THE FUNDAMENTAL INFORMATION BASE FOR MODELING HUMAN BEHAVIOR IN COMBAT*

By

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Fear in a Lethal Environment

Clausewitz and Behavioral Factors

Early in Book One of *On War*, Clausewitz emphasized the significance of passion in war. He dismissed the efforts of those who would study war as though it were merely an intellectual exercise. Of course intellect is import, he asserted, but simply to analyze combat in terms of numbers, he suggested somewhat contemptuously, is "kind of war by algebra." Among other things, he wrote: "... the impulse to destroy the enemy ... is central to the very idea of war." He then went on, in a brief chapter, to discuss "Danger in War." Time and time again he made the point that the activities of participants in combat involve passion and emotion, and are performed in a pervasive environment of fear.[1]

In these early pages Clausewitz touched lightly on points to which he devoted more attention later in the book. Numbers are important. So is rational analysis; for instance, numbers are less important for defenders than attackers because "defense is a stronger form of fighting than attack." Intellect and "genius" play a very significant role in successful combat.[2]

But he returned, time and again, to passion, emotion, and fear as the fundamental characteristics of combat.

No one who has participated in combat can disagree with this Clausewitzean emphasis on passion, emotion, and fear. Without doubt, the single most distinctive and pervasive characteristic of combat is fear: fear in a lethal environment.

There are, of course, mitigating factors. Discipline, training, and the inspirational influence of leadership can to a considerable degree offset--but never eliminate--the impact of fear on the activities of men in a combat environment. Also offsetting the degrading and depressing effects of fear, to some extent, are excitement and exhilaration experienced by some men (far from all) when offered an opportunity to excel in a risky situation. Yet even these brave, or foolhardy, men cannot completely escape the often-paralyzing effects of fear.

Quantifying the Effects of Fear

Since presumably all present at this meeting are here because they would agree with Clausewitz that human factors are important in war, I may be accused of preaching to the choir in my emphasis on those three human characteristics of passion, emotion, and fear. Perhaps **I** am guilty. But I suspect not. Just as many OR analysts often ignore the human element in war, so even among those who have not forgotten that element, there is a tendency to overlook the ubiquity of that one emotion which I have been

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* Paper presented at the Military Operations Research Society (MORS) Mini-Symposium, "Human Behavior and Performance as Essential Ingredients in Realistic Modeling of Combat – MORIMOC II," 22-24 February 1989, Center for Naval Analyses, Alexandria, Virginia.

emphasizing for the past few minutes: fear. Fear, I repeat, is the most pervasive aspect of combat, from which even the bravest are not immune. We cannot replicate fear in laboratory experiments. We cannot introduce fear into field tests. We cannot create an environment of fear in training or in field exercises.

So, to study human reaction in a battlefield environment we have no choice but to go to the battlefield, not the laboratory, not the proving ground, not the training reservation. But, because of the nature of the very characteristics of combat which we want to study, we can't study them during the battle. We can only do so retrospectively.

We have no choice but to rely on military history. This is why military history has been called the laboratory of the soldier.

This does not invalidate the results of non-battlefield experiments. It does not mean that we cannot learn from field tests and field exercises. It means that these results are not quite the real thing. They are to some extent distorted. We can eliminate the distortion only through studying such non-battlefield results through the prism of military history.

Military History: Indispensable, but Imperfect

Please do not get the impression that I am saying that military history analysis will provide all answers to questions about human behavior in combat, or that from military history analysis alone we can determine how to represent human behavior in combat simulations. I am saying two things:

1. We cannot get the true answers about human behavior in combat without analysis of military history, and

2. Simulation factors that are inconsistent with historical experience are almost certainly wrong.

I must also make clear my recognition that military history data is far from perfect, and that–even at best—it reflects the actions and interactions of unpredictable human beings. Extreme caution must be exercised when using or analyzing military history. A single historical example can be misleading for either of two reasons: (a) The data is inaccurate, or (b) The example may be true, but also be untypical.

Beware a statement which asserts: "Military History proves that…" (Who among us has not seen such a statement?!) Military history doesn't prove anything. Good military history simply reflects—within the constraints of numerous human frailties—what has happened in the past under a great variety of circumstances, each set of which is probably non-reproducible. But, when a number of respectable examples from history show consistent patterns of human behavior, then we can have confidence that behavior in accordance with the pattern is typical, and that behavior inconsistent with the pattern is either untypical, or is inaccurately represented.

My approach to historical analysis is actuarial. We cannot predict the future in any single instance. But, on the basis of a large set of reliable experience data, we can predict what is likely to occur under a given set of circumstances. It is this actuarial approach which permits insurance companies to predict likely human life spans, and to make modifications to those predictions on the basis of varying circumstances—such as the smoking habits of an individual.

One last general word about the value, and the limitations, of military history for analysis purposes.

Some operations research analysts believe that we cannot be confident that historical data is reliable—whether because of limitations on accuracy, or because of human unpredictability. Thus, they suggest, the data is unscientific, and so it should be ignored. They insist that our simulations should be based on scientifically provable data.

There are two things wrong with that approach.

In the first place it is impossible. Every model is based upon some fundamental assumptions that are entirely intuitive and totally unprovable.

In the second place, for the reasons I pointed out at the beginning, to ignore reality in favor of the laboratory is to assure failure to represent human behavior in combat.

For all of its shortcomings, military history is essential to good simulation of combat. From it we can substantiate our model assumptions. And from it we can see how humans really behave under the real circumstances of passion, emotion and fear. We have no choice but to recognize that there are shortcomings, and to do our best to eliminate those shortcomings by the greatest possible accuracy, combined with an actuarial approach.

Combat Phenomena Related to Human Behavior

Before considering how military history can provide us with a fundamental and indispensable basis for analysis of human factors in war, it might be helpful to review some of the more important combat phenomena that are directly or indirectly related to human behavior. I recognize ten such phenomena. While my list may not be exhaustive, I believe it is comprehensive.

Dispersion. There is one basic reason for the dispersal of troops on modern battlefields: to mitigate the lethal effects of firepower upon troops. As Lewis Richardson wrote in *The Statistics of Deadly Quarrels*, there is a limit to the amount of punishment human beings can sustain.[3] Dispersion was resorted to as a tactical response to firepower mostly because—as weapons became more lethal in the 17th Century—soldiers were already beginning to disperse without official sanction. This was because they sensed that on the bloody battlefields of that century they were approaching the limit of the punishment men can stand.

Defensive Posture. When men believe that their chances of survival in a combat situation become less than some value (which is probably quantifiable, and is unquestionably related to a strength ratio or a power ratio), they cannot and will not advance. They take cover so as to obtain some protection, and by so doing they redress the strength or power imbalance. A force with strength y (a strength less than opponent's strength x) has its strength multiplied by the effect of defensive posture (let's give it the symbol p) to a greater power value, so that power py approaches, equals, or exceeds x, the unenhanced power value of the force with the greater strength x. It was because of this that Clausewitz--who considered that battle outcome was the result of a mathematical equation--wrote that "defense is a stronger form of fighting than attack."[4] There is no question that he considered that defensive posture was a combat multiplier in this equation. It is obvious that the phenomenon of the strengthening effect of defensive posture is a combination of physical and human factors.

Surprise. A military force that is surprised is severely disrupted, and its fighting capability is severely degraded. Surprise is usually achieved by the side that has the initiative, and that is attacking. However, it can be achieved by a defending force. The most common example of defensive surprise is the ambush.

Perhaps the best example of surprise achieved by a defender was that which Hannibal gained over the Romans at the Battle of Cannae, 216 BC, in which the Romans were surprised by the unexpected defensive maneuver of the Carthaginians. This permitted the outnumbered force, aided by the multiplying effect of surprise, to achieve a double envelopment of their numerically stronger force. It has been hypothesized, and the hypothesis rather conclusively substantiated, that surprise can be quantified in terms of the enhanced mobility (quantifiable) which surprise provides to the surprising force, by the reduced vulnerability (quantifiable) of the surpriser, and the increased vulnerability (quantifiable) of the side that is surprised.

Fatigue. The effectiveness of a military force declines steadily every day that it is engaged in sustained combat. This is an indication that fear has a physical effect on human beings equitable with severe exertion. S.L.A. Marshall documented this extremely well in a report that he wrote a few years before he died.[5] I shall shortly have more to say about S.L.A. Marshall.

An approximate value for the daily effect of fatigue upon the effectiveness of weapons employment emerged from a HERO study several years ago.[6] There is no question that fatigue has a comparable degrading effect upon the ability of a force to advance. I know of no research to ascertain that effect. Until such research is performed, I have arbitrarily assumed that the degrading effect of fatigue upon advance rates is the same as its degrading effect upon weapons effectiveness. To those who might be shocked at such an assumption, my response is: We know there is an effect; it is better to use a crude approximation of that effect than to ignore it.

Combat Intensity. No one who has paid any attention at all to historical combat statistics can have failed to notice that some battles have been very bloody and hard-fought, while others—often under circumstances superficially similar—have reached a conclusion with relatively light casualties on one or both sides. I don't believe that it is terribly important to find a quantitative reason for such differences, mainly because I don't think there is any quantitative reason. The differences are usually due to such things as the general circumstances existing when the battles are fought, the personalities of the commanders, and the natures of the missions or objectives of one or both of the hostile forces, and the interactions of these personalities and missions.

From my standpoint the principal reason for trying to quantify the intensity of a battle is for purposes of comparative analysis. Just because casualties are relatively low on one or both sides does not necessarily mean that the battle was not intensive. And if the casualty rates are misinterpreted, then the analysis of the outcome can be distorted. For instance, a battle fought on a flat plain between two military forces will almost invariably have higher casualty rates for both sides than will a battle between those same two forces in mountainous terrain. A battle between those two forces in a heavy downpour, or in cold, wintry weather, will have lower casualties than when the forces are opposed to each other, under otherwise identical circumstances, in good weather. Casualty rates for small forces in a given set of circumstances are invariably higher than the rates for larger forces under otherwise identical circumstances.

If all of these things are taken into consideration, then it is possible to assess combat intensity fairly consistently. The formula I use is as follows:

$$CI = CR / (sz' \times rc \times hc) \quad (1)$$

When: CI = Combat Intensity Measure
CR = Casualty rate in percent per day

sz' = Square root of sz, a factor reflecting the effect of size upon casualty rates, derived from historical experience

rc = The effect of terrain on casualty rates, derived from historical experience

hc = The effect of weather on casualty rates, derived from historical experience

I then (somewhat arbitrarily) identify seven levels of intensity:

0.00 to 0.49	Very low intensity (1)
0.50 to 0.99	Low intensity (56)
1.00 to 1.99	Normal intensity (213)
2.00 to 2.99	High intensity (101)
3.00 to 3.99	Very high intensity (30)
4.00 to 5.00	Extremely high intensity (17)
Over 5.00	Catastrophic outcome (20)

The numbers in parentheses show the distribution of intensity on each side in 219 battles in DMSi's QJM data base. The catastrophic battles include: the Russians in the Battles of Tannenberg and Gorlice Tarnow on the Eastern Front in World War I; the Russians on the first day of the Battle of Kursk in July 1943; a British defeat in Malaya in December, 1941; and 16 Japanese defeats on Okinawa. Each of these catastrophic instances, quantitatively identified, is consistent with a qualitative assessment of the outcome.

Suppression. Suppression is perhaps the most obvious and most extensive manifestation of the impact of fear on the battlefield. The British did some interesting but inconclusive work on suppression in their battlefield operations research in World War II. In the United States I am aware of considerable talk about suppression, but very little accomplishment, over the past 20 years. In the light of the significance of suppression, our failure to come to grips with the issue is really quite disgraceful.

We at HERO believe that we have a potential methodology, but have been unable to arouse any official interest in our approach. In brief that approach is to measure the relative combat effectiveness value (CEV) of two forces in a historical battle under "normal" combat circumstances, and then measure it again in a battle in which one side made extensive use of suppressive fire. Comparison of the two CEVs, in consideration of the ammunition expenditure rate; in the two battles, should give a handle on the relationship of suppressive effect to volume of firepower. Results with one or two such comparisons have been promising.

Friction. Very briefly friction, as described by Clausewitz in *On War*, is simply degradation of the effectiveness of a force resulting from numbers of human interactions; i.e., numerical strength. I discuss friction fairly thoroughly in my book *Understanding War*.[7] Time precludes any elaboration on this at this time. This concept of friction, however, appears to me to be the only possible explanation of the unquestioned pattern of differences of casualty rates incurred and inflicted by forces of different sizes. This pattern, incidentally, exists, even after all due allowances for the proportions of larger forces in supporting and reserve roles. It provides the answer, in my opinion, to most of the problems of relationships in hierarchies of models.

Diminishing Returns. This, also, is discussed in *Understanding War*. Again time precludes any extensive discussion here. The important thing is that an understanding of the operation of the phenomenon of Diminishing Returns should facilitate application of the principle of Economy of Force.

Interaction of Variable Factors. It is almost undeniable that there must be some interaction among and within the effects of physical as well as behavioral variable factors. I know of no way of measuring this. One thing that is reasonably certain is that the use of the bottom-up approach to model design and development cannot capture such interactions. (Most models in use today are bottom-up models, built up from one-on-one weapons interactions to many-on-many.) Presumably these interactions are captured in a top-down model derived from historical experience, of which there is at least one in existence.

Finally:

Combat Effectiveness. Those of you familiar with my books *Numbers, Predictions, and War*[8] and *Understanding War; History and Theory of Combat*, will be aware that I have in recent years devoted much attention to the concept of Relative Combat Effectiveness and its quantification. The results of that work are considered by some people to be controversial. I am, however, sufficiently satisfied with the almost total consistency of those results with observed historical combat phenomena to have no doubt as to the validity of my concepts, arrogant though such a statement may seem. I am less satisfied–though not dissatisfied–with the specific relative Combat Effectiveness Values (CEVs) that emerge from my efforts at quantifying the results. Let me briefly summarize the concept, and its quantification.

Most of the physical factors affecting combat outcomes lend themselves to quantification in one fashion or another. Few of the behavioral factors are so readily quantifiable. I do believe, for reasons I have noted above, that some behavioral factors are quantifiable from observation of results; surprise is one such behavioral factor that I believe is quantifiable, as I have indicated above. But, in general, most behavioral factors are intangible, and not readily quantifiable. This, of course, is why we are meeting in this mini-symposium.

According to Clausewitz's "Law of Numbers" the outcome of a battle can be represented as follows:

$$Pr/Pb = (Nr \times Vr \times Qr) / (Nb \times Vb \times Qb) \quad (2)$$

When: P = the combat power of a force
N = numerical strength
V = variable factors representing "circumstances of the combat"
Q = quality of a forces, which Clausewitz says "is a given quantity"
r = Red force identifier
b = Blue force identifier

The values for N and V are physical values, and can be obtained or derived from the historical data. The quantified ratio of the two qualities (Qr and Qb) provides us with a relative combat effectiveness value (CEV) for the forces in the engagement.

Thus:

$$Pr/Pb = [(Nr \times Vr) / (Nb \times Vb)] \times CEVr \quad (3)$$

When: $CEVr = Qr/Qb$ (Obviously $CEVb = Qb/Qr$)

The theoretical outcome of a battle, without consideration of the intangible behavioral factors, is:

$$P'r/P'b = (Nr \times Vr) / (Nb \times Vb) \quad (4)$$

When: P' = Combat power without considering qualitative factors

Thus:

$$Pr/Pb = (P'r/P'b) \times CEVr \quad (5)$$

I have also demonstrated, fairly conclusively I believe, that the actual outcome of a battle can also be represented by another ratio:

$$Rr/Rb = (MFr + Espr + Ecasr) / (MFb + Espb + Ecasb) \quad (6)$$

When: R = Result value for a force in a battle
MF = Mission accomplishment factor (an expert judgment assessment)
Esp = Spatial effectiveness factor (ability to gain or hold ground, equation empirically derived)
Ecas = Casualty effectiveness factor empirically derived; (considers strengths and losses of both sides)

Thus,

$$Rr/Rb = Pr/Pb = (P'r/P'b) \times CEVr \quad (7)$$

or:

$$CEVr = (Rr/Rb) / (P'r/P'b) \quad (8)$$

Or, verbally, the relative combat effectiveness value of one force with respect to another is equal to the ratio of their result values divided by the ratio of the theoretical outcome (combat power ratio without consideration of intangible factors).

Using this approach, the overall or combined quantitative effect of all of the intangibles--practically all behavioral factors other than surprise (which is also a circumstantial factor)--can be determined in individual historical battles from a study of the historical records. So, even if we are never able to break down the individual effects of the components of relative combat effectiveness, this method provides a value for a composite of these intangibles, which we can call combat effectiveness, or troop quality.

Why am I satisfied with my results? For two reasons.

First, in any set of battles involving two specific opponents, or two specific national military forces, the CEV ratios cluster in groups quite consistent with historical observation of the relative capability of the opponents. For instance, the CEV values marking the superiority of Germans over Western Allies in World Wars I and II cluster around 1.2. In other words the Germans were consistently better than the Americans, British, and French, but only by a relatively narrow—even though consistent—margin, about 20%. The values for the German superiority over Russians in those World Wars cluster between 2.0 and 2.5, with the German superiority declining to about 1.8 in late 1944 and 1945. The values for Israeli superiority over

Arab opponents cluster in separate groups for combat with Jordanians, Syrians, and Egyptians, but they all average close to 2.0.

The second reason for my satisfaction with the concept is that there is an obviously close relationship between the CEVs so calculated and the exchange ratios by which these opponents inflict casualties on each other. Almost invariably 100 Germans inflicted casualties on their opponents on all fronts at a higher rate than 100 of their opponents were able to inflict on them. This, of course, is not conjecture, and is not the result of any manipulation of numbers. This is solid, quantitative historical fact. And the same is true of the relative casualty-inflicting capability of Israelis and Arabs.

Let me elaborate briefly.

The New Square Law. Some years ago it became evident to me that the CEV values in a battle were similar to, but always less than, the ratio of the casualty-inflicting capabilities of the two forces. After some experimentation, it became obvious that the relationship was as follows:

$$\text{CEVr} = \sqrt{(\text{Lr}/\text{Lb})} \quad (9)$$

When: L = The casualty inflicting capability of a force, derived, of course, from the casualties incurred.

I called this "The New Square Law." I soon discovered that this relationship had several, interesting uses.

In the first place, it permitted calculation of the coefficients for the Lanchester Equations for these battles.[9]

Second, it provided an alternative way of calculating the relative combat effectiveness of the opposing forces, simply on the basis of strength and casualty figures of the battle.

Third, and perhaps most important, it demonstrated that Napoleon was almost right when he said something like: “The moral is to the physical as three is to one.” The New Square Law says that the “moral is the equivalent of the physical squared,” and that the importance of the human element in war is exponentially greater than that of the physical element (i.e., people are more important than weapons.)

Let me demonstrate the significance of this with respect to the current confrontation of NATO and Warsaw Pact in Europe.

Our potential enemy has about twice as many troops and major weapons as we do. We cannot make weapons twice as good. NATO's political leadership will never double the strength of our forces. But if we can, through emphasis on troop quality and the human factors, increase the CEVs of our troops with respect to the Soviets to a factor of 1.41 (not a hopeless possibility, as demonstrated in World War II), we can offset the enemy's twofold numerical superiority. This is because the square of 1.41 is 2.0.

Components of Relative Combat Effectiveness

Now, then, what are the components of Relative Combat Effectiveness values, or CEVs? I believe that they are all of the intangible factors—behavioral, or behavioral mixed with physical—that I have been able to identify, but not yet satisfactorily quantify. I shall not take time to discuss any of these, but I shall list them. The first four or five are, I believe, the most important, and probably make up the bulk of the CEV value. The values of the others I simply do not know, but I am sure they have some value, and cannot be ignored:

- Leadership
- Training or Experience
- Morale, which may or may not include
- Cohesion
- Logistical effectiveness
- Time and Space
- Momentum
- Technical Command, Control, Communications
- Intelligence
- Initiative
- Chance

Is chance, or luck, a behavioral factor? Quite frankly I do not know. But I do remember Napoleon's famous remark: "Give me lucky generals."

Status of Historical Research in Behavioral Factors

Before World War II

We know from their writings that two, and possibly three, 19th Century military scholars were obviously aware that it was possible to quantify behavioral factors. These were Clausewitz; the American military historian, Theodore Ayrault Dodge; and possibly another American military historian, Thomas L. Livermore.

As to Livermore, in his classic *Numbers and Losses in the Civil War*[10], he clearly recognized that the exchange ratio of casualty infliction was an indication of relative combat effectiveness. However, the quality differential between Union and Confederate forces was negligible, and so Livermore had little to say about the potential measurement significance of this quantitative approach, which he pioneered.

Clausewitz, despite the common perception that he ignored numbers and concentrated on qualitative concepts, demonstrated in *On War*[11] his understanding of the quantitative, or scalar, significance of such things as leadership, troop quality, defensive posture, and friction. In one of his more obscure works there is also a clear statement, in unambiguous quantitative terms, of the concepts which we now call the Lanchester Equations. Unfortunately, however, he never did more than express his general ideas on quantitative relationships, and (except for the Lanchester-like concept) one looks in vain in his writings for numerical historical data relating to these concepts.

Dodge was the first scholar to translate Clausewitz's ideas about friction into numerical values.[12] It is doubtful if Dodge realized that he was putting flesh on the Clausewitz concept of friction by using a large historical data base to arrive at what were really friction coefficients. Of course he realized what he was doing; he simply doesn't seem to have been aware of what Clausewitz had written on the subject. (There was little appreciation of Clausewitz in the United States in his time.) From his data base he also formulated some quantified hypotheses about the effects of fatigue on troop movements in a combat environment.

There is some evidence that German General Staff officers were interested in trying to adapt Delbrück's quantitative historical comparisons to historical combat analysis. However, I know of no published works reporting on such adaptations.

Surprisingly J.F.C. Fuller, who in so many other ways stressed the importance of military history analysis, does not seem to have given any special consideration to the quantification of behavioral factors.

Since World War II

In the last half century there have been four or five examples of quantitative analysis of historical combat data by individuals or institutions, but only two of these seem to have been either extensive or systematic.

During World War II when Colonel S.L.A. Marshall was the Chief Historian of the US European Theater of Operations, he undertook a number of interviews of units just after they had been in combat. After the war, in his book *Men Against Fire*, Marshall asserted that his interviews revealed that only 15**%** of US infantry soldiers fired their small arms weapons in combat. This revelation created something of a sensation at the time.

It has since been demonstrated that Marshall did not really have solid, scientific data for his assertion. But those who criticize Marshall for unscholarly, unscientific work should realize that in private life he was an exceptionally good newspaper reporter. His conclusions, based upon his observations, may have been largely intuitive, but I am convinced that they were generally, if not specifically, sound.

Undoubtedly the most massive effort to analyze historical combat data has been that of the Soviet Military History Institute, operating under the direction of the Soviet Army General Staff.[13] We do not know too much about that Institute. Apparently it is made up of some 300 professional scholars, led by a lieutenant general, devoting themselves to the application of historical experience to the current problems of the Soviet armed forces.

In my opinion, nothing better demonstrates the application of the results of historical analysis to combat theory than the official statement of the Soviet concept of "Correlation of Forces and Means." Summarized below is a three-page exposition of that concept as it appears in the official Soviet Military Encyclopedia:

> An indicator of the fighting power of opposing sides, showing the degree of superiority of one over the other. It is determined by comparison of existing quantitative and qualitative data of opposing forces.
>
> An analysis of the correlation of forces permits a deeper investigation into the essence of past battles and engagements. It is usually calculated during preparation for battle. An estimate is made of the quantity of forces and means necessary for accomplishing missions.
>
> A correlation of forces was estimated during the great patriotic war based on the combat and numerical strength of our own forces and the enemy's. This method of calculating the correlation of forces is also useful today.
>
> Where combat capabilities differ significantly, estimated coefficients of comparability of combat potentials are used. The following are also taken into account: opposing organizations, training, nationality, moral and fighting qualities, armament and equipment, leadership, terrain, etc. Factors are compared with the aid of coefficients.

> Modern computers speed up computation. Changes during combat can be determined by modeling.[14]

The United States Armed Forces pay lip service to the importance of military history. Officers are urged to read military history, but given little guidance on how military history can be really useful to them. The fundamental difference between the Soviet approach and the American approach, as I see it, is that the American officer is invited (but not really encouraged) to be a military history dilettante. The Soviets seriously study, and use military history. Figure 1 summarizes the differences in approaches of the U.S. and the Soviet armed forces to military history analysis.

One of the few examples of the use of military history in the West in recent years was an important study done at the British Defence Operational Analysis Establishment (DOAE) by David Rowland. An unclassified condensation of that study was published in the June 1986 issue of the *Journal of the Royal United Services Institution* (RUSI). The article, "Assessments of Combat Degradation," demonstrates conclusively that, in historical combat, small arms weapons have had only one-seventh to one-tenth of their theoretical effectiveness. Rowland does not attempt to say why this is so, but it is interesting that his value of one-seventh is very close to the S. L. A. Marshall 15% figure. Both values translate into casualty effects very similar to those that have emerged from my own research.

Figure 1
Comparison of US and Soviet Use of Military History

Characteristics	US Mil. Establishment	Soviet Mil. Establishment
Emphasis On:	Inputs & Mathematical Forms	Outputs & Reality
Treatment of "Intangibles"	Omitted as not Measurable	Included & Effects Assessed
Size of Data	Small, Selective, & Theoretical Base	Large & Comprehensive
Attitude on Analysis	Non-Quantifiable for Analysis; Use of Quantified "Norms"	Essential to History
Use of History	Infrequent, Selective & Subjective	Comprehensive (& Objective?)
Scientific Rigor	Fair	Good
Confidence in Results	Dubious	Substantial

I should also mention Sally Van Nostrand at the U.S. Army Concepts Analysis Agency. With the encouragement of the Director, E.B. Vandiver, she has been doing some interesting work analyzing historical data on human performance.

I believe it is safe to say, however, that the most intensive work on the analysis of military historical data west of Moscow has been done by my own Historical Evaluation and Research Organization, known by its modest acronym, HERO. I cannot comment on our work objectively, of course, but I believe that our greatest contribution has been in focusing attention on the importance of behavioral factors in combat, and in demonstrating that it is dangerous to ignore these factors, simply because we don't have good values for them.

Unfortunately, however, HERO has had no endowment, and no regularized funding support that would enable us to undertake a comprehensive, systematic approach to the analysis of historical data. HERO has eked out a bare survival existence over the past 25 years only by scrambling for crumbs from the tables of large OR projects, in which any historical analysis has usually been an afterthought.

Over this quarter century HERO has performed more than 160 studies directly or indirectly for the US Government. Some of these have, in one way or another, produced results of actual or potential value to the modeling community. The principal study reports in this category are listed in Appendix "A". Other studies have, in many instances, led to conclusions and recommendations about actions that could be (or should be) taken to improve our understanding of and (implicitly or explicitly) our representation of, behavioral factors in combat. I recently made a survey of 15 of these reports, for the purpose of assessing what has been done about the recommendations presented in them.

The result of my survey (See Appendix B) was quite discouraging. For all practical purposes, nothing has been done. In its wisdom, the Government has spent a substantial sum of money (although, Lord knows, not much for any single one of these studies) to seek the application of our expertise in research and analyses, and has then virtually ignored what we did. This implies an inefficiency which is mind-boggling.

Let me summarize what I believe HERO has done over the past quarter century on a listing of Behavioral, or Moral, Factors in War, in Figure 2. Shown here are some 22 different behavioral factors, in four rather general categories. We have produced some sort of quantification hypothesis for 14 of those factors.

Figure 2
Behavioral (Moral) Factors in War

Leadership
- Training/Experience
- Application of Combat Multipliers*
- Set-Piece Battle Preparations*
- Logistical Effectiveness

Quality of Forces & Manpower
- Relative Combat Effectiveness*
- Trends over Time*
- Morale
- Cohesion
- Fatigue*

Disruption
- Surprise*
- Suppression*
- Unit "Breakpoints"*

Relationship of Moral & Physical Factors*
- Interaction of Firepower, Mobility, Dispersion*
- Combat Intensity*
- Friction*
- Defensive Posture*
- Momentum
- Time & Space

* Quantification hypotheses exist

What Needs to be Done

I hope I have conclusively demonstrated three things:

First, military history can contribute greatly to our understanding, and quantitative representation, of behavioral factors in combat.

Second, behavioral factor research without military history will provide results that are at best distorted and at worst wrong.

Third, the United States defense establishment does not adequately use military history for operations research analysis.

If I am right, something needs to be done. I shall conclude by presenting an approach to getting something done.

I have ideas on a comprehensive program for military history research, to provide data for further study of the impact of behavioral factors on combat operations. However, given the background of the status of military history research in the United States, a preliminary assessment of requirements is necessary. This should be a reasoned and objective consideration of the merits and demerits of historical analysis as an addition to the arsenal of analytic tools used in DoD. I would propose that this consideration should be by a qualified mixed military-civilian study team in terms of five tasks, as follows:

Task 1. Establishing a Concept for Historical Analysis. This will lay the groundwork for the four remaining tasks. Historical Analysis will be defined, differentiated from history, and illustrated by use of historical examples. Uses of historical analysis by the Great German General Staff, in particular, will be examples. Instances of good use and bad use of history in combat will be examined, as will be the nature of historical analysis and its relationship to the scientific method, operations research, policy formulation, and doctrinal development.

Task 2. Assessment of the State of Historical Analysis in the United States DOD. Using the definition and concept of historical analysis developed in Task 1, the extent to which the DoD understands and applies historical analysis in its decision-making process will be assessed. Interviews will be conducted with influential officials in OSD, OJCS, and the Services. Visits will be made to major centers of policy and doctrinal development and all senior service colleges. The assessment will be based to a great extent on the results of these discussions and on documentary references in DoD and Service regulations.

Task 3. Summary Assessment of the State of Historical Analysis in the Soviet Armed Forces. This will be a brief summary of the approach taken by the Soviets in using historical analysis in their military decision—making process. The work will be based on open, published sources. Task 3 will be accomplished at the same time as Task 2.

Task 4. Summary of Program Alternatives. Five alternative programs for DoD use of Historical Analysis will be presented for evaluation. Pros, cons, costs and benefits of each program alternative will be examined. Alternatives will range from a minimum level program to a massive program similar to that of the Soviets. Alternative means of applying historical analysis will be examined. The elements of each program alternative will be defined and elaborated. Finally, specific applications for historical analysis within DoD will be suggested.

Task 5. A draft final report will be prepared and submitted to the sponsor and to other authorities for review and comment, including those visited during Task 2. Comments will be consolidated and included in the final report. The final report will suggest a course of action for DoD. A briefing will be provided.

A number of years ago I wrote to a friend–retired (and now deceased) Marine Corps Brigadier General Samuel Griffith, with a PhD in history from Oxford, and best known as the translator of Sun Tzu's *The Art of War*[†]–asking his opinion about what could be done to improve the use of military history in military analysis in the United States. He wrote back:

"You're wasting your time. Americans have never paid any real attention to military history, and they never will."

Despite many disappointments, I am more optimistic than Sam Griffith, because I remember a historical example.

In the early Nineteenth Century, Gerhard von Scharnhorst struggled vainly for several years to overcome the intellectual rigidity and regimentation of the Prussian Junker officer corps, and their deep suspicion of academic achievement in both history and science. Nevertheless (admittedly with some assistance from Napoleon and the thrashings he gave the Prussians at Jena, Auerstadt, and Friedland), by 1814 Scharnhorst had initiated a military system that would soon bring to the Prussian/German military establishment a well-deserved reputation for technical efficiency combined with historically-inspired, imaginative, innovative leadership and flexible combat doctrine and tactics.

In large part this achievement was possible because Scharnhorst's creation, the Prussian General Staff, deliberately attempted to offset the stultifying effects of typical German rigidity and regimentation by inculcating in its officer corps the concepts of initiative and flexibility, concepts which were not typical of Germans, but which Germans could learn and apply. The General Staff did this by institutionalizing military genius, and then imparting these learned (non-inherent) traits to the entire German officer corps.

If the Germans could institutionalize non-typical, non-traditional characteristics in their General Staff and officer corps, so can we. What is needed is a conscious decision, like that of the Prussians after 1807. The institution by the Department of Defense of a multi-year program of military historical analysis, adequately funded and enthusiastically supported, can accomplish what is needed. Here are some of the results that would flow from such a program:

- Immediate meaning and focus would be provided to the pro-forma military history instruction in service schools and war colleges.

- Military history would be used consistently in all of the services, in DOD, and the Joint Staff.

- Decision-makers and planners would be encouraged to use, and to rely upon, analyses based on military history.

- A truly focused effort would be made to use history to bring realism to the simulation of human behavior in our combat models.

Sam, such a dream could come to pass. And your ghost could take comfort in knowing that Americans really can learn!

[†] Griffith, Samuel B., *Sun Tzu "The Art of War,"* Oxford, 1963.

Appendix A

HERO REPORTS CONTRIBUTING TO MODEL DEVELOPMENT

No.	Title	Significance
4.	Historical Trends Related to Weapons Lethality (CDC, 1964)	• Relating weapons changes to tactical & doctrinal change • Theoretical Lethality Index (comparison of weapons effectiveness)
16.	Average Casualty Rates for War Games, Based on Historical Combat Data (RAC, 1966)	• Provided basis for casualty rates for ATLAS (CEM? FORCEM?) & other models
17.	Developing a Methodology to Relate Mobility to Combat Effectiveness (RAC, 1967)	• Showed historical significance of Mobility • A step toward quantifying effectiveness
27-35.	Historical Data Research on Air Interdiction in WW-II (USAF, S&A, 1969-72)	• Survey tactical air support & interdiction, Tunisia to Germany, 1942-1945 • Relationship of ground & air operations
32.	Use of Historical Data in Evaluating Military Effectiveness (USAF, S&A, 1969)	• Effort to quantify data & factors to represent air supported ground operations • Beginning of ground battle data base
34.	A Study of the Relationship of Tactical Air Support to Land Combat (DOAE, 1970)	• Quantification of data & factors in QJM • Quantified relationship of air & ground combat
50.	Combat Data Subscription Service (1975-1977)	• Comprehensive quantification of miscellaneous combat data
51.	A Survey of "Quick Wins" in Modern War (N/A, 1975)	• Importance of Quality (troops, leaders, staffs • Importance of Mobillty (technological, conceptual) • Importance of Surprise
52.	A Study of Breakthrough Operations (DNA, 1976)	• Quantification of "Multipliers" • Quantification of Attacker & Defender norms • Recognized Relative Combat Effectiveness
56.	Assessment of Arab & Israeli Combat Effectiveness 1967 & 1973 Wars (CIA, 1977)	• Detailed breakdown of engagement data • Evaluation of Relative Combat Effectiveness of Israelis & several Arab armies
95.	Analysis of Factors .... A Data Base of Battles & Engagements (CAA, 1983)	• Comprehensive data base 603 battles & engagements, 1600-1973
165.	Comparison of Relative Combat Effectiveness, Offense, Defense (DOAE, 1988)	• Comprehensive review of CEV methodology • Compares national CEVs, and effect of offensive & defensive postures
166.	Forced Changes of Combat Postures ("Breakpoints")(CAA, 1988)	• Compilation & analysis of factors associated with "breakpoints" • Development of breakpoint models for regt & division, time-step & event-sequence • Demolishes idea of attrition-related thresholds or breakpoints

Appendix B

SOME HERO RECOMMENDATIONS AND GOVERNMENT ACTIONS ON SELECTED HERO REPORTS

No.	Report Title & Recommended Actions	Government Action Y	N
20.	Comparative Analysis of Armored Conflict Experience (DOD, PA&E, 1967)		
	• Review existing historical data to determine characteristics of tank endurance & reliability		x
	• Establish armored conflict experience data base		x
	• Review previous studies of such experience		x
	• Review campaign experience of US, British, and German armored units in World War II		x
28.	Disruption in Combat (USAF, 1970)		
	• Systematic exploration of historical effects of combat disruption	#	
	• Determine historical relation of disruption & behavioral factors		x
36.	Opposed Rates of Advance of Large Forces in Europe (ORALFORE) (USA, DCSOPS, 1972)		
	• Tentatively adopt detailed rates established in study		x
	• Develop advance rate data base to refine rates		x
41.	Rate of Ammunition Expenditure in Relation to Posture (SHAPE, 1973)		
	• Develop historical data base for determination of method to calculate combat intensity	*	
	• Determine systematically the relationship of historical expenditures to posture & intensity		x
44.	Historical Evaluation of Barrier Effectiveness (CAA, 1974)		
	• Verify detailed historical defense & delay factors for barriers & terrain found in study		x
	• Verify detailed historical factors for constraints on construction efforts found in study.		x
58.	Assessment of Danger of Surprise Attack in Europe, & NATO Vulnerability (USAF, 1977)		
	• Comprehensive assessment of historical factors in achievement or frustration of surprise	#	
	• Review & reassess past related studies	#	
61.	Implications of Surprise in Conventional & Tactical Nuclear Combat in Europe (DNA, DCSOPS. 1978)		
	• Refine tac nuclear combt model designed in study		x
	• Comprehensive study to relate historical effects of surprise on advnce rates, force ratios, attrtion, etc.		x
62.	Search for Historical Records Records of High Rate Artillery Fire in Combat (HEL, 1978)		
	• Establish artillery combat data base		x
	• Review historical data to test results of preliminary investigation in this study		x
65.	Effects of Combat Losses & Fatigue on Operational Performance (TRADOC, 1979)		
	• Verify findings regarding Fatigue Indicators		x
	• Verify findings regarding degradation factors		x
71.	The Value of Field Fortifications in Modern Warfare (DNA, 1979)		
	• Extend, refine, & validate factors in earlier Barrier study		x
	• Verify findings on establishing barrier in Europe		x
73.	The Impact of Nuclear Weapons Employment on Factors of Combat (DNA, 1980)		

•	Establish historical combat engagement data base	*
•	Undertake detailed survey of data base design	x
81.	Soldier Capability-Army Combat Effectiveness (SCACE); Historical Analyses (USA Soldier Spt Ctr, 1980)	
•	Compare combat effectiveness of selected US divs in WW-I & WW-II	x
•	Assess small unit performance in historical data of 1st and 2d Divisions in WWI	x
•	Explore relationship of national manpower quality & demonstrated historical combat effectiveness	x
•	Investigate & analyze relevant Israeli experience	#
•	Examine conscript & volunteer performance in Franco-Prussian War	x
•	Examine historical experience of US Army & US Marine Corps combat effectiveness	x
•	Compare troop performance & capability in field training exercises	#
•	Survey 20th Cent US manpower capability experience in combat & suppport, for draftees & volunteers	x
•	Examine historical records of elite units' performance, and effect on non-elite units	x
88.	The US Army 88th Division in World War II (OASD-MRA&L, 1981)	
•	Make comparable analyses of other 88th Div engagements	x
•	Compare training & combat performance records of 88th and 85th Divisions	x
•	Compare findings with literature relative to morale & esprit de corps	x
91A.	Conventional Attrition & Battle Termination Criteria (DNA, 1982)	
•	Develop a QJM methodology for naval warfare	*
•	Develop historical naval warfare data base	x
136.	Handbook on Ground Forces Attrition in Modern Warfare (CIA, 1986)	
•	Verify handbook data from further historical study	x
•	Verify concept of Relative Combat Effectiveness	x
•	Verify Attrition Verities from more historical data	x

Summary

Actions Taken on HERO Recommendations

Action may have been taken (*):	5
Action taken for another reason (#):	3
(Same action in two cases; non-funded in the other)	
No action taken (x):	33-38

NOTES

[1] Clausewitz, *On War*, Howard—Paret translation, Princeton, 1984, Chapter One, Book One, *passim*.

[2] Ibid.

[3] Richardson, Lewis F., *The Statistics of Deadly Quarrels*, Pittsburgh, 1960.

[4] Clausewitz, *On War*, 84, Section 17.

[5] "The Shock Impact of Combined Arms Forces in World War II Amphibious Operations," *History, Numbers and War*, Vol. 2, Number 1, Spring, 1978.

[6] *HERO Combat Data Subscription Service*, Winter, 1975, 80.

[7] Dupuy, T.N., *Understanding War; History and Theory of Combat*, New York, 1987, Chapter 14.

[8] Dupuy, T.N., *Numbers, Predictions and War* (Revised Edition), Fairfax, VA 1984.

[9] *Understanding War*, *op cit*, Chapter 16.

[10] Livermore, Thomas L., *Numbers and Losses in the Civil War*, Bloomington, IN, 1957.

[11] Clausewitz, *On War*

[12] Dodge, Theodore Ayrault, *Great Captains, Alexander, Hannibal, Gustavus Adolphus, Napoleon*, Boston, 1890-1904.

[13] See *Understanding War, op cit*, Chapter 5.

[14] Extract from V.I. Belyakov, *Soviet Military Encyclopedia*, Moscow, 1979.