

SOLDIER CAPABILITY - ARMY COMBAT EFFECTIVENESS (SCACE)
HISTORICAL COMBAT DATA AND ANALYSIS

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The study report includes recommendations for further research in the quantification of troop capability and its effect on combat. A fully annotated bibliography accompanies the report.

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This report was prepared by Trevor N. Dupuy and Gay Hammerman, with the research assistance of Dee Allyson Horne. It was reviewed by Grace P. Hayes, HERO Director of Research. Abraham Wolf and Angus M. Fraser participated in the study as consultants.

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EXECUTIVE SUMMARY

This study included a survey of historical literature related to troop quality and capability; a survey of psychological literature dealing with the relationship of individual aptitude to group performance, with special attention to the group performance of low-aptitude individuals; a statistical comparison of quantified ratings of the combat effectiveness of 17 national military forces since 1945 with demographic, educational, and other statistical characteristics of the nations involved; and a survey of collections of combat data for the purpose of identifying units with unusually high combat effectiveness, and also of identifying detailed combat data on relatively small units (regiments and battalions) that would make possible quantitative analysis of unit combat effectiveness at those levels.

The study concluded that superior leadership and training are required to compensate for low troop quality, with leadership of prime importance; that there is a strong statistical association between the combat effectiveness of armies during the past 40 years and national characteristics of male literacy, household size (negative), birth rate (negative), and temperature of the capital city in the hottest month (negative); that the high level of correlation found indicates the probability that a formula could be derived to estimate the effectiveness of any two forces in a war game; and that detailed data on combat experience is available for units of exceptionally high combat effectiveness and for both sides in combat between battalions and regiments.

The study report includes recommendations for further research in the quantification of troop capability and its effect on combat. A fully annotated bibliography accompanies the report.

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Introduction

In fulfillment of the objectives of the SCACE Study, HERO was asked to provide a literature overview of historical and other related materials, to conduct such relevant historical analysis as was possible within the brief assigned time frame (45 days), and to identify data gaps and recommend follow-on studies for which a need was found.

For purposes of HERO's work, the following definitions have been established, and an effort has been made to use the terms thus defined consistently in this report:

- Quality is the basic aptitude the soldier brings with him when he enters the Army. In the US Army today it is measured by the amount of prior schooling and scores on standard aptitude tests.
- Capability is the skills and aptitudes the soldier brings into battle, after quality has been tempered by training and/or experience.
- Combat effectiveness is the capability of units. It is in part dependent upon troop capability, but is also dependent upon leadership, tactics, and other factors.

Research and Analysis

The following research efforts were carried out:

1. Literature overview
 - a. Historical materials

Following consultation with staff military historians, the following categories of relevant literature were selected for investigation:

- classical military studies dealing with troop combat performance
- memoirs of commanders known to have treated the subjects of training and combat performance

- accounts of combat from the point of view of the individual soldier that might be expected to provide insights on troop quality and troop performance
- materials dealing with the performance of troops regarded as of very high or very low quality
- analytic accounts relating training to combat performance

In carrying out this research, the US Army Military History Research Collection at Carlisle Barracks, Pennsylvania, and the guidance of its staff historians were used, as was the Army Library collection at the Pentagon; a computer-assisted search of Library of Congress holdings was also carried out.

The literature examined, which stretches from the early 16th Century (Niccolo Machiavelli*) to the most recent Arab-Israeli war (Luttwak and Horowitz), produced a clear consensus on a number of points related to troop behavior:

- leadership is crucial to combat success
- unit cohesion and loyalty are crucial to combat success
- unit training under realistic conditions, and/or combat experience, is extremely important to combat success
- discipline and drill are valuable in forming capable soldiers and cohesive units
- the factors listed above can outweigh opposing superior numbers
- panic in combat is a function of the group environment rather than of the individual's personal qualities, but the action of a few individuals can start or stop it.

Very little is said specifically about troop quality or capability in this literature. It may fairly be stated that most of the writers reviewed assumed a normal distribution of inherent quality as a given for combat troops, and also assumed the desirability of at least basic general and military education. For works that deal with quality more explicitly than most, see Baynes, Chuikov, Machiavelli, Marshall 1956, and Truscott.

* Names inserted in the text within parentheses refer to entries in the attached bibliography.

Since it appeared that a reasonably normal distribution of troop quality was an assumption for most authors, HERO sought extreme cases in which a force of acknowledged low-capability troops fought another representing a national demographic cross-section; HERO also sought examples of individual units regarded as made up of elite troops or very poor troops in order to compare their combat performance with their assumed quality. A number of examples of both were identified. For example, most armies during the Thirty Years' War of the 17th Century were composed of either mercenaries or impressed troops, or both, units made up of what is usually referred to as the "dregs of society," while the highly successful Swedish army of Gustavus Adolphus, in the same wars, was a truly national army.

Another area in which extreme cases were sought was that of prolonged and especially deadly wars that severely drain manpower. Cases identified were the case of Paraguay in the Lopez War of the mid-19th Century, of Germany near the end of World War II, and of both Union and Confederate armies near the end of the Civil War. There was not time within the limitations of the present study to develop appropriate bibliography for these cases, much less to conduct research, but further study might well prove rewarding.

Another, probably more promising, area for exploring the impact of troop quality and capability appeared from the literature review. The Israel Defence Forces induct almost all Israeli young men (and many women), and serve an important educational role for those without elementary education, especially Israelis of non-Western origin. Luttwak and Horowitz, Appendix 5, includes some relevant material on troop capability problems. For example, the IDF discovered that providing concentrated elementary-school education in the first months of military service does not improve the chances of military success for those who take it, and consequently reverted to its earlier practice of giving this training at the end of the three-year period of service. Further research in IDF reports and through interviews would appear desirable.

b. Results of training and unit readiness evaluations and weapons tests

A preliminary survey of material in this area, consultation with Army Research Institute personnel engaged in evaluation of training and

proficiency, consultation with the COTR for this study, and examination of the extensive bibliography for the SCACE study, prepared by the COTR, confirmed that the COTR had investigated all readily available material in this area. It appeared that a study of the relationship between success of individual soldiers in field training exercises on the one hand, and the quality of individual soldiers as measured at induction and their capability as measured by job-performance tests (SQT scores) would be highly desirable. Such a study should help validate SQT scores and make a contribution toward establishing a predictor for individual and crew performance in combat.

c. Theoretical data pertaining to the objective of the SCACE Study

A research psychologist was given the task of providing an overview of relevant theoretical material relating individual performance to aggregate group performance. He conducted a preliminary survey of the literature and found:

- The most relevant research is military related. It was determined that this research has been fully explored by the COTR.
- A search of the massive literature on the relationship of individual to small-group (crew-size) performance would require more time than was allocated to this investigator under the contract. It also appeared doubtful that such an effort would yield significant amounts of relevant material.
- In general, research studies in this field tend to use college students as subjects, so that the question of a high proportion of low-aptitude (low-quality) subjects (as measured by standard tests or educational level) is not dealt with.
- Industrial studies, which deal with the relationship between training and performance and might be expected to be useful, are not a promising source, because they rarely include a sizable proportion of low-aptitude personnel.

It was therefore decided, in consultation with the COTR, that the most useful theoretical contribution for this task would be an overview of the relationship of cognitive skills to training and performance, with special reference to man-machine systems, and the problems that still remain to be solved in this area. A summary of this work is attached as Appendix A.

2. Assessment of correlation between historical data and data on combat effectiveness of soldiers, and relevant analysis
 - a. Preliminary investigation of the relationship between national demographic, educational, economic, political, military, and climatic statistics and troop capability

This task was designed as a first step toward establishing a possible link between troop quality and the performance of units in combat. The first exercise carried out in fulfillment of this task was the scaling (ranking) of 17 armies of the past 40 years as to the combat effectiveness of their forces in battle.

Ideally, it would have been desirable to scale the average capability of the individual soldiers, since troop capability is the independent variable of this study. However, there is no way that troop capability can be seen in isolation when one examines the performance of soldiers at the national-force level. Performance at this level inevitably reflects additional factors, including especially quality of leadership. Combat effectiveness presumably includes troop capability, and is the only way we now have of examining troop capability at the national force level. Therefore, these 17 national forces (armies) were scaled according to the quality of their combat effectiveness.

The scaling described above was done by a group of highly qualified military historians, using the method of paired comparisons, a simple, but widely accepted, and mathematically rigorous, procedure. The resulting scalings of armies were then compared with a group of national demographic, economic, and other statistics in an effort to find possible associations between national armed force capability and national statistics. Appendix B presents a discussion of the results, together with tables showing the scalings and associations. Some of the conclusions of these exercises are these:

- The military historians who ranked the 17 armies judged the Germans in 1943-44 to have had the most effective forces, with the Israelis during the period 1967-73 ranked second. The least effective forces were those of the Iraqis and Syrians during the latter period.
- US forces during the period 1966-70 were evaluated as somewhat lower than US troops of 1943-44 and 1951, but higher than Japanese or

Soviet troops of 1944. (No effort was made, of course, to rate US forces of today, since judgments were made only on the basis of combat performance.)

- Two characteristics related to demography were very strongly negatively associated with national combat effectiveness. These were
 - household size
 - birth rate
- One characteristic related to education was very strongly positively associated with combat effectiveness:
 - male literacy
- One characteristic related to climate was strongly negatively associated with combat effectiveness. This was
 - temperature in the hottest month
- A number of other factors tested were associated with combat effectiveness less strongly or not at all. (See Appendix B for details.)
- The strong associations noted above indicate that it may be possible to derive a formula for estimating the combat effectiveness (including troop capability) of any given national force being analyzed or war gamed.

As part of this same task, a review of the findings of HERO's Quantified Judgment Model (QJM) on the combat effectiveness of national forces was carried out. Analysis of a large number of combat engagements -- analysis carried out during the past 10 years -- has shown that there is a quantifiable factor in addition to numbers of men and firepower that helps determine the outcome of battles, and that this factor differs from division to division and from national force to national force. This factor is termed by HERO the relative combat effectiveness value (CEV). The CEV is assumed to include troop capability, along with leadership training, and tactics. Thus far it has not been possible definitively to isolate any of these subfactors, including troop quality, from the total CEV, but the unquestionable existence of CEVs does show objectively that numbers and weapons alone do not determine battles. To put it another way, it can be readily demonstrated that numbers alone do not win battles, and CEV is the term used in the Quantified Judgment Model for the quantifiable qualitative difference between two forces of equal size and weaponry.

When the scale of force effectiveness derived from the judgment of military historians, which has been described above, was compared with a scale based on the CEVs of the national forces under consideration, the

two scales agreed closely.

b. Review of data in HERO Engagement Data Base for relevant material

A search was made in the HERO Engagement Data Base for units that had unusually high CEVs, in the hope that demographic and other relevant data about the troops composing these units might help establish a link between individual capability and unit performance. The division identified as having a particularly high CEV is the 88th Division, in its performance against German units in Italy in 1944. It was not possible within the time frame of this study to carry out any research on the relationship of the relative combat effectiveness of divisions and demographic or other statistics, but follow-on research would appear promising. See Recommendations for Follow-on Research, below, for a fuller discussion.

c. Search for detailed combat data on US regiments and battalions

In pursuit of this task, a very promising source of data was discovered in the US Army Military History Research Collection at Carlisle Barracks, Pennsylvania. This is a collection of raw combat data compiled by the US 2d Division, an outstandingly successful World War I combat division. The 2d Division, following the war, collected the war diaries of all the German units that had opposed it in battle in 1918 and also compiled its own war diaries and those of all its subordinate units. This data will make possible the kind of small-unit combat analysis for which this task of the current study sought data.

In addition, there are some groups of information on US regiments and battalions in the Federal Records Center. The chief difficulty in determining the combat effectiveness of these units, and thus providing a link between individual performance and division-and-higher performance, is the task of reconstructing the combat data for opposing forces. This work would require a large investment of time, but it is believed to be feasible, and could have extremely useful results.

Conclusions

The following conclusions emerged from a consideration of the military historical literature reviewed for this project, the preliminary statistical analysis described above, and HERO's past work on the relative combat effectiveness of large units and national forces:

- There is almost certainly some tradeoff between the factors that compose combat effectiveness; that is, leadership and training almost certainly can compensate to some extent for low troop quality. However, it is obvious that superior leadership and training would be required if quality were low, not just average leadership and training.
- There also seems to be some synergistic effect among troop capability, training, and leadership. Good commanders raise the capability of their troops, and with good troops a commander performs better. Leadership is especially important, because of its impact on training, and the impact, in turn, of training on troop capability. This does not mean that low troop capability does not have a degrading effect on combat performance, and it does not mean that a predictor for degraded combat performance cannot be found, but it does complicate the task.
- National combat effectiveness appears to change very slowly over time. For example, despite the Bolshevik revolution and many years, Soviet CEVs with respect to the Germans were only slightly higher than those for Russia in World War I. German CEVs relative to the Western Allies for World Wars I and II are also close. These facts indicate that while a country may expect to coast for some time on the intangibles of troop quality, leadership, discipline, training, and tactics, a high level of combat effectiveness, once lost, may be hard to restore.
- Preliminary exploration of the relationship between the combat effectiveness of armies during the past 40 years and a variety of national demographic, economic, and other factors indicates a strong association between a number of these factors -- male literacy, household size (negative), birth rate (negative), and temperature of capital city in the hottest month (negative) -- with national combat effectiveness. Two points may be made about this

preliminary finding. One is that some of the statistics that characterize an industrialized society are also associated with high troop quality in the middle-to-late 20th Century. Another is that one of these factors, male literacy, is one that can be identified in the individual soldier and thus controlled for the army. Also, it is possible that it could become the basis for a predictor of army combat effectiveness. It is important to understand, however, that the findings so far do not give any reason to believe that increasing literacy in a given army will significantly increase combat effectiveness.

- It seems possible that a national army that represents an economic, social, and educational cross-section of the nation will generally be more combat effective than one that includes low-capability individuals in sharp disproportion to the general population. This appears to be a hypothesis worth testing. Both volunteer and conscript armies vary in their troop quality, with no clear pattern emerging, but there is some reason to believe that cross-section armies are of higher quality. The German armies of World Wars I and II, the Israeli army of the present, and the US and British armies of World War II, almost certainly the most combat effective armies of the 20th Century, have all been cross-section, universal-military-service armies. There is some evidence that the US Army that fought in Korea, which (for a peacetime army) included a very high proportion of the US population, was of somewhat higher capability than the less representative, although also conscripted, army that fought in Vietnam. S.L.A. Marshall believed it to be better in some ways than the US Army of World War II (Marshall 1956), an observation which does nothing to support (or deny) the present hypothesis but does indicate how fine the army in Korea was. (See Moskos 1980 for an excellent discussion of the strengths of a representative army.)
- The work carried out thus far has yielded no method for quantifying the impact of troop quality or capability upon weapon effectiveness, on the basis of historical data and analysis, but several research tasks have been defined that offer good probability of contributing to this quantification.

Recommendations for Follow-on Research

The SCACE Study seeks to clarify and quantify the links between the quality or capability of the individual soldier and the effectiveness of the weapons system, small unit, larger unit, and force. Some of these links are considerably clearer than others. In particular, there is a good deal of data on the link between the capability of the soldier before combat and his performance in combat. There are also some well-supported hypotheses about the quantitative role of human factors, or relative combat effectiveness values (CEVs) at the division and force level, based on HERO's past work in this field. The chief need, therefore, is more quantifiable information about the role of human factors at the small-unit level and up through the regimental level, and a methodology for relating these quantities to each other.

Strongly Recommended Research

HERO has carefully considered a number of possible follow-on studies suggested by the present work, and has selected three to recommend strongly, on the basis of their contributions toward filling these identified needs, as well as of the availability of data.

A. A Comparison of the Combat Effectiveness of Selected World War I and World War II Divisions

HERO's QJM methodology for assessing, consistently and reliably, the relative combat effectiveness of opposing forces in battle has shown that in the Italian Campaign of 1944 the relatively unsung 88th Infantry Division (a National Army organization) consistently performed better than any other American division involved in the campaign. Interesting corroboration of this quantitative analytical assessment comes from the war diary of the German Tenth Army, in which the 88th Division is referred to as "shock troops"; the record further shows that whenever the 88th Division was committed to combat the Germans shifted reserves to that sector of the front. The extent to which the superior performance of the 88th was due to better leadership, better training, better quality of manpower, or some other reason or reasons cannot be determined without further research. With that

research it may be possible to tell whether or not superior manpower quality was a contributor to the success of the 88th Division.

There are other possibilities for assessment of relative combat effectiveness of American divisions in Italy and Northwest Europe in World War II, divisions for which HERO has already assembled some data, including the 3d, 34th, 36th, and 45th Infantry Divisions and 1st Armored Division in Italy, and the 1st, 2d, 29th, 26th, 35th, and 90th Infantry Divisions and the 4th, 5th, and 6th Armored Divisions in Northwest Europe.

In World War I, the US 1st and 2d Infantry Divisions have consistently been judged by informed military opinion to be almost certainly the best divisions in General Pershing's AEF. Statistics on casualties, ground gained and prisoners taken, and other measures of combat effectiveness compiled by the Statistical Division, War Department General Staff, under the direction of Col. Leonard P. Ayers, appear to confirm this assessment.

A more reliable and precise method of confirming the superior combat effectiveness of the 2d Division is now possible. In the course of the present study, HERO discovered a collection of raw combat data on that division that will make possible an analysis of the 20 or more engagements of the 2d Division in World War II by HERO's QJM methodology. The data collection consists of the war diaries of all the German units that opposed the 2d Division, together with its own written combat orders and those of its subordinate units. Carrying out this analysis will quantify the almost certain combat effectiveness superiority of the 2d Division.

With the high standard of combat effectiveness of two divisions from two separate wars established and quantified, the reasons for this superiority, in comparison to performance of other divisions engaged at the same time, can be sought, and the possible role of troop quality and capability, and of various demographic and other national statistical characteristics, as predictors of combat effectiveness can be assessed.

The objective of this follow-on study would be to use the promising data available on these two divisions to seek a precombat predictor of combat effectiveness. This study is very strongly recommended.

B. Small-Unit Combat Effectiveness Assessments

As noted above, one of the greatest needs in SCACE Study research is for quantified data on unit performance in small-unit actions. This kind

of information has been difficult to obtain, since combat records at levels below the division are rarely complete. If complete records were available, it would be possible to carry out QJM analyses for small units. It might then be possible to relate individual soldier capability to small-unit performance, and also to develop aggregation factors relating small-unit performance to the performance of divisions.

A very promising resource is now available for carrying out this analysis. The 2d Division collection of records, compiled after World War I, includes not only all written division combat orders and the war diaries for units opposing the division, but also the orders for subordinate units of the division. This will make possible low-level QJM assessments, and since the corresponding division records are also available, comparisons can be made and aggregation factors derived.

Since preliminary research has indicated that low-level data of quality adequate for QJM analysis can also be found -- with difficulty -- in the World War II records, the relevance of World War I experience to that of World War II can be tested, and at the same time the nature of trends in low-level combat can be assessed.

This research could be carried out in two stages:

- The QJM analysis of the World War I performance of small-unit components of the 2d Division, and a comparison of the results with findings for the performance of the division.
- The compilation of combat data for selected small units in World War II; the reconstruction of data for enemy forces facing them; the QJM analysis of the results; and the comparison of QJM findings for these units and for the divisions of which they are components with those for the World War I components of the 2d Division, and analysis.

The objective of this study would be to quantify the relationship between small-unit performance and division-level performance. The study is strongly recommended.

C. National Manpower Quality and Combat Effectiveness

In the present study, a beginning has been made in exploring the relationship between national demographic, economic, and other statistics,

on the one hand, and the combat effectiveness of armies, on the other. (See Appendix B.)

In another approach to the question of comparative combat effectiveness, HERO has made consistent, and demonstrably reliable, comparisons of the combat effectiveness of opposing national armies in World War I, World War II, and the Arab-Israeli wars. It is clear that to a large extent the differences in national combat effectiveness from one country to another in these wars are a reflection of professionalism, leadership, and training. At the same time, it appears likely that cultural and technological differences in the societies have influenced the quality of military manpower and the comparative battlefield performance of individuals and units to some thus far unquantifiable extent.

If it should be possible to find some way to compare the quality of manpower of the various armies of these wars, and also to compare their military training systems and level of leadership, the significance of manpower quality could be assessed and at least roughly quantified.

Following are the next steps to be taken in this effort:

- Preparing plots of data already gathered and examining them for relationships that may not be detectable by the method already carried out, i.e., calculating a correlation coefficient.
- Refining the scaling of national combat effectiveness and establishing a broad consensus on the scaling by obtaining the judgments of a large number of both military historians and experienced combat troop commanders.
- Considering other possible statistical indicators of national combat effectiveness.
- Broadening the statistical base. Preparing reliable statistics for the earlier periods involved (pre-World War II) will require an appreciable investment of time.
- Examining the effect of time lags on the correlation between force effectiveness and demographic, economic, and other national characteristics. It may be that the characteristics of a society that produces effective combat forces are effective only after a delay in time.

The objective of this study would be to derive and quantify a predictor for national troop capability, or national troop combat effectiveness, from national demographic, economic, and/or other statistics. The study is strongly recommended.