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A Theory of Deterrence

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A THEORY OF DETERRENCE

by

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March 20, 1991

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INTRODUCTION

OVERVIEW

The purpose of this monograph is to start a theory of deterrence which has the capability of quantitatively answering the question of what is required to deter a nation or alliance from certain acts. Despite the existence of voluminous writing on deterrence, from the beginning of the nuclear age and even before, none of it attempts a theoretical discussion of how to calculate what it takes to deter a country from committing some acts which are objectionable to another country.

Many theories of deterrence have already been created. They have exclusively been of two separate forms - those of the social scientists, which deal with political questions, and how the concept of mass destruction psychologically deters the initiation of war; and those of the mathematicians, who model the quantities of one country's arsenal of strategic systems needed to destroy a certain portion of another country's. Only the latter is quantitative, but they lack an essential element needed to answer the question "*How much is enough*"?

The question of "how much is enough" becomes even more pressing now, as arms control proposals and treaties are being written with greater frequency than ever before. If there is a threshold for deterrence, it is important to know it, both to prevent the number of weapons retained from dropping below the level needed to maintain deterrence in all future situations, and to avoid the expense of prolonging the life of several times more weapons than are actually needed.

In order to use the techniques of operations research on the questions of what type and amount of weapons are adequate for deterrence, the definitions of quantities occurring in the calculations need to be made in a quantifiable way. Numbers of weapons, as remarked above, have been the only quantified parameter in previous deterrence calculations. Yet weapons alone do not deter. The threat of destruction and damage does. How is that threatenable damage to be measured, and as through defensive system construction, counterforce capability improvement, arms control, or other means, it becomes less, when is the threshold for deterrence met and crossed?

As will be elaborated later on, the calculation of this damage, and the implication of that damage to decision-makers capable of making a war initiation decision, is a complicated process, and it is what constitutes a theory of deterrence.

The theory proposed here concerns military deterrence only, that is, the use of weapons of destruction, nuclear missiles or armed forces, to threaten the country being deterred. It might be possible to extend it to economic threats or other types, but the theory required to simply treat military threats is formidable enough to merit separate treatment.

DEFINITIONS AND TERMINOLOGY

What Is a Definition

Definition, or the process of putting labels on objects, areas, actions, events, qualities and more, is an arbitrary process made usable only by the understanding that we will each try to learn definitions and not misuse them too much. So much discussion of facts in the literature of the world consists of refining or disputing definitions that it would be a useful digression to say what, at least here, constitutes a definition, and just how far we can push one.

Definitions are simplest to do when there is continuity in time and discreteness in type. We give a person a name at birth which lasts to death, when almost all aspects of that person change tremendously over his lifetime. The discreteness of a person and the continuity of the changes allow this. Nations also shift: the territory occupied by Poland now is not the same as it was earlier in the century or before, yet we label it the same on the grounds of some (interrupted) concept of continuity. Weapons also shift. Consider the labeling of warship categories. At a particular time, say 1945, there were frigates, destroyers, cruisers, and battleships, among others. Each of these was distinguished by its size as opposed to aircraft carriers, which were distinguished by having fixed-wing airplanes on them and little other armament and submarines, which were distinguished by their ability to submerge. As time progressed, ship designers kept making destroyers a bit bigger with each new group, until by the 1960's U.S. destroyers were bigger and more capable than World War II cruisers. Since there was no clear differentiation by type, various classes eventually had to be renamed, depending on their size relative to the latest groups produced. Unless there is a type differentiation, labels may not stick. Most of the existing theories of deterrence or war initiation rely on words such as large, significant, important, and others. These are not type differentiating words, and so any concept of deterrence which depends on them will slide as time progresses and situations evolve. A theory without them is needed.

What Constitutes War

When we speak of war in this monograph, we mean a conflict using weapons between military forces of major powers. The conflict must involve "significant" damage

and casualties so that the countries involved regard it, in their publications, as a war. This is a usable definition of war. Terrorist attacks or sabotage clearly would not be included, even though they could certainly lead to a war. Assassinations or the downing of civilian aircraft do not constitute war. Military forces must counter opposing military forces on the ground, or else major weapons systems, 'weapons of mass destruction' must be employed. A single such weapon, used on enemy territory, will suffice.

Earlier definitions of war have been size-dependent. How big a conflict does there have to be before it is labeled a war? When Richardson¹ was making his unique statistical study of wars, he used a cutoff based on casualties - 1,000 or more constituted a war. Other researchers used different lower limits. It is clear that there must be a lower bound of some sort, as we would not want a single border skirmish with one casualty to be classed as a war. Yet, by comparing medieval times, when armies were much smaller, with the world wars of the twentieth century, it also becomes clear that a single number will not suffice.

An alternate way of defining wars, or anything else, is by listing. To define wars in the past, we can simply make a list of the ones we think shall be included, using vague or intuitive judgments. In essence, these are the only two ways of defining anything, a listing, or a description in terms of more basic attributes.

For the purposes of this monograph, we do not need an exact definition of war. We will not be collecting statistics on the past, nor making any specific numerical use of projected numbers of casualties. Instead we can rely on a less specific definition. War is the deliberate destruction of substantial amounts of property or population of another country by military means. Since we will, for reasons described later, not be applying the theory here to early wars, we only need have a definition applicable to the twentieth century. Note that we do not involve any sort of legislative declaration or proclamation in the definition of war.

Deterrence terminology

There is a set of categories of terms relating to deterrence which will be used in this monograph. In order to avoid the difficulty that definitions in this area have been different with different authors, it is important to carefully define each of the terms used prior to expounding on them. We follow the terminology of Fought². "Fundamental deterrence" is used to describe one country using its weapons to threaten retaliation if it should be attacked. In other words, fundamental deterrence only protects the country itself. "Extended deterrence" is when one country tries to defend another against attacks or conquest by a third. The theory developed here will treat fundamental deterrence first, and extended deterrence later.

"Counterforce" attacks or weapons are those which affect only the weapons of the opposing side. Admittedly, a pure counterforce attack cannot occur, because any nuclear

explosion on the surface of the planet is bound to cause damage to its surroundings and to the environment. However, if strategic weapons are located in areas remote from urban populations, it would be reasonable to say that the significant effect of an attack on enemy weapons is simply counterforce. This logic applies even more strongly to weapon systems at sea, far from any coastline.

The inverse of counterforce is "countervalue", which refers to attacks designed to destroy the population or economy of the targeted country. Any countervalue attack must reduce that enemy's ability to carry on a war, but by drawing a line between strategic systems and the rest of the warfighting capability of a nation, it is possible to have a countervalue attack when the strategic systems of the enemy are not directly targeted. The chaos following an attack, the disruption of communications or the chain of command, a breakdown of authority or the disappearance of the leadership may occur and may inhibit a response. However, these are hard to assess and are considered not reliable indicators of the ability to respond with strategic weapons. Thus even though such things may occur in a countervalue attack, it is considered countervalue alone. Only direct attacks on the missile weapons and strategic air forces are considered counterforce.

What Causes Conflict: Some Semantics

If one attempts to categorize the reasons for or causes of destructive conflict, one must first describe in what terms or frames of reference causes can be ascribed. Conflict is often a very muddled process, and there are often many different versions of the history of events which occurred before and during the conflict. Each historian, in order to write a sequence of connected events which is humanly understandable, must pick and choose among the mass of available or possible details. He must form his own concept of what was important, and then in terms of a chosen number of concepts, explain how they evolved together in time to produce the conflict as it happened. Compare, for example, histories of the second world war written by Western historians such as Churchill and those written by Marxist historians. Even the definitions of words are debatable.

Marxists see the world in one view, that of the class struggle. They interpret events as to how they relate to their concept of class struggle. They include details according to how it fits in with the historical view they have, which means a stepwise evolution of social systems, and the revolutionary changes necessary in society to make each step.

Other historians have viewpoints which are often as fixed, but which are not as clear and well-enunciated as those of Marxist historians. In an earlier epoch, we saw war described in religious terms, relating to the moral standing of the nations involved. Economically-centered historians concentrate on the relations of trade and colonial domination for their view of war initiation and causes. Military writers are often concerned with armaments; psychologists with the need for power in high-placed individuals. Some political theorists see war as a process of politics.

Here we will tend to an operational definition. War does not start in chaos or by chance. Someone with authority must make a decision to begin the conflict and to continue or expand it. That person or persons, the decision-makers, are assumed to not be insane or irrational, but to think carefully about the sequence of events they are about to engage in. They may lack information or at least correct information, but on the basis of what they know, they ponder the decision and decide to initiate war. The causes of war, as defined in this theory, are rational expectations, based on existing information, that some desirable outcome will emerge with a tolerable probability. In short, we attribute the cause of war to be rational calculation of some gain. The underlying concept is then related to that of Blainey³, who defined war as "a dispute about the measurement of power. War can only occur when two nations decide that they can gain more by fighting than by negotiating." We differ, in noting that the gain is not necessarily for the entire nation involved, as we shall discuss later. However, it is important to first set the stage by discussing earlier theories of war and deterrence.

PSYCHOLOGICAL THEORIES OF DETERRENCE

Psychological theories of deterrence can be thought of as extensions of the theories of war initiation. A decision-maker is deterred if he decides not to do something, initiate a war or some related act, because of his expectation of the outcome. He is deterred by his own expectations. War is initiated when his own expectations are more positive, and deterrence occurs when they are not sufficiently positive to allow him to take the risk of initiating conflict.

Many theories of war initiation exist, ranging from rational calculations by leaders personally interested in power or conquest, to theories discussing war in terms of the historical struggle of ideology, to theories expressed in terms of uncertainty in the minds of national leaders and their quest to resolve it, and on to theories based on armament production. We review them here.

Existing Theories of War Initiation

The 'why' of war has occupied thinkers for centuries, perhaps starting with Vegetius' "*si vis pacem, para bellum*". There are enough completed distinct theories to cover almost all academic fields of natural science: biological theories, psychological theories, sociological theories, political theories, behavioralist, demographic, geographic, clerical, and other theories. Several authors have attempted exhaustive categorizing of these theories, for example, Lider^{4,5,6,7,8}, Small and Singer⁹, anonymous Russian authors¹⁰, Forman¹¹. There is no purpose or need to repeat such categorization here. Instead some key insights will be collected.

Long¹² has analyzed the onset of WWI and four other major conflicts. His conclusion is that, in each, prior to the first military acts, there was a chain of escalating events. He feels that the political leaders had no choice but to continue escalating once the sequence was begun. From this he concludes that the initiation of war is not a rational act. In other words, the nation's leaders were not calculating if the nation would be best served by initiating the war. A different way of saying this is that the leaders, although completely rational, were not making the calculation Bueno¹³ attributes to them - that of maximizing the nation's utility. They had other values than national utility.

Besides the illusory controversy over the rationality of decision-makers who initiate wars, a similar controversy exists over the role of uncertainty. Midlarsky¹⁴ argues that political elites initiate wars to put an end to their uncertainty about the future, and that more turbulent times evoke wars. The opposite view is put forward by Singer and coauthors¹⁵ who hold that wars occur when one side feels confident of their nation's power, dominance and eventual victory in the war.

Another use of the word uncertainty is to denote a decision-maker's misestimate of his nation's power. If this type of uncertainty exists, because of bad intelligence, misunderstanding of capabilities or a failure to consider certain strategies, rational calculations can clearly be seen to lead to war.

In order to put these concepts into a whole, we can try to model the decision to initiate war. Some key players have to be informed of their own military capabilities and their opponents, as best known by their intelligence agents or services. They estimate, according to the analytical, or intuitive ability of themselves and their advisors, what the likely result of war or peace would be. They compare these futures effects on their values, and make a decision. Note that we are saying that war initiation is a complex process, and in different situations different connections will play the leading role. Often this is the military establishment, by which we mean that group of persons who estimate whether a war could be won, what would be the risk involved, what the potential gains and losses would be. In other situations it may be other groups. Writers have discussed the interest some of the military establishment might have in promoting a conflict so as to advance their careers. It is somewhat hard to see how losing a major conflict would be good for a military career, but for small conflicts this could certainly be true. If optimism about an advisor's own nation's capabilities were coupled with a design for an improved career, possible biased advice might result, in a conventional conflict. Certainly in a nuclear conflict such optimism would be hard to find.

The decision-maker is the key player. Assuming he is rational, is he calculating his own future, that of a ruling group to which he belongs or that of the entire nation. Normally these would be coupled together, but if a strong influence group, who had concluded war was in their interest if not in the nation's, were able to break this coupling

and force the decision-maker to decide between his own and his nation's, it would appear as a nonrational decision to someone looking at a national utility function.

This is the essence of the historical discussion that Long gives concerning the onset of WWI. According to his interpretation, the Austro-Hungarian monarchy was concerned about a social revolution within their own empire, and to avoid it they did not dare to appear conciliatory to a traditional enemy.

Here we explore a more integrated set of assumptions and a different viewpoint. Since it is always individual human beings who participate in the conflict, by definition, we can ask what mental process occurred in the minds of the decision-makers of each side which led to the choice to initiate it. This material is not likely to exist except in reminiscences of those figures who played a role, and even in those situations where written material exists, it is likely to be colored by the desire of the writers to have themselves or others appear in a particular guise, e.g., wise, insane, or violence-prone. To sidestep this problem for the present, and leave such determinations of mental processes of historical figures to future work, we will explore the possible domain over which such processes can roam, and see how much effect different assumptions about the processes have on a major conflict decision.

Note that we are hereby implicitly restricting the discussion. We assume that there is some event which can be tagged as the initiation of the conflict. Wars which start with gradual escalation sequences may have to be treated differently. The Japanese attack on Pearl Harbor can be considered as a preeminent example of such an initiation event. We would like to be able to lay the groundwork for a deterrence model in which the decision around such an initiation event could be intelligently discussed in a quantitative way.

Another restriction of the types of conflict arises also. There are certainly conceivable situations in which war breaks out without there being any rational calculation given to the gains and losses attendant to the conflict. One of the nations involved can be controlled by an irrational decision-maker, who simply opts for war. There could be pressure from irrational groups within the nation, who can exact from the decision-maker more personal cost than he is willing to bear for the nation's sake. There must be no veto power in these cases by rational elements within the nation.

Alternatively, a situation could arise in which no person or persons would be available to the decision-making elements who are able to make the calculation of possible gains or losses. No data could exist, or certain critical chunks might be missing and inestimable. Note that these assumptions mean that a deterrence theory would be more applicable to recent and future situations than to historical times, when analytical capability was merely qualitative or nonexistent.

In earlier eras, or even possibly currently, one other worrisome possibility appears: A war might itself be an end, rather than a means, to a gain. An ideological payoff for combat, despite losses, could start a war despite probable loss. These types of situations make war a possibility even in the most stably deterred cases. Nothing can be done from a weapons procurement standpoint to lessening this sort of conflict; an educational or informational approach may hold promise. However, we can attempt to make a definition of national value as broad as possible, so as to gather up as many questionable situations as possible. We keep the definition of value, and national gain as change of value, very broad, and attempt to proceed without any dispensable restriction.

In this last sense, we solely concentrate on wars undertaken for some type of gain and discuss how to categorize them. The principal item of interest here is the measure used by a nation to evaluate its benefit. Most studies of deterrence assume two sides to a conflict will have the same measures; this simplifies analysis. We do not make the assumption, but instead first explore how varied these measures might be.

STATISTICAL THEORIES OF WAR INITIATION

None of the theorists listed above have attempted to seriously quantify their conclusions, any more than psychology itself is quantitative. What quantitative work has been done has covered statistics of wars, such as the correlation of armaments production and the outbreak of hostilities. The correlation work, done largely by Wright¹⁶, Midlarsky¹⁷, and Singer and his followers^{18, 19}, has covered such variables as alliances made and existing at the time of the outbreak of wars, the number of borders a country has compared to its propensity to be involved in war, its population, the time since the last war and others. Some significant correlations have become clear from this work, but it has never proceeded to any predictive capability nor any method for calculating, for example, the increase or reduction in probability of war initiation as armament type or numbers change. Singer's conclusion was pessimistic, that no long-term trends occur, and that statistical analysis does not yet have any crucial insights.

EXCHANGE CALCULATIONS FOR EXPECTED DAMAGE

The other side of the world of war modelers belongs to the military operations research analysts. In the area of strategic missiles and their airborne analogs, two areas of numerical calculations exist: damage expectancy and exchange studies. The damage expectancy work attempts to determine what would happen in a one- or two-sided use of nuclear weapons. The damage expectancy calculations are largely based on one-on-one models of the effects of nuclear weapons with targeting inaccuracies, as in Barnett²⁰ or Constant²¹. The exchange studies are much more diverse, and attempt to determine, given a set of armaments on two sides and models of how they operate, what would be the result

of an exchange. They answer questions as to what would be an optimal targeting or an optimal defense.

The next step that OR analysts take is to calculate stability, which some define as a situation where neither side is better able to win a war after a two-sided exchange of missiles than they were before. In other words, if the ratio of missiles after a counterforce exchange is more favorable to the side that starts the exchange and takes the first shot, then the situation is unstable. Otherwise it is stable.

This definition of stability does not connect to the theories of war initiation which have been discussed above. No one expects that missile counts would be used to determine if a country would go to war. Instead, they are useful for weapons planners who are convinced that their opponent might want to go to war for other reasons and would ignore all the destruction of nuclear war in his calculation except his missile count ratio. In this case it provides a number of missiles which have to be procured in order to make sure that the missile count ratio after an optimal exchange is more adverse.

The exchange modeling often allows a tradeoff in targeting between counterforce and countervalue. By using some arbitrary level of countervalue that a side deems necessary to deter, it can then calculate how many missiles it would need to have in order to be able to cause this much destruction with the missiles it would have after an exchange. In essence it calculates the excess number of missiles needed to preserve a fixed number of them after the opponent goes all out to try to destroy them. These calculations can involve defensive forces as well as offensive ones.

A wide variety of exchange models have been used to determine the number of missiles needed so that a second number, those needed to accomplish the chosen level of destruction, will be available after an attack by the opponent. Reinhardt and co-authors^{22,23,24,25,26,27}, Kupperman and coauthors²⁸, Erickson²⁹, Grotte³⁰, Smith³¹, Chrzanowski³² and Burr and coauthors³³ have worked out models for assessing residual capability after a wide variety of attacks, with and without defenses. Discussion of how these exchange models interact with a particular set of values will occur in a follow-on paper to this one.

THE BRIDGE BETWEEN DAMAGE AND PSYCHOLOGICAL DETERRENCE

This exchange modeling merely pushes back the question of how much is enough one step, to that of what amount of destruction is enough to deter. Neither do the psychologists' or statistician's theories answer the question of how much destruction is enough to deter. The gap between weapons quantities and psychological effects on decision-makers has not been bridged.

Yet, in order to decide how many weapons were enough, some decisions had to be made at each budget cycle in the past. In the United States, a stop-gap measure, the concept of strategic parity was used. If we do not know how to figure out how many weapons we need, why not build as many as our principal opponent. This policy was originally formulated by Secretary of Defense James Schlesinger, and called for *essential equivalence*, meaning that we did not want an exact mirror image of the other side's weapons, but we wanted to have essentially the same as the Soviet Union, adjusted by the differences in our weapon technology and geography. Included in the policy was the need (for both sides) to have enough to retaliate to an attack by the other side. According to Edward Luttwak³⁴, this represents a "failure to think strategically", and an absence of the proper framework in which to analyze weapons programs. For example, it did not take into account differences in Soviet intentions and goals, nor defenses³⁵. In other words, it omitted values. An earlier logic, Secretary of Defense Robert McNamara's *mutual assured destruction*, essentially stated that we should purchase the upper bound on destructive capability in that we could not determine a wholly credible lower one. As noted by Rosenberg³⁶, weapons procurement policy has been more driven by technological innovations than any analysis.

As we discuss in detail, the existence of a national value is the central assumption in the theory of deterrence proposed here, yet with a properly broadened definition of value, one which is very arguable and reasonable. If there is no way to calculate a reliable value function, there is no way to answer the question of how much is enough in any scientific way.

The purpose of this monograph is to present a theory of deterrence based on two important elements. The first is the new one, a concept of national value, by which we denote the mathematical function which top-level decision-makers implicitly use to make decisions concerning war. This is to be derived from historical and sociological data about the country being deterred. The second element is weapons procurement policy, which decides which weapons will be deployed on each side. This element has been extensively developed over the last three decades. They are tied together by the quantitative process of exchange modeling: the analysis of what would happen in a war, and the calculation of national value, after any such a conceivable war.

In the next section we will be discussing the likelihood that an estimate or an approximation of a national value function can be found, which will ultimately allow us to calculate the possibility of deterring a particular type of war. First we will have to define "value."

After defining and circumscribing the concept of value, we can use it to discuss the differences in viewpoint that surround the concept of deterrence, especially nuclear deterrence. The means by which a nation preserves a stable value system through decades

and centuries are broadly discussed, and the applications for each type of preservation process on the type of values to be expected are examined.

THE CONCEPT OF NATIONAL VALUE

In this section we define a new concept, national value. As noted above, national value exists in the minds of decision-makers. Different nations' decision-makers may have totally different values that they use for war initiation decisions. There is no reason to think that any simple measure, such as population or gross national product or standard of living, has any use whatsoever as a cross-national standard for national value. Each nation's decision-makers have to be examined separately to determine that nation's national value. And the potential dimensions of the quantity are quite diverse.

DIMENSIONS OF VALUE

One well-used measure of value is the surviving number of strategic nuclear warheads. To be more specific, value is computed after the conflict halts. The item measured is a specific type of weapon, one which existed before the conflict. That item is a surrogate for the nation's capability to still defend itself or to attack another nation, but the relationship between the purpose of the defense or attack, the weapons themselves and their function is not elucidated. A count of weapons is used and the number of similar weapons on the opposing site is ignored or is assumed to be zero. Lastly, such a value measure would be used to concentrate on nuclear all-out attack, rather than any other type of violent conflict. While simplistic, this listing of points can serve as a framework. By generalizing each of the points just mentioned we are led to a fourfold classification of measure, which appears to be complete.

The first classification of measures relates to the time of evaluation. National standings, possessions, control and similar things change with time, and a negative contribution of one time may turn into a positive one later. A simple example is the conquest of territory. If the conquering nation loses much in the war, its immediate result of the war might be thought very negative. However, as the conqueror and conquered recover, much resources and production could flow to the conqueror. If enough comes in time, the war can be considered worth its losses. To abbreviate a complex question, it can be said that the time of reckoning of gains and losses can be immediately after war's conclusion, after a recovery period, or far into the future, such as when a geographic addition can provide a large increment of economic growth. The particular nation's viewpoints on immediate gain versus long-term future has to be a vital part of the determination of national value for each nation.

Even in the simplistic case of warhead counting, if one side has a vulnerable weapon production line, and the other has an invulnerable one, the time of reckoning could make a

difference in whether one side considered itself the victor or not. If the value considered was the net difference in warheads, a side which destroyed the other's weapons but lost its production capability might consider itself the victor if its time of reckoning was immediately after the war. An opposing side who preserved its production capability and could rebuild more weapons in a year than the first side had surviving, and which considered one year after the war as the proper time of reckoning, would also foresee the war as winnable. Both sides, believing that they can win a war, could cause actions to be taken which might provoke the war.

The more complex the value is, the more difficult it would be to project it into the future after a conflict. Simpler quantities, like areas, troops, land conquered and so on, are projectable under various sets of assumptions, but something such as a future economic situation might be beyond any hope of calculation, and therefore not includable in a national value of a nation which reckons far into the future.

The second classification category of measures of value is the item or quantity measured. One possibility must be land area, in hectares controlled at the time of reckoning. This measure, unlike most others, does not vary with time between conflicts. A quality factor can be attached to land, with barren desert being less valued than coastlines and harbors. Farmland alone may be the measure, or its near equivalent, food production, or food production capacity. Resources may be the measure, as for example oil reserves or valuable mineral ore bodies. Manufacturing production, or the number of factories may be the measure. Population, or the self-supporting portion may be the measure. Gold reserves of a nation's central bank, or even the number of obedient vassal states might be it.

Most of the quantities would be highly correlated, in that expanding the limits of one nation's controlled area would likely increase population, resources, factories and food production as well. There would, therefore, be little point or occasion for a decision-maker to bother to assess the relative value of a hectare compared to a barrel of proven oil reserves. What would be necessary would be a coarse overall measure of the value of the increase in territory compared to whatever losses its conquest might require.

This set of quantitative measures certainly does not exhaust the physical quantities which could be used to describe a nation or controlled area. Yet a wholly different class arises from the realization that the decision-maker may be a person (or group of persons) with particular goals of his own, for example personal gain or reduction in risk of loss of power. In these latter cases, the nation involved is being introduced into a war which it may suffer losses from, while at the same time enriching the ruler. Yet, if this fact were not known to another nation trying to deter the first, it could make great errors in structuring its deterrent patterns.

Put another way, it may be that those who have the power to start a conflict do not identify with the nation as a whole, but instead think of personal or group gains. An example might be a war which impoverishes a nation, even virtually exhausts it, in which the living standard of the people plummets, but the leaders personal ambitions, revenge, or other motives are satisfied, or a leading group's ideological or religious desires and demands are met. To make the mistake that national interest is the controlling factor in initiating or continuing a conflict in situations where control rests tightly in a small group is to abandon the possibility of effective deterrence.

A third category of classification is the type of quantification done in computing the measure. A nation's decision-makers may only worry about the value of their nation's measure, for example simple hectares controlled. Yet, if the nation or the decision-maker is competitive, the measure actually used might be the difference between his nation's quantity and his nearest or favored competitor's. Alternatively, it may be the ratio instead of the difference. And the noticed relationship might be nonlinear, in the sense that if the nation is ahead, it matters little how much, but being slightly ahead is vastly different from being slightly behind, even though the actual values involved were close. This perception of global action as a race, in which the key is winning rather than moving fast, may replace what scientists might regard as rational measures, which are only functions of an individual nation. This opinion would be a hasty judgment, as third parties on the planet may regard the leading nation as the preferred one to ally with, or to trade with, thereby providing a greater gain in the long run to a nation only marginally ahead of its competitor.

In the extreme, it is even conceivable that one nation's decision-makers so detest the practices of another, be they religious, political, economic, social or otherwise, that the destruction of it is their principal value and the measures related to their own nation are only slightly influential. In such an inverted situation it is hard to see how deterrence can work. The only option available to the despised nation is defense rather than deterrence, and attacks on the leadership of the first nation perhaps the most primary avenue to limit damage.

The fourth and last category of classification of deterrence measures relates to what is being deterred. The acts of conflict range from a major war with unlimited use of weaponry all the way down to subversion. If one includes third powers into the picture, acts such as gobbling up a small nation, punishing an ally which tipped toward neutrality, or having a small ally attack a fourth power are all acts which may require deterrence. If decision-making is fractionated in a nation, so that, for example, the decision to go to war requires the concurrence of one body of people, and the decision to support terrorists' acts can be made by a different individual or group, then it is possible that two different deterrence measures can be operating at the same time between the same two nations.

This would occur if there were uncontrolled elements operating within a nation. A weakly governed nation, possibly one which had experienced war or another catastrophe,

or which was prevented by a larger neighbor from exerting control over its whole population, could have, for example, terrorist elements ranging inside it. In this case, the nation seeking to do the deterring must decide on whether to attempt to deter that third party which shields the internal fraction, or to deter that fraction directly, or to attempt to deter the nation itself from allowing the internal group to continue operating.

We have not explored in any detail yet the complications caused by a three-sided competition. There are a whole new set of problems which arise in such a situation where, for example, a war between nations A and B is deterred solely by the fact that nation C would be more powerful than either A or B after their conflict terminated. These complexities are left for discussion elsewhere, and will probably require the application or development of a new area of mathematics rather than the simple one used here, possibly group or game theory.

To sum up our discussion on values, the obvious point to be made from the above elaboration of possible measures of value is that what may be a deterring posture relative to one measure is not necessarily deterring relative to another. A set of deterrence weapons aimed at a nation's industrial complex may be totally deterring to a decision-maker whose background is manufacturing, and who subjectively evaluates his nation's worth in terms of its industrial output. However, if the individual replacing him has an agricultural background and regards land area as the only true measure of worth, deterrence would not occur if an opportunity arose to substantially add to the nation's area at the cost of eventually replaceable industry. The nation doing the deterring is required to either cover several reasonable measures of value that the decision-makers of the nation to be deterred may take or else to know the decision-maker's rules and to keep him in power or replaced by someone similar.

The realization of the possibility of multiple measures seems to make deterrence much harder, but in some conceivable situations the opposite result might occur. The values that are important to a decision-maker may be more vulnerable to threat or destruction than a presupposed set. The systems needed to threaten the actual valued parts of a nation may be cheaper (or more expensive) than the deterring nation might guess. What is needed is a deep understanding of who is the decision-making leadership, what their values are and what changes in this are likely to occur.

As mentioned above, some previous studies of deterrence have assumed that measures of worth in two states desiring to deter each other were such that they could reduce to the number of weapons or strategic warheads that the country possesses. Clearly, no such reduction can occur if one country is a land-desiring nation - land being not destroyable by strategic weapons in the long run - but possibly it could, if both valued living standards, which is a near equivalent of industrial production for developed countries.

THE ORIGINS OF VALUES

All countries have individuals or small groups leading them, with some power to make decisions concerning the initiation of conflict. Their power may be absolute and incontrovertible, or proscribed in multiple formal and informal ways. It may even be limited so much that decisions of importance are very hard to make.

Each person who contributes to the central decision-making has his own priorities as to what is important, what types of things should always or should never be done, and what constitutes an event which demands a response. When a decision is made, it represents some sort of averaging out of the individual priorities. To try and understand what these average values might be for a particular nation, we can examine several sources.

First and foremost, these values are held by individuals in the nation. More likely than not, they have grown up in that particular country, and have absorbed its teachings about what is to be valued. Some countries, like the USA, are quite heterogeneous, both in ethnic background, religious background, political background, quality, degree, and scope of education, and many other factors, so that one individual chosen at random would have very distinct values from another. Other countries, like Russia, have done more to homogenize their children's teachings, with respect to political ideology and cultural history, at the least. In such countries, it may be most useful to first examine the standard education children receive.

Secondly, it is not an average citizen who rises to power in any country, but those with special talents. Each country's political system makes special demands on people who move up the ranks to become national leaders. This process can be thought of as a filter, in which people with divergent values are strained out. Thus we are likely to see, in societies with monolithic governments, a convergence of personal views of national values. A single party nation such as the Soviet Union would be an ideal example to study the effect of the leadership ladder on national values. A two-party or multi-party system would not do the same, but instead would tend to some degree to do the opposite. People with differing value systems would be introduced into national positions, because of the need for each to differentiate himself and be distinguished by voters. A person in power in a multi-party nation can be there as a result of an appeal to voters, not with average values, but to particular values. Thus it should be more difficult to determine values for a multi-party nation, because of such things as the process by which leaders rise to national positions.

Two other sources of information can indicate national values: publications and historical decision-making. In the Soviet Union, publication was formerly only done when permitted by the State, and thus viewpoints expressed during that period represent a formal viewpoint of the government, if not an actual one. A well-known difficulty is the predilection of Soviet leaders to follow Lenin's precedent and use information sources as propaganda. Any publication designed for mass consumption, either by Soviet citizens or

foreign nationals, at least before glasnost, must be viewed as propaganda, designed to show the Soviet Union in a particular guise. Ferreting out the actual viewpoints held by high officials from the materials they deem necessary to publicize is a complex task. Other publications, however, show more promise. Soviet journals, intended to educate certain special groups of citizens, such as diplomats, military officers, trade officials, and others, cannot simply repeat propaganda "facts" if they are to serve their purpose of educating individuals to act for the state in external or internal affairs.

The other source of insights consists of historical decisions made and actions taken. Under the assumption that decisions will represent a choice between two or more alternatives with differing value, the choices could then be interpreted to corroborate assumption of national value made in other ways. As an example, the records of the various arms limitation talks show negotiating choices being made by both parties. As a caveat it should be remembered that the texts are subject to interpretation in different ways by each nation, and misunderstanding can result from a one-sided view of what the positions were.

THE PRESERVATION AND STABILITY OF NATIONAL VALUES

The national value can be thought of as a goal for a nation, one which, to an extent, guides its aims and the aspirations of the nation, in the eyes of its elites. If the national value is thoroughly accepted by those who are in power and able to make decisions of national importance, they will make those decisions to increase that value. They will also seek to impart the same national value to future generations of citizens of that nation, and they will work to raise to leadership positions and decision-making positions, those who adhere to and appreciate the national value, and who accept its increase as one of their own personal goals. Thus a nation with a homogeneous, albeit implicit, national value will tend to have that value preserved.

QUANTIFICATION OF NATIONAL VALUE

Once a national value is determined, it can be quantified. If only one quantity is held to be important, say for example, population controlled by a central authority, quantification is done the instant the value is defined. On the other hand, there may be a set of quantities which are important and which we discern play a role in national value of the nation being scrutinized. If an exact calculation were desired of national value, we would have to assign a weighted sum to the various components that are important, or possibly some other formula for mixing them. This might be done, although the form of the function would introduce more uncertainty into the measure. On the other hand, so many measures are reduced in a war, that it may be redundant to have to weight, for example, population and industrial strength. Both would be destroyed in a war.

Most of the benefit of having the elements of national value would be to be able to target them properly, and to be able to use the damage expectancy methodology mentioned above to figure out how many weapons are needed to reduce it in war. It would serve to eliminate whole classes of war as ones which could not increase national value of a principal enemy, and therefore would not have to be considered in weapons purchases. For example, if population controlled by a central government were the value, and immediately after the war the time of reckoning, then a war which had no territorial control resulting even from a favorable conclusion would immediately be dismissable from consideration. For example, solely naval confrontations would simply be ignorable.

Because of the novelty of the theory, it will be necessary to test it by doing some example nations before its resiliency and usefulness can be properly estimated. It may be that sociological data alone is insufficient to determine national value. However, even the process of attempting to determine national value for potential adversaries should lead to insights useful for adjusting weapons procurement.

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