nations countering aggression as well as in mediating disputes. As a result, UN resolutions and UN brokered cease-fires and political agreements have become the norm. When Argentina invaded the Falklands, Britain did not declare war. Instead, it went to the United Nations and secured UN resolution 502 demanding an Argentine withdrawal.[37] The Gulf War and President Bush's commitment to a "new world order" are early indications that the dissolution of the Soviet state will not reverse this trend.

While some of these trends could be viewed as positive steps toward greater stability, the down side is that third party mediation and intervention have left a number of what Paul Seabury characterizes as "unconsummated wars." He defines an unconsummated war as a· "conflicts which - ceasing to be one of manifest organized hostile action - results in some form of stalemate in which the substantive issues at stake are not even for the moment resolved, but rather are held in abeyance."[38] In other words, they are conflicts in which conflict reduction stops at war termination and never proceeds to conflict resolution. In this regard, peacekeeping could be viewed as an exercise in creating and maintaining provisionality. The object is "to obtain an end to fighting, without prescribing the substance of a political solution."[39] The situation in the Middle East and on

Cyprus are examples of this problem.

In a broader sense, lack of decisiveness is a characteristic of any stalemate. Moreover, limited war by its nature will not resolve all the disputes between two nations. Returning to the conflict model, the phenomena of "unconsummated wars" again affirms that war termination and conflict resolution are not the same. Consequently, any strategist who hopes to achieve lasting peace must look beyond the termination of hostilities and tackle the underlying disputes that led to war.

Victory and Defeat - Winners and Losers

What does it mean to win a war? In the aftermath of World War II, the average American equated victory with the enemy's unconditional surrender. As a result, the idea of fighting a limited war in Korea was difficult for many Americans to understand. The wisdom of fighting a war for limited objectves was challenged by General of the Army Douglas MacArther in his farewell address to Congress:

> But once war is forced upon us, there is no other alternative than to apply every available means to bring it to a swift end. War's very object is victory - not prolonged indecision. In war, indeed, there can be no substitute for victory.[40]

Implicit in MacArthur's statement is an assumption of a common definition of victory. However, as noted eariler, unconditional surrender is only one of the many ways in which wars have ended. Moreover, in recent times it is the exception rather than the rule. Nevertheless, one side invariably claims victory. For example, the average American probably considers

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the War of 1812 a victory, but the fact is that the United States achieved none of its principal war aims and was fortunate to negotiate a return to the status quo.[41]

The term victor is often used interchangeably with winner. However, it is also commonplace to refer to a nation as having "won the war and lost the peace." This slogan is used to castigate political leaders for a diplomatic failure in securing a favorable peace settlement at the conclusion of a successful military operation, but it is also a way of recognizing that the alleged "victor" may emerge from a war with greater losses than gains.[42] The classic example is Britian's decline following its "victory" in World War II. The term "pyrrhic victory" named after King Pyrrhus of Epirus who exclaimed after a particularly costly battle, "One more such victory over the Romans and we are utterly undone" conjures up a similar idea regarding military operations.[43]

The purpose of these comments is not to endorse the pacifist theme that "there are no winners in war." Rather they simply highlight the fact that war termination is a complex issue and that simple terms like victory and winning are far from adequate in describing war aims. It should also be noted that use and definition of these terms is the subject of a great deal of debate and commentary in the literature of war termination. For example, Bernice Carroll offers the following list of fifteen different conceptions of victory grouped into four categories:

(1) Victory interpreted in a military sense:

- Total annihilation of opponent's forces, industry, etc.
- Destruction of opponent's military forces.
- Gradual or piecemeal subjugation or expulsion of the opponent's forces.

(2) Victory as a relationship between the parties:
- Capitulation or submission of opponent's force (strategic surrender).
- Imposition of dictated terms of armistice or peace.
- Attainment of military successes greater than those of the opponent.
- Imposition on the opponent of losses greater than one's own.
- Survival (as in some contemporary anticipations of all-out nuclear war.

(3) Victory as a relationship between war aims and war outcome:
- Attainment of the initial war aims.
- Attainment of any war aim or aims formulated in the course of the conflict.
- Frustration of the initial war aims of the opponent.
- Frustration of any war or aims of the opponent.

(4) Victory as interpreted in terms of gains and losses:
- Attainment of gains (territorial, economic, political, psychological, strategic) beyond the status quo ante and outweighing losses.
- Attainment of any gains beyond the status quo ante, regardless of losses.
- Attainment of any gains perceived as greater than the gains of the opponent.

She concludes by noting that some interpretations of victory may require a combination of two or more of these elements.[44]

While perhaps not exhausting every possibility, Carroll's list is certainly comprehensive enough to make the point that "victory" is not self-defining. In that regard, I believe that Harry Summers' discussion of the "Weinberger doctrine's" implications for war termination offers the strategist a succinct answer to this problem:

> With this "Weinberger doctrine," the United States has taken heed of Clauswitz' admonition "not to take the first

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step without considering the last." His emphasis on the importance of clearly defining our political and military objectives before we commit US forces to combat is long overdue. Further, war termination is given the emphasis it deserves and winning is correctly defined as the realization of the objectives we set out to attain.[45]

Thus, although others have offered alternative terminology such as "aggressee and aggressor," "initiator and resistor," and "sustainer and quitter," in order to finesse the issue, there is no need to abandon the time honored vocabulary of war as long the terms are placed into proper context.[46] For this paper, that context is the achievement of the nation's war aims.

TOWARD A THEORY OF WAR TERMINATION

Since Machiavelli wrote The Prince in the sixteenth century, Western writers have been analyzing war in the context of international politics. Nevertheless, there is still no generally accepted theory of war in the sense of a set of propositions or axioms that are the "product of deductive reasoning and subject to empirical test."[47] As a result, the subject of war termination has been approached using a variety of theoretical perspectives and methods, none of which can claim to be authoritative.

As previously discussed, the western concept of strategy is inherently a rational actor model. War is seen as coercive instrument of policy presumably guided by "rational" decision makers pursuing political objectives. However, this perspective is by no means universal. Anatol Rapport drew the distinction between fightlike and gamelike concepts of war. Rational actor models are gamelike theories. Fightlike theories see war as a function of mass behavior, of impersonal forces beyond the control of decision makers, or of repetitive group behavior predictable on the basis of quantitative patterns.[48]

Fightlike Theories and War Termination

Although fightlike theories have been frequently employed in explaining the causes of war, they are relatively rare in the field of war termination. Lewis Richardson attempted to apply an epidemiological model to explain war termination as the spread of war weariness throughout a population. Frank Klingberg and John

Voevodsky independently attempted to establish some fixed, repetitive relationship between casualties and the termination point.[49] Cythia Cannizzo conducted a broader statistical analysis to correlate military capabilities, battle casualties, war duration and victory.[50] All four of these studies are covered in considerable detail in Appendix I.

After an extensive analysis of the historical data, Klingberg was unable to correlate casualties and war termination.[51] However, in a more limited study, Voevodsky made the dubious claim that through cybernetic analysis of trends in causalities and battle strength, he could predict the approach of a crisis point in a war that would result in settlement or a major escalation.[52] Cannizzo limited her findings to a series of observations on statistically supportable historical trends such as, "the longer the war, the lower the probability of victory by the [initially] stronger nation."[53]

In my estimation, these studies demonstrate the futility of employing the fightlike approach which attempts to predict war termination without reference to the ends being sought. Consequently, the remainder of the paper will deal only with rational actor models.

The Limits of Rationality

Most of what has been written about war termination assumes that nations make "rational" decisions about war and peace. However, defining the limits of such rationality is a matter of intense debate. At one extreme, is the idealized case of what

Trevor Salom characterized as "comprehensive rationality" by which he means that:

> . . . all necessary and relevant information to the problem in hand is available: that all possible relevant alternatives are thoroughly and carefully examined; that there are never too many problems for him to be able to cope with each one properly, and that each individual problem can be looked at carefully and comprehensively, without emotion, stress or time pressures having any effect.[54]

At the other extreme, is what Colonel David Jablonsky calls "extrarational" factors in decision making. These are heavily influenced by "subconscious processes such as intuition and judgement or through the interplay and charisma and ideology." In what he terms as "crazy states" these processes dominate decision making usually as the result of dictatorial rule by a leader who sees himself as a heroic figure who "has an intuitive sense of reality that allows him to feel and grasp new and unusual possibilities that otherwise are hidden from the senses."[55] The classic example is Hitler but more contemporary figures such as Saddam Hussein may also fit the mold.

Although no decision maker can hope to meet the idealized standard of comprehensive rationality, the entire concept of strategy with its emphasis on logically relating ends, ways and means is inherently a rational model. Of course in the real world, there are practical limits to rationality as Alexander George points out:

> (1) The political actor's information about situations with which he must deal is usually incomplete.
> (2) His knowledge of ends-means relationships is generally inadequate to predict reliably the consequences of choosing one or another course of action.

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(3) It is often difficult for him to formulate a single
        criteria by means of which to choose which alternative course
        of action is "best."[56]

Such practical limitations are no reason to disregard rational

models. Reduced to the bare essentials, a decision maker is

rational if he evaluates and orders his policy choices on the

basis of some consistent criteria and chooses the more preferred

over the less preferred course of action.[57] Stated differently:

"Rational actors need not be assumed to have a crystal ball.

They are assumed to do what they believe is best, given the

information they have."[58]

Why Do Wars End?

The question of why wars end is closely related to the

previous discussion of war endings. With the exception of

extermination and expulsion, some degree of explicit or tacit

agreement is involved in all types of war terminations.

Obviously, the amount of give-and-take involved varies

dramatically from a negotiated peace treaty to the tacit

understandings that provide the backdrop for an otherwise

"unconditional" surrender. Even a unilateral withdrawal requires

the acquiescence of the other side in not pursuing the

withdrawing forces and continuing the war on the other's

territory. Consequently, except in those increasingly rare cases

of extermination and expulsion, wars end because both sides, at

least tacitly, agree to stop fighting.

War Termination as a Bargaining Process

Paul Pillar likened war termination to a bargaining process.

In general, all bargaining problems have three essential characteristics: the bargain must be mutually beneficial, it must be reached by mutual consent, and there must be more than one possible agreement.[59] In a bargain, both parties hope to improve their situation by reaching an agreement. Two motivations are possible. Either disagreement is mutually costly so the parties seek to end it, or agreement is profitable so they seek to attain it.[60] In war termination, both elements are usually present.

Few would question the assertion that war is costly. In addition to material costs in blood and treasure, there are social, political and psychological costs. War also entails opportunity costs as the result of the diversion of attention and resources from other international and domestic concerns. The greater the cost, the greater the incentive to reach agreement.

From a Clausewitzian perspective, wars are fought to achieve specific ends or objectives such as the acquisition of territory or the favorable resolution of a political conflict. These ends are success-oriented goals in that they are the fruits of victory. There are also conflict-oriented goals which are satisfied by the struggle itself. Examples, include preserving national honor, increasing national dynamism and cohesion and enhancing the power and influence of the military.[61] For the most part, such conflict-oriented goals are the by-products of wars fought to achieve concrete objectives.

The second characteristic of bargaining is that mutual action is required to reach an agreement. Disagreement persists if one

of the parties wants it to persist.[62]   History is replete with examples of defeated aggressors who would have been happy to terminate hostilities after achieving early conquests at relatively low costs. However, as long as the enemy has the capacity to resist, war termination requires joint action.

This discussion is not intended to de-emphasize the role of coercion in war termination. As pointed out earlier, the scope of the agreement and the extent of negotiations varies enormously with circumstances and the type of war ending. However, even in the case of unconditional surrender, there is an element of agreement and it is motivated by a desire to avoid unnecessary additional costs as Paul Kecskemeti explains:

> Surrender means that the winner and loser agree to dispense with the last round of fighting. . . . What the loser avoids by offering to surrender is a last, chaotic round of fighting that would have the characteristics of a rout. . . . By the same token accepting surrender is a rational decision for the winner: he can obtain his objective without paying the costs of a last battle.[63]

In less one-sided endings, neither side will attain all of their war aims and the agreement would be an explicit compromise on the substantive issues of the conflict.

The third characteristic of a bargaining problem is that there is more than one possible solution. Peace terms are often subject to minute variations. When dealing with quantitative issues such as the division of territory or monetary reparations, the number of possible agreements can be virtually infinite. Even when dealing with qualitative issues, various combinations of concessions can be used create a number of packages.

Moreover, as Pillar points out, bargaining is a dynamic process:

> . . . war costs often become sufficiently great to produce a bargaining range large enough to accommodate even gross differences among possible agreements. This does not imply that the limits of this range are always clear . . . When one side rejects a proposed settlement, . . . the opponent . . . may not known whether it was rejected as being worse than a continued war or rejected in an attempt to make acceptable terms even better. Nor does it imply that the limits of the bargaining range remain fixed. It is more common for them to fluctuate in the course of a war as costs increase or decrease, opportunities open or close, and hopes appear or disappear.[64]

Only in those cases where one side has the capability and will to achieve a truly unilateral solution through extermination or expulsion does the bargaining range disappear entirely.

Although it is instructive to conceive of war termination as a bargaining process in which both sides seek to minimize their costs and maximize their gains, the analogy offers only a partial explanation of the war termination process. The next step is to examine the factors that cause the belligerents to decide that the time has to come to cease hostilities and which shape the final settlement.

Balance of Power and War Termination

Another useful way of conceptualizing war termination is as the final stage in the process of achieving a new balance of power. In this sense, war is a decision mechanism in which both sides struggle to achieve dominance and impose their will on the enemy. The war ends when a new balance of power is established and accepted by both sides as the basis for their future relations.

The principal exponent of this perspective is R.J. Rummel. He defines power as the product of interests, capabilities and will. In his view, international conflict and war results from a change in the perceived balance of power which, in turn, leads to a disruption in the structure of expectations that defines the status quo. War is a bargaining process which determines "the real goals of the parties; their actual relative military and economic power, national morale, and qualities of leadership; and will power."[65] The outcome is a new balance of power supporting a new structure of expectations - a new status quo.

The new balance of power requires a new equilibrium between the interests, capabilities and will of the belligerently. A new balance means that both parties better perceive their mutual interests and strength of purpose and are willing to live with whatever degree of satisfaction of interests results from the confrontation. Except in the case of total victory, war ends in some sort of implicit or explicit compromise, where the costs of additional conflict can no longer be justified by the interests involved.[66]

Although he acknowledges the necessity for a rational cost/benefit analysis, Rummel cautions against reading too much into this assertion:

> This does not imply that the parties to a conflict are computing machines weighing explicit costs against articulated interests. Nothing so precise. . . . Emotion, jingoism, nationalism, ideology, hate, and all may be involved to some degree. Nevertheless, there is some definition of the interests engaged, simply from the need of bureaucratic organizations and groups to define some specific goals and the demands of interest groups that costs be

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justified. And costs are weighed, not necessarily as an investor calculating the return in interests, but more as a sense for proportionate costs given the aims.[67]

In other words, there are practical limits to rationality.

The second element of the new balance of power is the capability of each side to continue to pursue the conflict and achieve their interests. War is a process of "reality testing."[68] Numerous authors have commented on the role of perception and uncertainty in the decision to go to war. For example, Fred Ikle referred to "The Fog of Military Estimates" and Geoffrey Blainey observed that, " when nations prepare to fight each other, they have contradictory expectations of the likely duration and outcome of the war."[69]

War resolves ambiguities and uncertainty. Prior to the war, intelligence estimates tend to focus on concrete, quantifiable capabilities. Intangibles such as the state of training, the ability of the leaders, and determination of the soldiers are much more difficult to assess. Consequently, there is usually ample room for wide variations in estimates. After the first major battle, both sides have a much more objective appraisal of the their relative combat power. As the war drags on, a similar process takes place at the national level where, as William Staudenmaier put it, "the social, political and economic costs of the war are unveiled."[70] Eventually, a new balance of power is established which reflects a "new, mutual realism about each party's capabilities to achieve the interests involved."[71]

The third element in the new balance of power is a fresh,

mutual appreciation of each other's wills which are "the most elusive and ambiguous of psychological variables."[72] The resolution and determination of each party to pursue its interests will be demonstrated in the conflict.

Thus war will end when the confrontation clarifies unambiguously a new balance of power based on a new appreciation of relative interests, capabilities and will. This results in a new structure of expectations that will form the post-war status quo. According to Rummel, establishing a new balance of power is the only "necessary and sufficient" cause of war termination.[73]

Having discussed the dynamics of the war termination process in general, the next step is to construct a model which describes a set of specific conditions which results in termination of hostilities. Ideally such a model would be quantifiable and have predictive value. However, even a subjective model could be of value.

Irreversability and Correspondence

Paul Kecskemeti proposed a relatively simple model in which he argued that war termination implies an agreement by both sides that "the armed struggle as a decision mechanism has produced politically conclusive results, at least for the time being." Termination involves two basic considerations the military outcome and the political payoff. In his view, the military outcome provides the basis for distributing the payoffs but does not determine the magnitude of the payoffs directly. In essence, the military outcome determines the relative bargaining strength

of the parties.[74]   In these respects, his model closely follows
the previous discussion.

Kecskemeti's refinement is in suggesting concrete criteria
for determining whether a given outcome will be accepted by both
sides as terminal.   He argues that this judgement depends on two
factors:

> (1) Whether the outcome can be reversed by renewed efforts.
> (2) Whether the "stake" is high enough to justify an
>   attempt in this direction.[75]

The answers to these questions are found in the principles of
"irreversibility" and "correspondence."

The principle of irreversibility provides a rational criterion
for making choices between continuing or terminating hostilities.
Despite an unfavorable battlefield trend, a belligerent may still
have unmobilized reserves and other resources available.   The
basic decision criteria is if the trend can be reversed with the
application of these additional resources or whether the point
has been reached where further effort means only additional costs
and loses without really improving the existing balance of power.
Once the military trend has stabilized and is no longer
reversible, the rational decision is to stop war.[76]   While the
military trend could point to eventual victory or defeat, a trend
pointing toward continued stalemate is also a definite
possibility.

The total effort undertaken by a belligerent is not
determined solely by the goal of achieving the best possible
military outcome.   It also depends on the magnitude of the

political gains and losses at stake. "Even when a belligerent judges that additional effort could reverse the military trend, he may decide to settle on the basis of the prevailing military situation, on the grounds that the better political payoff he might obtain would not justify the additional costs, risks, and hardships."[77] Hence, the second principle is the correspondence between the effort and the political stake.

Although Kecskemeti's twin tests of irreversability and correspondence have some logical appeal, their relationship is far from clear. For example, he makes the point that under some circumstances, an imbalance between the effort and political stake could lead to the termination of a war despite the availability of resources that could improve the military trend. Unfortunately, he goes no further in specifying how these two considerations interact or are weighted in termination decisions.

Expected Utility Theory

One means of overcoming the inherent difficulty of describing the interrelationship between two of more factors is to express the concept as a mathematical equation. For war termination, most work of this type is based on expected utility theory. According to this theory, decisions are based on calculations in two dimensions: utility and probability. A rational person attempts to maximize expected utility which is calculated by multiplying the utility of a possible outcome by the probability that it will occur.[78]

In the field of war studies, the best known proponent of

expected utility theory is Bruce Bueno De Mesquita. Expressed in words his basic proposition is that a nation's expected utility for a war is equal to the probability of success multiplied by the possible policy gains, minus the probability of failure multiplied by possible policy setbacks.[79] If the expected utility is positive, the nation has an incentive to go to war. Bueno De Mesquita's theory and its relevance to war termination is discussed in detail in Appendix II.

The most sophisticated application of expected utility theory to the problem of war termination is C.R. Mitchell's refinement of a model developed by Donald Wittman.[80] The model begins with an equation for the expected utility of continuing the war at time t:

$$U_{x,t}(W) = P_{2,x,t+r} \; [U_{x,t+r}(S_2)]f^r \; - \; (1-P_{2,x,t+r}) \; [U_{x,t+r}(S_o)]f^r$$
$$- \; \frac{C \; (1-f^{r+1})}{1-f}$$

where:

$U_{x,t}(W)$	= Expected utility at time t of continuing the war
$P_{2,x,t+r}$	= Nation X's subjective probability of achieving a better outcome, S_2, at time t+r.
$U_{x,t+r}(S_2)$	= The utility of settlement S_2 to Nation X
f^r	= Discount rate for future gains at interval r
$1-P_{2,x,t+r}$	= Nation X's subjective probability of achieving a less favorable settlement, S_o, at time t+r
$U_{x,t+r}(S_o)$	= The utility of settlement S_o to Nation X
$C \; \frac{(1-f^{r+1})}{1-f}$	= The discounted cost of continuing the war for time interval r

This reads, "the utility of continuing the war at time t is equal to the expected value of the discounted utility of some future preferred settlement at t+r minus the expected discounted utility

of a possible worse outcome of S_0 at $t+r$, minus the discounted costs in utility terms of pursuing the struggle."[81]

If $U_{x,t}(W)$ is defined as above, and the expected utility at time t of its opponent continuing the war $[U_{y,t}(W)]$ is defined analogously, then a necessary condition for a settlement is that there exists at least one settlement such that:

$$U_x(S_i) > U_{x,t}(W) \quad \text{and} \quad U_y(S_i) > U_{y,t}(W)$$

This reads that the utility of the settlement available at time t to nation X exceeds its expected utility of continuing the war, and that the utility of the same settlement to nation Y exceeds nation Y's expected utility of continuing the war.[82]

A REFINED WAR TERMINATION MODEL

A Simplified Expected Utility Formulation

My starting point for developing a new war termination model is Mitchell's expected utility equation. Unfortunately, his use of multiple subscript notations makes the equation difficult to follow. At the risk of losing some precision, a simplified version is presented below:

$$EU_{x,t}(W) = P_2 [U_{t+r}(S_2)] - (1 - P_2) [U_{t+r}(S_0)] - C_r$$

This reads that nation X's expected utility at time t for continuing the war is equal to the product of the utility and probability of a better settlement (S_2) at time t+r, minus the product of the utility and probability of a worse outcome (S_0), minus the cost of continuing the war for the additional time period (r).

For clarity it should be noted that all of the utilities and probabilities in the equation are nation X's subjective estimates made at time t. These estimates are likely to change over time. The simplified formulation also removes the social discount rate (f_r) from the equation. This concept is borrowed from economics and is intended to compensate for the fact that future gains are generally not valued as highly as an immediate payoff. As Wittman explains, "because war and postwar events are not instantaneous, expected utility from continuing the war depends on the present value of future outcomes."[83] The higher a

country's discount rate, the less it will weigh future outcomes in making decisions. For purposes of this discussion, it assumed that any discounting is included in the country's estimate of utility.

Using the simplified equation, nation X's necessary condition for war termination can now be restated in a single equation:

$$U_x(S_t) \geq P_2 [U_{t+r}(S_2)] - (1 - P_2) [U_{t+r}(S_o)] - C_r$$

This reads that nation X's utility for a settlement perceived to be available at time t must be equal to or exceed the expected utility of achieving a better settlement (S_2) in the future, minus the expected utility of a worse future outcome (S_o), minus the cost of continuing the war for the additional period (r). Of course, the right side of this equation is the expected utility of continuing the war. In addition, the analogous equation must simultaneously hold for nation Y so that its utility for the same settlement is equal to or exceeds its expected utility of continuing the war:

$$U_y(S_t) \geq EU_{y,t}(W)$$

A Note on Quantitative Methods

Although some may be put off by the "quasi-mathematical" formulation of this war termination proposition in expected utility terms, the approach has the merit of compressing a series of interrelated conditions into a single expression. The alternative verbal explanation fills a paragraph but fails to convey every nuance.

Before examining the model in detail, a disclaimer is in

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order. Despite its formulation as an equation, this is a purely heuristic model. I do not believe that it is possible to meaningfully operationalize this expected utility equation and assign numeric values to the variables. I do not envision that real decision makers are, as Rummel put it, "computing machines weighing explicit costs against articulated interests," nor is the model intended to suggest that they or their staffs should be.

A Critique of Wittman's Model

In his original article, Wittman notes that although the model includes only two settlements there could actually be a entire range of possibilities. This could be dealt with by replacing the two settlements currently considered with the summations of two sets of expected utilities. One set would be include all realistic settlements better than the one currently perceived to be available and the other a set of all those that would be worse. From a mechanistic perspective this would require assigning each a probability with the stipulation that the sum of all probabilities equal 1. However, given the heuristic nature of the model, this refinement can be accommodated conceptually without changing the formulation of the equation.

Mitchell identified a second limitation in that the model considers the options available only at a single point in the future (t+r). This limitation is easily overcome by employing an iterative process that covers as many future projections as desired. If the expected utility for continuing the war in any

of them exceeded the utility of the currently available settlement, the rational choice would be to continue the war.

The third flaw with the model is more serious. In the spirit of the utility maximization, Wittman conceives of outcomes only in terms of positive utility. Thus unconditional surrender by Y represents the greatest utility that X can receive. In a negotiated settlement, "the less utility that X receives, the more Y receives."[84] Thus, the more unfavorable the settlement, the smaller its utility. From a mathematical perspective this presents a problem since the model subtracts the expected utility of the less favorable settlement from the that of the more favorable as a way of reflecting risk. However, given Wittman's scale, the worse the alternative outcome, the smaller the number and therefore the less impact it should have on the decision.

Improving the Expected Utility Model

In order to overcome this problem it is necessary to modify the formulation using a concept borrowed from Bueno de Mesquita. A simplified version of his model for determining the utility of prospective war by nation i could be expressed as follows:[85]

$$E(U_i) = P_i(U_{ii} - U_{ij}) + (1 - P_i)(U_{ij} - U_{ii})$$

Where:

U_{ii} = Nation i's utility for the new status quo it would impose if victorious. $U_{ii} = 1$ by definition.

U_{ij} = Nation i's utility for the status quo that it anticipates nation j would impose if it were victorious. U_{ij} can vary between 1 and -1.

Thus, the equation reads that nation i's expected utility for a war with nation j is equal to the probability of success

multiplied by the utility of possible policy gains plus the

probability of failure multiplied by the negative utility of

possible setbacks. In each case, utility is measured by

computing the difference between two possible outcomes. When

multiplied by probabilities, the potential gains and losses

become expected utilities. If $E(U_i)$ is positive, then nation i

can expect to profit from the war.

If the Wittman/Mitchell equation is modified using some of

Bueno de Mesquita's techniques, the problem of adequately

representing risk can be solved. Consequently, I have

reformulated the war termination equation as follows:

$$\Delta EU(W) = P_b \; [U_{t+r}(S_b) - U_t(S_t)] - (1-P_b) \; [U_t(S_t) - U_{t+r}(S_l)] - C_r$$

Where:

$\Delta EU(W) =$ Expected utility differential between continuing the war until time t+r and terminating at time t.

$P_b \quad =$ Nation X's subjective probability of achieving a better future outcome, S_b, at time t+r.

$U_{t+r}(S_b) =$ Utility of a projected better settlement, S_b, at time t+r

$U_t(S_t) \quad =$ Utility of the settlement perceived to be available at time t.

$[U_{t+r}(S_b) - U_t(S_t)] =$ Nation X's perception of what might be gained by continuing the war until time, t+r, in hopes of achieving a better settlement than the one available at time t.

$1 - P_b \quad =$ Probability of achieving a less favorable future settlement, S_w, at time t+r.

$U_{t+r}(S_l) =$ Utility of projected less favorable settlement at time t+r.

$[U_t(S_t) - U_{t+r}(S_l)] =$ Nation X's perception of what might be lost by continuing the war until time, t+r, if it must settle for a less favorable outcome than the settlement available at time t.

$C_r \quad =$ Cost of continuing the war for the period r.

This reads that the expected utility differential between

continuing the war until time t+r and terminating at time t is

equal to the expected utility of the potential gains, minus the expected utility of potential losses (risk), minus the cost of continuing the war for the additional time period (r).
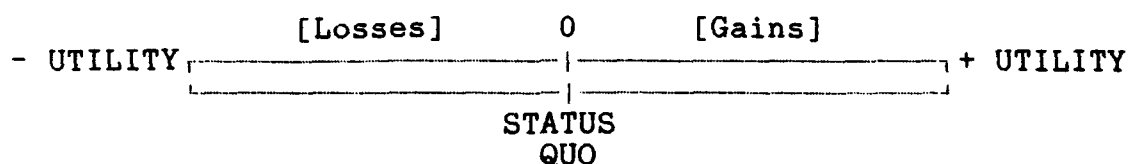
If $\Delta EU(W)$ is negative, the costs and risks of continuing the war outweigh any potential gain. If the analogous equation is also negative for nation Y, then the necessary condition for war termination has been achieved. If the expected utility differential for continuing the war is positive for either side, the rational decision is to continue the war.

This formulation accommodates both positive and negative utility and correctly predicts that the worse the projected less favorable outcome, $U_{t+r}(S_1)$ becomes, the more it will influence the decision in favor of war termination. Although I do not intend to operationalize this equation, a brief discussion of utility values might be helpful. In Wittman's model, all utilities are positive. The worse the outcome, the smaller the utility. This idea could be related to a country's war aims. The worse the outcome, the fewer war aims accomplished. At the very bottom of the scale would be country X's survival as a nation and the physical survival of its population. Thus, except in cases of annihilation, the utility is always positive.

Measuring Utility

In my model, outcomes are viewed in terms of improvements or deterioration of the prewar status quo. I think this a more accurate portrayal of way in which decision makers view the world. People tend to think in terms of gains and losses, not

just varying amounts of gain. A graphic representation is shown
below:

```
                    [Losses]        0        [Gains]
 - UTILITY ┌─────────────────────────┬─────────────────────────┐ + UTILITY
           └───────────────────────┐ │ ┌───────────────────────┘
                               STATUS
                                QUO
```

Thus a war that ends in a return to the status quo ante
bellum gains nothing for attacker. However for the defender,
this might be a much more favorable outcome than being conquered
by the attacker or losing disputed territory. Using this system,
the utility of any settlement is the sum of its positive and
negative elements. Thus, it is possible that the three
settlements in the model (S_t, S_b, S_l) could all have positive
utility, all have negative utility or have some mix of positive
and negative utilities.

Testing the Model

Although the equation is meant to be a model of a thought
process not a quantitative decision aid, two numerical examples
will illustrate its operation. Recall that the basic equation
is:

$$\Delta EU(W) = P_b [U_{t+r}(S_b) - U_t(S_t)] - (1-P_b) [U_t(S_t) - U_{t+r}(S_l)] - C_r$$

If $P_b = 0.5$; $U_{t+r}(S_b) = 10$; $U_t(S_t) = 4$; $U_{t+r}(S_l) = 2$; $C_r = 1$

$$\Delta EU(W) = 0.5 [10 - 4] - (0.5) [4 - 2] - 1 = 1$$

Since this is a positive utility differential, the rational
decision would be to continue the war. If the equation is
correctly constructed, a decrease in the utility of the less
favorable outcome should reduce $\Delta EU(W)$. Furthermore, the

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equation should be able to handle negative expected utility. These propositions can be tested by changing $U_{t+r}(S_1)$ to -4 and keeping all other variables constant:

$$\Delta EU(W) = 0.5\,[10 - 4] - (0.5)\,[4 - (-4)] - 1 = (-2)$$

The shift to a negative expected utility differential confirms that the equation functions as anticipated.

Bearing in mind the preceding definitions, the basic concept can be conveyed by the following simplified expressions:

$$\Delta EU(W) = P\,(\Delta GAINS) - (1-P)\,(\Delta LOSSES) - \Delta COST$$

This reads that the expected utility differential between continuing the war and terminating on currently available terms is equal to the expected utility of a potential increase in gains minus the expected utility of potential losses minus the cost.

The Impact of Probability

In addition to utility, probability and costs are the key determinates of war termination decisions. The ability to accurately assess the probability of various outcomes is directly related to the clarity of trends developing on and off the battlefield. These probabilities are the subjective estimates of the participants since their decisions are based on their perceptions of the situation not objective reality. Consequently, it is possible that the estimates of the two belligerents will diverge.

In the beginning of the conflict, it is likely that both sides will have relatively optimistic estimates of their ability

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to achieve a favorable outcome. The greater their optimism, the greater will be their expected utility for continuing the war and the less the chance for a settlement. As the war continues, uncertainty will decrease and trends will begin to emerge. It may be that one side will achieve ascendancy or the trend might indicate that a stalemate is likely. In any case, as the estimates of the two sides begin to converge on a shared view of the future, the possibility of settlement increases.

Kecskemeti's principle of "irreversibility" as a condition mandating war termination actually reflects a boundary condition in the range of probability. If the eventual "loser" recognizes that the trend in military developments can not be reversed, his probability for achieving a better settlement at a later date is zero. Thus the expected utility equation becomes:

$$\Delta EU(W) = 0 \; [U_{t+r}(S_b) - U_t(S_t)] - (1) \; [U_t(S_t) - U_{t+r}(S_l)] - C_r$$

As a result, the expected utility differential must be negative and logic would dictate terminating the war. Unfortunately, as Kecskemeti points out, "irreversibility is only too likely to be recognized long after it has set it, with the result that futile effort and losses pile up."[86] In addition, the eventual loser runs the risk of squandering his residual bargaining power and fighting until the enemy enjoys a true monopoly of power.

While irreversibility is certainly a rational criteria for war termination, it is by no means a requirement. The probability of achieving a better settlement is only one factor in a complex relationship. In fact, one of the principal

advantages of using the expected utility methodology is that it demonstrates the interaction of the factors in a precise manner that is hard to duplicate in words.

The Cost Differential

In addition to utility and probability, cost is the third variable in the war termination equation. C_r is the additional cost that would be incurred if the fighting were continued in hopes of achieving a better settlement. Sunk costs play no direct role in the model since they cannot be effected by the termination decision. The expectation of incurring high additional costs serves as a counter weight to the tendency to fight on in hopes of improving the outcome.

Despite the compelling logic for including costs in the termination equation, their inclusion creates a major obstacle to any attempt to operationalize the equation. As discussed earlier, there is no common currency with which to measure the utility of a settlement and the cost in blood and treasure necessary to achieve it. Wittman and Mitchell neatly side stepped this issue by noting that costs are in utility terms. I have retained this convention since the model represents a thought process where the relative values of all the variables reflect subjective judgements and a rough sense of proportionality as opposed to specific numbers.

EXPANDING THE MODEL TO INCLUDE OTHER FACTORS

The refined war termination model developed in the preceding
section posits that the differential expected utility for
continuing a war depends on the magnitude of the additional costs
to be incurred and the probability and utility of possible gains
and losses. This proposition can be expressed in the following
simplified equation:

$$\Delta EU(W) = P (\Delta GAINS) - (1-P) (\Delta LOSSES) - \Delta COST$$

However, a review of the literature reveals that many other
factors have been identified as having a major impact on war
termination. For example, Berenice Carroll suggested a war
termination formula that consisted of the summation of nine
variables: war aims, military situation, morale, costs,
vulnerability to destruction, potential, domestic conditions,
external conditions and peace terms. [87]

Michael Handel conducted a survey of war termination theories
and concluded that the decision to start negotiating is a
function of "relative power relations." He also identified eight
"circumstances" that impact on the decision to terminate
hostilities. They included the trend in the overall situation
(military, political and economic), time pressures, military
potential, external support, domestic situation, war aims, peace
terms, and bargaining strength.[88] However, he made no attempt to
weight these factors or suggest any relationships.

In addition to his general proposition that establishment of

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a new structure of expectations consistent with the relative power of the belligerents is the only necessary and sufficient condition for ending a war, R. J. Rummel listed four "accelerators." He found that war termination is positively correlated with shifts in domestic opinion against the war, mutually consistent expectations of the outcome on the part of all belligerents, a decisive shift in military power to favor one side, and the ideological devaluation of the conflict. [89]

All of these factors undoubtedly influence war termination. However, it can be argued that each actually bears on one of three basic variables included in the refined war termination equation and are, therefore, not additional independent variables. In essence, if probability, utility and cost are defined broadly enough, the effects of all other factors will be reflected through their impact on these prime variables.

Factors Effecting Probability

Following the logic of Rummel's argument, the probability of any particular settlement is directly related to the balance of power between the belligerents. The greater the asymmetry in relevant power, the greater the probability of the stronger side achieving a favorable settlement. However, no settlement is likely until the general trend of war is clear to both sides. If the weaker side persists in holding out in hopes of attaining a better settlement until the situation is "hopeless", meaning that the probability of a more of favorable outcome is zero, it risks losing all bargaining power.

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The most obvious ingredient in assessing the probability of achieving a more favorable outcome is the current military situation. In some cases, such as the fall of France in 1940, military pressure can bring a war to a rapid close by achieving a decisive battlefield victory before other elements of national power have time to have a major impact. However, even in such cases, there are additional factors such as the possibility of intervention by other powers, that play a role. For example, superpower intervention and U.N. negotiations prevented Israel from consolidating its victory over Egypt in 1973.

Significant factors that impact on the probability of achieving a more favorable outcome include:

(1) The current military situation, especially trends.
(2) The overall economic and military potential of the belligerents.
(3) The availability of external support ranging from direct intervention of an ally to favorable world opinion.
(4) Domestic political support, cohesion and commitment to the struggle.
(5) Statements or indications of the opponent's minimum peace terms. These could range from formal diplomatic offers, to secret terms offered through third parties, to public statements by enemy leaders.

In regard to the last point, Paul Pillar pointed out that there is a tendency to exaggerate the interests involved in a war and to paint the enemy as the personification of evil in order to sustain the domestic consensus and present a determined image. Unfortunately, "such bellicose posturing can delay the opening of peace negotiations by effecting the enemy's view of the prospects for peace."[90] In the age of instant global communications exemplified by CNN, it is increasingly difficult for world

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leaders to separate statements meant for domestic consumptions and those aimed at a wider foreign audience.

Factors Effecting Utility

The most reliable yardstick for measuring the relative utility of various settlements is the status quo ante bellum. Not only does it provide a common reference for both sides, it is a standard of infinite detail. No matter how seemingly trivial, any subject that could come up in negotiations can be compared against the prewar status quo. A second set of benchmarks are the war aims or objectives of the participants. However, objectives are often stated in rather vague terms and have a tendency to change as the conflict progresses.

In an insightful analysis of war related decision making, James Foster observed that because of the monumental uncertainties involved in going to war and the conflicting goals of competing interest groups within a government, "it is often easier and more timely to agree that action must be taken than to agree on the ultimate purpose of that action." Moreover, the demands of domestic politics, especially in democratic societies, "creates incentives for the political leadership to remain vague about their objectives as a means of keeping their options open."[91]

Even when political objectives are fairly well articulated at the start of the war, they have a tendency to change. One phenomena is what Raymond O'Conner called the "victory disease" in which success fuels growing ambitions leading to increasing

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war aims.[92] Another factor that impacts on war aims is the
tendency to view past costs as an investment. Employing the
concept of cognitive dissonance, Pillar explained that "mounting
costs engender an upward reevaluation of one's objectives,
thereby reducing the discomfort of knowing that one has incurred
costs without sufficient reason." "The reevaluation in turn
makes further costly efforts even more justifiable." [93]

The tendency to exaggerate the interests at stake in a war
often results in characterizing a conflict as a clash of basic
political ideologies. Prior to the end of the cold war,
virtually every conflict was seen in terms of the struggle
between democracy and communism Since such appeals engage
fundamental beliefs on both sides, they limit the possibilities
for compromise. As a result, Rummel included "ideological
devaluation" as a factor favoring war termination.[94]

In light of these considerations, a list of factors that
influence judgements about the utility of various settlements
would include:

(1) The status quo ante bellum.
(2) Both the original and current war aims of the
     belligerents.
(3) Sunk costs.
(4) The intensity of the interests at stake. For instance,
     if survival interests are at stake, decisive military
     victory may be required to coerce the enemy into
     submission.
(5) Ideological engagement or devaluation.
(6) The likely domestic impact of the settlement.
(7) The long term international impact of the settlement on
     the reputation and power of the nation.

The last two factors deserve further comment. One of the

problems with the application of limited war theory as popularized by Kaufmann, Osgood and Kissinger is too narrow a focus on direct costs and immediate objectives. When assessing utility, consideration must be given to second order consequences of a proposed settlement. As James Foster points out, "the cost consequences of termination usually have to do with political circumstances far removed from the circumstances of the immediate military situation."[95]

Ending a war without having achieved major war aims frequently leads to an internal political crisis. As Fred Ikle wrote, "nothing is more divisive for a government than having to make peace at the price of major concessions."[96] The government must simultaneously attempt to bargain with the enemy from a position of strength while persuading the nation that the situations demands compromise on objectives which it had previously insisted were vital.

It is little wonder that many governments fail to survive the crisis of terminating an unsuccessful war. Many authors have commented on this phenomena with some suggesting that it may be a necessary condition for war termination. For example, in his seminal 1944 study Lieutenant Commander Calahan commented that:

> It is strange that in the majority of the wars we have reviewed, the party that made the peace was not the party that made the war. . . . It seems fair to conclude that a change of regime for the vanquished comes close to being a condition precedent for the making of peace. . . . If this is the case, . . . then it would seem logical to make a change of regime for our opponents one of our fundamental war aims.[97]

Consequently, domestic repercussions can significantly decrease

the practical utility of a settlement.

A similar situation exists at the international level. Whenever a nation goes to war, its international prestige and credibility are on the line. In the case of an intervention in a limited war by a major power on behalf of an ally, the adverse impact of termination short of victory on its international credibility may be the principal criterion for judging the utility of a settlement. The U.S. disengagement from Vietnam is a classic example. Moreover, the end of the cold war has not diminished the importance of international credibility.

Factors Effecting Cost

The third variable is cost. While it is difficult to relate costs to utility, they are the most visible and poignant manifestations of war. Although sunk costs have an indirect impact on utility, they are not considered in this portion of the war termination equation. At issue are only the prospective costs of continuing the war in hopes of achieving a better outcome.

The most obvious cost of war is death and destruction. There are also extensive direct economic costs in terms of the military supplies and equipment consumed. Other costs are less apparent. Wars entail opportunity costs both domestically and on the international scene. In the short run, a decision to continue the war when there appears to be an opportunity for peace, could shatter domestic cohesion, jeopardize international or coalition support, or even lead to a revolution or coup by an antiwar

faction.   Thus incremental costs include:

(1) Casualties.
(2) Physical damage and destruction.
(3) Loss of territory and control over population.
(4) Monetary costs of supporting military operations.
(5) Disruption of the civilian economy; economic hardships and shortages.
(6) Opportunity costs.
(7) Loss of domestic cohesion and political support.
(8) Decline in world opinion.
(9) Loss of allied or coalition solidarity and support.

Measuring costs also presents difficulties.   A purely quantitative approach based on absolute numbers frequently fails to convey the whole story.   Relative losses or "exchange ratios" may provide a more reliable indicator of the impact of losses on a decision maker.   The threat of future losses becomes more critical if a belligerent is approaching the limit of his resources in a particular area.

While this discussion of the variables in the war termination model is not exhaustive, it is extensive enough to illustrate the complex array of factors that impact on the decision to terminate hostilities or continue the war in hopes of achieving a better outcome.   I have made no attempt to prioritize these factors or assign them some kind of a weighted value.   Since the model is only intended to illustrate the basic thought process involved in war termination decisions, quantification is not necessary. Moreover, the relative importance of various factors will vary over time depending on the situation.

A Dynamic Factors Model

The idea that the dominate factors in war termination

decisions change as a conflict progress is illustrated in a novel
quantitative model developed by Quincy Wright. He formulated the
following equation to predict the probability of escalation or
termination as war progresses through four stages:

$$dx/dt = (Nx + Fy) - (Cx + Wx) + (Px\ Py) - (Vx - Vy)$$

Where:

```
dx/dt = Growth rate of hostilities for nation X.
N     = Intensity of national interests involved.
F     = Forces immediately available.
C     = Cost of hostilities.
W     = World pressures for peace.
P     = Military potential.
V     = Vulnerability to destruction.
```

The magnitude of the positive or negative value of dx/dt
indicates the willingness of a belligerent to escalate or
termination hostilities.[98] An analogous equation would
simultaneously be applied to the other belligerent, nation Y.

The most interesting aspect of Wright's approach is his
suggestion that termination decisions are influenced by the
emergence of new considerations as the war moves through the four
stages indicated by the parentheses. In stage one, nation X will
"develop forces in readiness for future action at a rate (dx/dt)
in proportion to the intensity of its national interest in the
issue (Nx) and it apprehension of the obstacles presented to
realization of its policy by Y's preparation of forces to resist
(Fy)."[99]

In stage two, nation X's prosecution of the war will be
inhibited by its losses in life and property (Cx) and the
pressure of negative world opinion both at home and abroad (Wx).

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If hostilities continue into the third stage, nation X is likely to consider its "long term power position in military forces, economic capability, political morale, and potential allies of itself (Px) and its enemy (Py)."[100] If hostilities progress to the final stage, nation X will consider its vulnerability to destruction by the military forces of the enemy (Vx) compared to the perceived vulnerability of the enemy (Vy).

Foresight about the later stages may influence behavior in the earlier stages. Thus nation X may have a lesser interest at stake and may initially have forces only sufficient for a defensive effort, but may believe that a superior economy and population base will enable it to out mobilize the opponent in the long run. A weaker nation might also count on world opinion and outside assistance in a showdown with an aggressive neighbor. On the other hand, nation X may have a pessimistic view of the future and seek to negotiate while it still has an advantage. War termination will take place only when both side see no advantage in continuing; that is both dx/dt and dy/dt are negative.[101]

Moving beyond the mechanics of his model, Wright asserts that since there is a "tendency of governments to act mechanically and not rationally, attention is usually devoted at first to past grievances and present interests and capabilities." Once armed force have been employed, considerations of cost and the development of world and national opinion may bring hostilities to an end. However, "a conflict in which each side believes involves its vital interests is likely to escalate until its

costs, in economic resources and casualties, have been so great that each is emotionally affected and incapable of rational thought." In these circumstances, each side may temporarily ignore losses, world opinion, international law and "even its future existence" in its efforts to destroy its enemy. However, ultimately "the probable destruction of one or both parties may become so obvious - if not to the government, then to the revolutionary regime which succeeds it - that the instinct of self preservation induces an end to hostilities."[102]

While I continue to believe that the differential expected utility model is the best representation of the basic conditions necessary for war termination, I think Wright's model is a good exposition of the thesis that the relative importance of various factors changes over time. However, given the multitude of factors identified in the previous section, his equation is not sufficiently comprehensive.

The Problem of Simultaneity

One of the basic assertions of the refined war termination model is that both belligerents must come to the conclusion that settlement is preferable to continued hostilities. In mathematical terms, this means that $\Delta EU(W)$ is negative for both sides. In reviewing a simple expected utility model developed by Lars Porsholt, both Berenice Carroll and Janice Gross Stein expressed serious doubts about the practicality of what Stein characterized as "simultaneous reciprocity."[103] For example, Carroll critiqued Porsholt's formula saying that:

The formula gives us both parties separately calculating gains, losses and probabilities; it demands that both arrive simultaneously at the conclusion that peace is more advantageous and desirable than war - but it does not tell us how each is to know, at the critical moment, that the other has reached this conclusion. [104]

The short answer is that simultaneous is not the same as instantaneous. Undoubtedly, there have been lost opportunities when both belligerents were temporarily willing to settle but failed to act decisively to end the fighting. However, ultimately the situation stabilizes and an explicit or tacit agreement is reached ending the war.

The Internal Dynamics of the War Termination Process

Several authors have examined the internal dynamics of the war termination process and there is an extensive literature on the negotiation of settlements to end wars. For simplicity, many expected utility theories assume a unitary decision maker capable of instantly ordering his preferences for all possible outcomes. [105] From my perspective, this assumption is not essential. It takes time for a government to receive and process information, build consensus and come to a decision. Given the nature of the model where any negative differential expected utility leads to a termination decision, I would expect that once the threshold favoring termination is crossed it would remain relatively stable barring major changes in the situation.

John Kettelle examined the dynamics of the war termination decision process for the loser. He identified a sequential process beginning with the "predict point" at which the outcome

of the war is objectively predictable. The process then proceeds

through the following steps:

(1) A significant faction in the losing country
    recognizes the adverse trend and predicts an unfavorable
    outcome.
(2) The governing regime then predicts the outcome.
(3) Coups, unsuccessful or successful, in which a faction
    favoring war termination seeks control of the government.
(4) The governing regime decides to seek peace.
(5) Internal acceptance of the available terms.
(6) Public acceptance of the terms.[106]

In the case of a highly polarized nation or alliance, this

process can be quite time consuming. In a case study of the Boer

War, C.R. Mitchell found that the intransigence of the Orange

Free Staters kept the Boers fighting for over a year after their

allies, the Transvaalers, recognized the hopelessness of the

struggle.[107]

CONCLUSIONS

Having carefully developed a detailed theoretical framework for thinking about war termination, the ultimate question is purely utilitarian - does any of this have a practical application? My answer is a qualified yes. The basic proposition is that nations make rational decisions about war termination which are, therefore, subject to analysis. This assumption is borne out by the patterns observable in the history of war. An understanding of the dynamics of the termination process will assist the strategist in accomplishing his two basic tasks: translating the political ends into military objectives and devising the ways to accomplish them.

On the first count, terminating the fighting on favorable terms and securing a stable peace is an "implied task" in any war. In an era when limited wars fought to secure limited goals are the norm, a vital component of any strategic vision is a clear idea of the conditions that will cause the enemy to abandon the fight and reluctantly accept a new status quo on our terms. In essence, these conditions must convince the enemy that any hope of obtaining better terms is outweighed by the costs of continued fighting and the risks that a further loss of residual bargaining power will lead to an even more unfavorable outcome.

There is nothing new in this basic thought. Writing over a century and a half ago, Clausewitz touched upon some of these same themes when he wrote that "if one side cannot completely

disarm the other, the desire for peace on either side will rise and fall with the probability of further successes and the effort required to achieve them."[108] What is valuable about war termination theory is not that it offers startling new recipes for victory, but that it organizes what is known from historical experience in a systematic way that highlights relationships.

The refined war termination equation developed in this paper defines the relationship between probability, utility and cost in a precise manner. In addition, a myriad of other factors which can influence war termination were grouped under the three prime variables. This organization of seemingly unrelated factors provides the strategist with a framework for analysis which will assist in accomplishing the second task of devising the ways to accomplish the end.

The development of the model suggests that the starting point for war termination planning is an assessment of the intensity of the enemy interests that will be challenged by our war aims. Furthermore, the most reliable yardstick for measuring the interests is the status quo ante bellum. The more intense the interest, the more strongly we should expect the enemy to resist. However, even if the interests are relatively minor, the strategist should anticipate that the first requirement for termination is the establishment of a clearly favorable military trend that will quickly deflate any of the enemy's unrealistic estimates or ambitions.

Beyond that the key to termination planning lies in the

variables themselves. Basically there are four possible

approaches to convince the enemy that he is better off bringing

the war to an end than continuing the fight:

    (1)   Decrease his subjective estimate of the probability of
           achieving a more favorable outcome.
    (2)   Increase the utility of the settlement immediately
           available.
    (3)   Increase the perception that he is risking a much more
           unfavorable settlement by continuing the war.
    (4)   Increase the costs of continuing the war.

In many cases, it may not be possible to effect all of the

variables that enter into the basic war termination decision

process. Moreover, the specific factors that are vulnerable to

manipulation and their proportional impact on the enemy

will depend on the situation. However, numerous candidates have

been identified and discussed.

My hope is that the war termination model developed in this

paper will provide a useful analytic framework that can assist

planners in devising war termination strategies. A realistic war

termination concept is a vital component of an overall strategic

vision. Our national military strategy calls for "applying

decisive force to overwhelm our adversaries and thereby terminate

conflicts swiftly with a minimum loss of life."[107] If this goal

is to be realized, military action must be viewed in a broad

strategic context and all elements of national power synchronized

to support a deliberate war termination strategy.

APPENDIX I: FIGHTLIKE THEORIES

Richardson's Theory of War Moods

Lewis Richardson attempted to explain war termination by the spread of war weariness in the populations of the belligerents using equations developed to predict the spread of contagious diseases. Using newspapers to track public attitudes in Britian and Germany during World War I, he found a rapid rise of "war fever" at the beginning of the war, a slow, gradual decline during the course of the war, and a dramatic drop-off at the armistice. Richardson explains this trend by postulating that each individual has two moods, one overt and one subconscious. At the start of hostilities, there is a sudden rise in war fever resulting a dominant mood of overt hostility. Over time a mood of war weariness slowly infects the population beginning at the subconscious level and ending with a sudden rise in overt war weariness at war's end. Aside from psychological theory, Richardson was driven to the double mood model by mathematical considerations in order to explain the sudden shifts in mood at the beginning and end of the war.[110]

Interestingly, Richardson considered and rejected outright the notion that changes in the terms of peace terms would have any effect on the course of war on the grounds that this would attribute "too much rationality to the belligerents". He also specified a qualitative estimate on the war termination point: "We may reasonably suppose that hostilities will come to an end

when about half the survivors are unwilling to continue the struggle." He mentions, but does not include in his calculations, the factors that lead to war weariness including casualties, scarcity of food and clothing and other inconveniences and deprivations.[111]

Of course, Richardson's arguments are far from rigorous since they are based on a single atypical war. Moreover, his model is totally deterministic. The epidemic will follow a regular course beyond the control of decision makers or strategic considerations. Despite its marginal utility, Richardson's war moods article is still frequently cited as an early attempt to apply quantitative methods to the war termination problem.

Klingberg's Casualty/Population Loss Model

This study was originally undertaken in the summer of 1945, in an effort to project the losses that would be necessary to cause Japan to capitulate, but was abandoned with the sudden end of the war. Frank Klingberg vastly expanded the scope of the effort to include a study all wars after 1618. The hypothesis for investigation was that a fixed relationship might exist between the proportion of casualties a nation would suffer before accepting defeat in individual battles and the proportion of population losses it would sustain before terminating the war.

Klingberg found that the "results show that there is no general ratio between casualties and population losses."[112] Furthermore, the mean deviation from the average casualties per battle in the same war were so great that the averages themselves

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seem to have little meaning.[113] Klingberg was able to conclude that there is some evidence that nations in modern times will tend to surrender before they have suffered population losses greater than three to four percent. Unfortunately, as is so often the case with large statistical averages, there are always exceptions. For example, Paraquay suffered the losses approaching 80% of its entire population in the Lopez War (1865-1870).

Klingberg also examined general statistical trends during long wars to determine if there are any shifts in trends that might be used to predict approaching surrender. Four indices proved significant: the percentage ratio of casualties between belligerents; size ratios of the opposing armies; proportion of battle defeats and intensity of fighting. When these indices showed unfavorable trends for two successive campaign periods, the end of the war was generally at hand. Abnormal increases in the number of prisoners or sick sometimes preceded the surrender by several months.[114]

Voevodsky - Quantitative Behavior of Warring Nations

While making some pretensions for universality, John Voevodsky's "inquiry into the repetitive behavioral patterns of nations at war" is basically limited to the major wars of the United States including the Civil War, World Wars I and II, the Korean War and Vietnam through mid-1968. He uses cybernetic analysis to examine the "vital statistics of modern armed combat" which he defines as battle strengths, battle casualties, and

battle deaths. His principal finding is "the remarkable

stability and trueness-to-course that, in general, wars follow

over long periods of time" when examined according to his

methods.[115]

Central to Voevodsky's methodolgy is the plotting of current

strength and cumulative battle casualties and deaths over time on

semi-logarithmic graph paper. A plot of the historical data for

the Korean War is shown in Figure 1. Based on similar graphs, he

concludes that, "the shape of the curves for the past wars, and

particularly the manner in which they level off, suggests that

peace is negotiated when [cumulative] death, casualty, and

[current] strength figures exponentially approach the

horizontal." Given the nature of semi-exponential plots, which

would convert a straight line buildup into an "inverted L-shaped

curve" like the ones he shows for Korea, I don't find the shape

of these curves particularly surprising. They would appear to

simply reflect an army which mobilizes (and in most cases

deploys) for war resulting in a buildup in strength over time

until it stabilizes to maintain a army in the field until the war

ends.

Two other conclusions, however, are much more interesting and

controversial. Acting on the premise already discussed, he

plotted the vital statistics for war in Vietnam (see Figure 2)

as of mid-1968, and concluded that:

> . . . the Vietnam War appears to be progressing in the same
> orderly manner as our four previous wars, despite its record
> duration. The repetitive behavioral pattern suggests that we
> are approaching a crisis point in the Vietnam War where

either a settlement is possible or another major escalation
is indicated.[117]

This statement was written in May 1969. While I suppose one
could argue that the Cambodian incursion was "a major escalation"
from a policy perspective, it certainly was not in terms of the
vital statistics he was tracking. If the same graph were to be
filled in for the entire course of the war with the benefit of
20/20 hindsight, it would show a rapid decline of U.S. battle
strength during the "Vietnamization" period that would break the
remarkably stable pattern he found in the record of our pervious
wars.

Voevodsky also makes an interesting observation about a
nation's ability to sustain casualties although he qualifies it
as tentative:

> . . . there are limits in strength build-ups and casualties a
> nation will sustain, beyond which it either accepts defeat,
> changes its leadership, or acquires new allies. This idea is
> graphically illustrated in Figure 3 by a lower boundary
> level, which defines the point where battle casualties
> [cumulative] and [current] battle strengths are equal.[118]

This conclusion appears to be based on that fact that U.S.
never exceeded this point for any of its modern wars and,
therefore, never suffered the consequences. On the other hand,
Britain did reach this point in 1918 when she had suffered two
million battle causalities compared to a strength in France at
war's end of two million soldiers. This equates to 3.33 percent
of her population. Not surprising this agrees with Klingberg's
observation since they are based on the same data. When this
proposition is applied to the U.S. in Korea and Vietnam, they

intersect the lower boundary limit and each other at the same point, 850,000 casualties and men."[119] I leave it to the reader to draw their own conclusions on this projection and on the general validity of statistical techniques that treat wars as mathematically predictable without reference to their political and strategic context.

Cannizzo - Death, Duration and Defeat

The most sophisticated attempt to statistically analyze general historical trends related to war termination that I found was conducted by Cynthia Cannizzo. Unlike other researchers, she explicitly recognized the great diversity of wars and set out to test a four variable model of two state wars for 30 historical cases. The four variables included were relative capabilities, war duration, relative battle losses and victory/defeat. Relative capabilities were measured on the basis of the manpower strength of the prewar standing armed forces. Two basic types of analysis were performed. Bivariate relationships were examined via scatterplots, correlations and regression. Second, a multivariate logit regression analysis was performed to produce a probability of victory based on the three variables.[120]

Although the multivariate regression was able to correctly predict the victor 86 percent of the time, it is of only historical interest in identifying countries that beat the odds since duration and casualty ratios are used as input. Of greater interest is her general conclusions regarding the lessons of history derived from her analysis:

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(1) The greater the initial numerical superiority one nation has, the less its relative loss.
(2) The greater the initial numerical superiority, the shorter the war.
(3) The greater the initial numerical superiority, the greater the probability of victory for the stronger nation.
(4) The longer the war, the lower the probability of victory for the stronger nation.
(5) The greater the relative losses suffered by the stronger nation, the less the probability of victory for that nation.

She also notes that if quick victory cannot be obtained, "and a war of attrition ensues, the advantage of power-in-being is lost; as the war continues and the losses climb, the chances of victory are diminished."[121]

Frankly, all of the above are simply reaffirmations of conventional wisdom but are, nevertheless, based on a detailed statistical analysis of the historical record. Thankfully, what is absent are claims of the ability to predict outcomes with mathematical certainty based on averages derived from widely variable historical data.
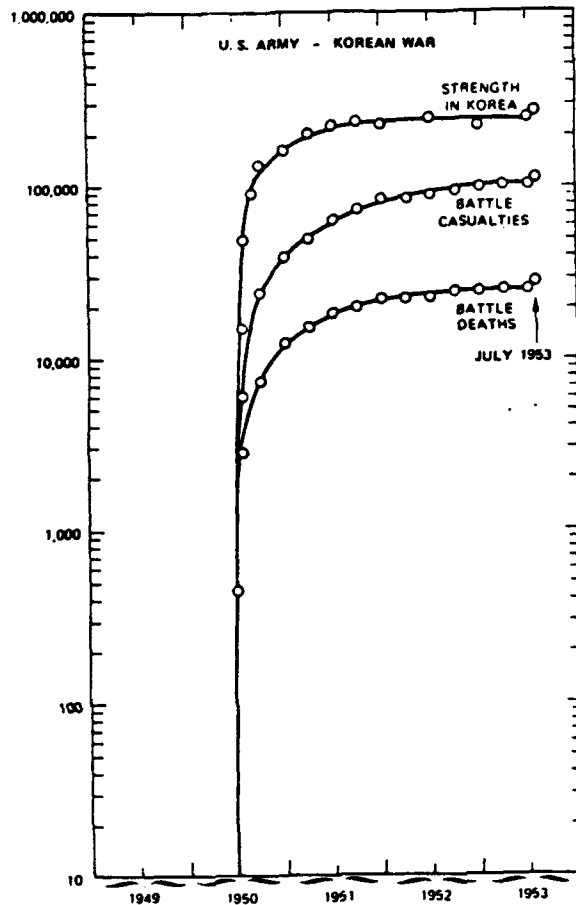
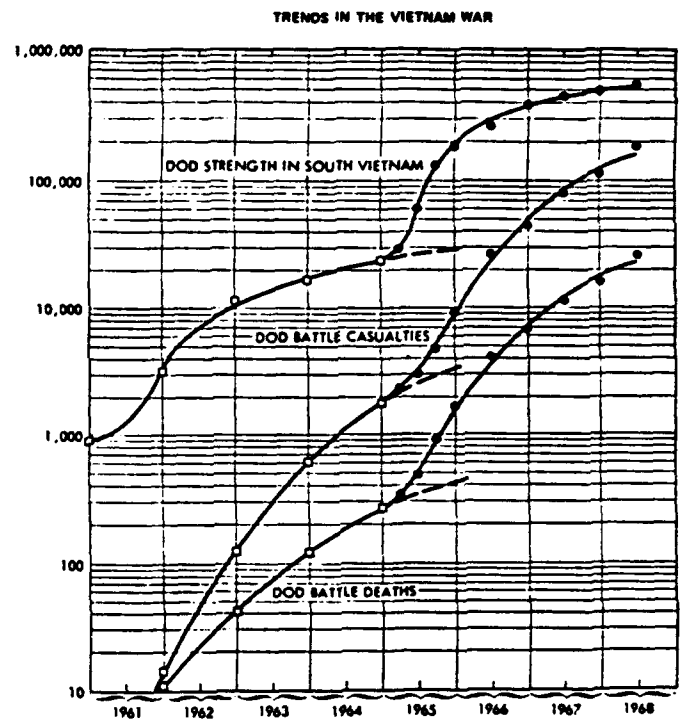Figure 1
US Army Korean War

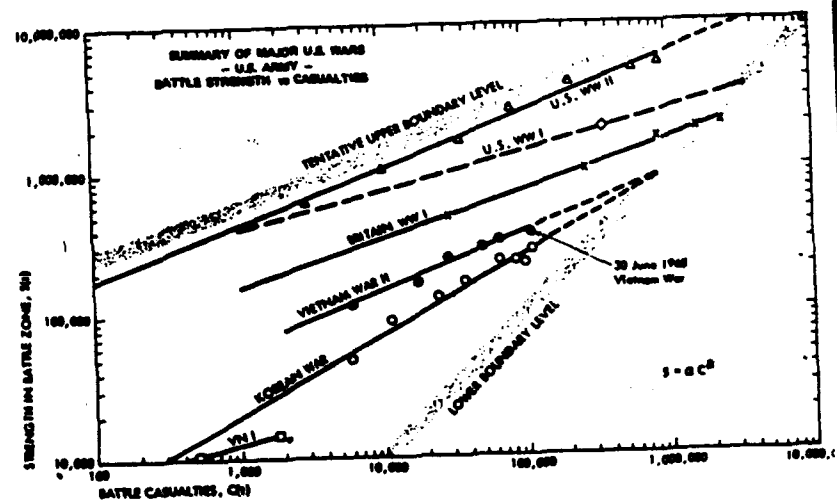Figure 2
Trends in Vietnam War

Figure 3
Summary of Major US Wars

APPENDIX II: EXPECTED UTILITY THEORIES

Bueno De Mesquita's Expected Utility Theory

In the field of war studies, the best known and most systematic proponent of expected utility theory is Bruce Bueno De Mesquita. Beginning with his 1981 book, The War Trap, he has refined and expanded his theory to deal with a variety war related issues.

Bueno De Mesquita's basic model asserts that nation's make decisions to go to war based on expected utility which is a function of three factors: the probability of winning, the utility of winning and the disut'lity of lossing. In mathematical terms, a simplified version is expressed as:

$$E(Ui) = Pi (Uii - Uij) + (1 - Pi) (Uij - Uii)$$

where

$E(Ui)$ = Nation "i's" expected utility.
Pi = i's current perception of the probability of success in a bilateral conflict against nation "j"
$1 - Pi$ = Nation i's current perception of the probability of losing in a bilateral conflict against nation j.
Uii = Nation i's utility for its preferred view of the world. $Uii = 1$ by definition.
Uij = Nation i's utility of nation's j's policies. It can vary between 1 and -1.
$(Uii - Uij)$ = Nation i's perception of what might be gained by succeeding in a bilateral conflict with nation j in which it can impose new policies on j. Thus the greater the perceived difference between the policies nation i would like nation j to pursue and nation j's current policies, the greater the utility.
$(Uij - Uii)$ = Nation's i's perception of what might be lost by losing a bilateral conflict j in which j could impose new policies on i. The term reflects how much j could shift nation i's policies, if j were victorious.[122]

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Expressed in words, nation i's expected utility for a war with nation j is equal to that probability of success, multiplied by possible policy gains, minus the probability of failure, multiplied by possible policy loses.

Like many quantitative theories designed to be tested against the historical record, the operationalization of the variables in the model depends to a large extent on the availability of data. As a result, the probability of success is measured by a straight forward ratio of national composite capabilities. The composite capability measure was developed by Correlates of War Project and is widely used in modeling of this kind. It reflects three dimensions of national capabilities: military, industrial and demographic resources. The index is measured as a proportion of each nation's share of the total capabilities in the interstate system. Military "war readiness" is based on the number of military personnel and military expenditures; industrial power by the share of industrial fuel consumption (for the period after 1900), and the demographic dimension by total and urban population.[123]

For some conflicts, Bueno de Mesquita adjusts the scores to reflect the debilitating impact of fighting a distant conflict using a "loss of strength gradient" where appropriate. After any such adjustment, the probability of success is calculated:

$$Pi = CAPij / (CAPij + CAP \ ji)$$

where

CAPij = Adjusted composite capabilities of nation i on the

territory of nation j.
CAPji = Adjusted composite capabilities of nation j on the
territory of nation i.[124]

In measuring utility, Bueno de Mesquita attempted to find an indicator that would capture the congruence of interests between nations. He chose membership in military alliances since they are "explicit statements about the contingent behavior of one nation toward another in the event of war." If nations belong to distinct alliance blocks with no overlap, then utility is judged to be large. Alternatively, overlap of alliances with third parties decreases utility. These utility scores were then adjusted to account for the uncertainty and risk taking propensities of the states. Uncertainty is measured by the tightness of a nation's alliances. If it increases or remains unchanged in the two years preceding a conflict, "uncertainty is assumed to be absent." Propensity for risk taking is measured based on a nation's policies of alignment or nonalignment. A nation is judged risk acceptant if "it expects to derive positive utility against fewer states than expect to derive positive utility by attacking it" using the expected utility calculation for a multilateral war.[125]

The objective of the preceding discussion is not to evaluate the methodology per se but to illustrate the complexity of operationalizing conceptually simple propositions. It also reveals the inherent limitations of such techniques. In order to encompass a large number of nations over an extended time period, the measures must be relatively simple and readily available.

Bueno de Mesquita explicitly recognized this lack refinement and introduced several decision rules based on other factors to adjust the data.

Despite his frequent pretensions about his model's ability to generate "significant lawlike generalizations about war," caution is advisable.[126] While I do not question the value of the model as a systematic method of assessing broad historical trends, there are significant limitations. First, an expectation of positive utility is a necessary but not sufficient reason to initiate hostilities.[127] Second, "generalizations" are simply statements of the most probable result. Although his analysis of wars in the 19th and 20th century shows that "87 percent of war initiators satisfied the necessary expected utility conditions," 13 percent did not.[128] Thus while the method might yield valuable historical insights they are far from "laws." Finally, the methodology, with its broad unfocused measures of variables, is not suitable for use as predictive tool in evaluating developing situations.

Most of Bueno de Mesquita's work deals with the implications of expected utility theory for the initiation and escalation of conflict. However, he also derived several interesting propositions about the outcome and severity of conflicts.[129]

Since both the aggressor and the defender are assumed to be expected utility calculators, war may rationally begin under any of three circumstances. In all cases, the initiator must expect a net gain. Consequently, his expected utility must be greater

or equal to zero. The victim's expected utility relative to the aggressor might be:

(1) Negative but less than what the initiator thinks the victim must lose, so that the victim expects the war to produce an outcome worse than the status quo ante, nut not as bad as the attacker demands at the outset.
(2) Positive but less than that of the initiator.
(3) Positive and greater than that of the initiator.

Even in the first case, the victim must perceive some benefit to fighting. If not, it would be expected to yield to the opponent's demands. Presumably, if it chooses to fight, it must hope to impose a sufficient cost on the opponent to reduce the concessions that have to be made at the time of surrender or avoid the need for total, unconditional surrender.[130]

In regard to war termination in the first case, Bueno de Mesquita asserts that:

Since the actor is rational, we should expect it to tolerate the cost of fighting only so long as that cost is less than the expected benefits of fighting. Once that point is past, it is irrational for a victim whose net expected utility from the war is negative to continue fighting. . . . Combat continues only as long as one of the combatants believes it can obtain a better settlement by fighting than negotiating. [131]

In wars of this type, both the attacker and defender agree on who is expected to ultimately win. This agreement removes one possible obstacle to settlement. The only issue is the magnitude of the loss the loser will suffer. The greater the difference in perceptions about a fair settlement, the more serious and, hence costly, the war will be. Conversely, if the differences in the adversaries expectations are small, the conflict should be amenable to resolution at a relatively low cost.[132]

When both sides expect to benefit from a war, differences exist not only over the amount to be gained but over who will win. Such disagreement about expected outcome "may be presumed to increase greatly the cost of ultimate settlement." When both sides believe they will win, "the potential for misperceiving setbacks as temporary aberrations is great, hence encouraging intransigence even in the face of losses on the battlefield."[133]

It is important to note that although Bueno de Mesquita introduces "the costs of fighting" into the discussion of war termination, they are only subjective factors. No attempt is made to formulate a war termination equation. In a later article, Bueno de Mesquita attempted to develop a cost model but it was not specifically related to war termination and its general propositions are similar to those already discussed. It also introduces the concept of "deceasing marginal value." He argues that "although more utility is always preferred to less, still each added increment in gains is not valued as highly as the preceding increment."[134] I think this is a case of pushing the economic analogy on which expected value theory is based beyond reasonable limits. The idea of "increments" of utility implies that war aims are easily divisible into degrees of success when, in many cases, it is difficult or even impossible to fashion a compromise solution. For example, the Gulf War objective of restoring the legitimate government in Kuwait cannot be broken into increments.

In concluding his discussion of war outcomes, Bueno de

Mesquita distills the preceding discussion into two basic

propositions:

> PROPOSITION: When only one side in a war expects to derive
> positive value from the war, that side will be the initiator
> and the winner. When both the initiator and its opponent
> expect to derive positive utility, there will be considerable
> variation in who wins. Generally, the side with the larger
> positive expected utility - and hence the greater incentive
> and pool of resources with which to keep fighting - will
> win.

> PROPOSITION: The greater the difference between what the
> initiator believes it can gain and what the opponent believes
> it must lose (including the possibility that the victim
> believes it can win) the more difficult it is to find a
> settlement that both sides can accept, and hence the costlier
> the war.[136]

These proposition are not only a good summary but they illustrate

the nature of the "lawlike generalizations" that Bueno de

Mesquita has developed.

Wittman's Rational Model Approach

In a 1979 article, Donald Wittman offered an alternative

expected utility model and applied it directly to war

termination. However, his model is strictly heuristic and no

attempt was made to operationalize the variables or test the

model with empirical data. Wittman's complete expected utility

formula is only described in words, although its various

components are expressed in mathematical symbology separately. He

states that:

> Country X's expected utility from continuing the war
> depends on the costs of the war, and the probabilities and
> utilities of its winning and losing. The more utility that X
> derives from winning, (and) the greater the probability that
> X does in fact win, and the less the costs to X of conducting
> the war, the greater X's expected utility from continuing it.
> [137]

He also introduces the concept of discounting future gains. Since they are not instantaneous, the expected utility from continuing the war depends on the present value of future outcomes. In turn, present value depends the country's discount rate. If it has a very high discount rate, it does not weigh outcomes in the distant future very heavily in its calculations. [138]

Based on these comments, his expected utility equation can be constructed and expressed as:

$$EUx(w)^t = fx\ (Pxw\ Uxw) + fx\ [(1 - Pxw)\ Uxl] - Cx$$

where:

$EUx(w)^t$ = Nation x's expected utility for continuing the war at time t.. (Note Wittman uses Ux(w) for expected utility but the E was added for clarity and consistency.)
fx = Discount rate for future gains.
Pxw = Nation x's subjective probability of winning.
Uxw = Utility (gains/benefits) of x winning.
1-Pxw = Nation x's subjective probability of losing.
Uxl = Negative utility of x losing.
Cx = The costs of continuing the war to nation x (e.g., destruction of resources, casualties)[139]

In regard to war termination, Wittman states that "an agreement (either explicit or implicit) to end a war cannot be reached unless the agreement makes both sides better off; for each country the expected utility of continuing the war must be less than the expected utility of the settlement." Therefore, a necessary condition for ending the war is that there exists a settlement s* such that:

$$EUx(s*)^t \overset{>}{=} EUx(w)^t \quad \text{and} \quad EUy(s*)^t \overset{>}{=} EUy(w)^t$$

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where:

$EUx_t(s*)$ = Discounted expected utility of settlement s* in year t.

$EUx_t(w)$ = Expected utility of continuing the war.

Wittman emphasizes that although this is a necessary condition, it is not sufficient. "It is entirely possible that, even if both countries can benefit by coming to a settlement, the war will not end for each side may be trying to gain more favorable terms."[140]

Wittman also examines the effect that changes in the values of individual variables would have on war termination. In the case of the probability of success, he observes that there will be times when the belligerents subjective estimate of their probabilities of winning will diverge. . That is $Pxw + Pyw = 1$. If the sum of their estimates is greater than one, the belligerents are jointly optimistic. The greater their optimism, the greater will be their calculation of expected utility for continued hostilities and the less chance of a settlement. The more jointly pessimistic they are, the more likely that the necessary conditions for war termination will be meet.

He also examines a symmetrical shift in the subjective estimates of the probability of success and its impact on the chances for settlement. What happens if county Y's probability of winning is reduced?

> Country Y's expected utility from continuing the war is decreased; therefore country Y is willing to accept less in negotiations. It may seem that a settlement . . . is more likely; but this is not true, because an increase in the probability of country Y losing means an increase in the probability of country X winning and thus country X's

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expected utility for continuing the war increases. . . . When the probability of X winning the war is increased, X's minimal demand is increased while Y's minimal demand is reduced.[141]

However, he reasons that these shifts in demands will not necessarily be symmetrical. Consequently, he concludes that "the better we do, the more we will demand" citing the increase in UN war aims in Korea following the successful counter-offensive as an example.[142] Although this phenomena is well known, I think he goes beyond the predictive limits of his method by making this observation into a lawlike statement. Moreover, it ignores the fact that nations can pursue limited objectives and resist the temptation to expand the scope of the war even when the opportunity presents itself. The coalition's performance in the Gulf War is a case in point.

APPENDIX III: THE REFINED EXPECTED UTILITY WAR TERMINATION MODEL

The refined war termination model developed in this paper posits that the differential expected utility [⚹EU(W)] for continuing a war is a function of the probabilities [P and (1-P)] of achieving alternative future settlements that are better or worse than the one perceived to be currently available, the utility of the gains and losses contained in these settlements as compared to the currently available settlement, and the magnitude of the additional costs that would be incurred in continuing the war. This proposition can be expressed in the following simplified equation:

$$\text{⚹EU(W)} = P(\text{⚹GAINS}) - (1-P)(\text{⚹LOSSES}) - \text{⚹COST}$$

If the projected expected utility gains of a future, more favorable outcome are outweighed by the risk of actually achieving a less favorable settlement and the costs of continuing the war, the rational decision is to terminate the war on the terms currently available.

Consequently, there are three key variables that condition war termination decisions are probability, utility and cost. Each of these factors are, in turn, dependent on a number of situational factors. The most important of these are summarized below:

Probability: Significant factors that impact on the probability of achieving a more favorable outcome include:

    (1) The current military situation, especially trends.
    (2) The overall economic and military potential of the belligerents.

(3) The availability of external support ranging from direct intervention of an ally to favorable world opinion.
(4) Domestic political support, cohesion and commitment to the struggle.
(5) Statements or indications of the opponent's minimum peace terms.

Utility: Significant factors that influence judgements about

the utility of various settlements include:

(1)   The status quo ante bellum.
(2)   Both the original and current war aims of the belligerents.
(3)   Sunk costs.
(4)   The intensity of the interests at stake.
(5)   Ideological engagement or devaluation.
(6)   The likely domestic impact of the settlement.
(7)   The long term international impact of the settlement on the reputation and power of the nation.

Cost: Incremental costs include:

(1)   Casualties.
(2)   Physical damage and destruction.
(3)   Loss of territory and control over population.
(4)   Monetary costs of supporting military operations.
(5)   Disruption of the civilian economy; economic hardships and shortages.
(6)   Opportunity costs.
(7)   Loss of domestic cohesion and political support.
(8)   Decline in world opinion.
(9)   Loss of allied or coalition solidarity and support.

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