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FINAL REPORT

COMPARISON OF DIFFERENCES OF RELATIVE COMBAT EFFECTIVENESS
OF NATIONAL FORCES IN DEFENSIVE AND OFFENSIVE POSTURES

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FINAL REPORT

COMPARISON OF DIFFERENCES OF RELATIVE COMBAT EFFECTIVENESS OF NATIONAL FORCES IN DEFENSIVE AND OFFENSIVE POSTURES

A Report to

The Defence Operational Analysis Establishment

by

The Historical Evaluation and Research Organization

A division of Data Memory Systems, Inc.
Fairfax, Virginia, USA

28 November 1988

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COMPARISON OF DIFFERENCES OF RELATIVE COMBAT EFFECTIVENESS OF NATIONAL FORCES IN DEFENSIVE AND OFFENSIVE POSTURES

INTRODUCTION

This report is prepared in response to a statement of work presented to the Historical Evaluation and Research Organization (HERO) under the provisions of a contract with the Defence Operational Analysis Establishment (DOAE), dated 20 October 1987.

Terms of Reference

The terms of reference are summarized as follows:

HERO is to re-assess Combat Effectiveness Values (CEVs) from existing data in which HERO had previously calculated such CEVs for military forces engaged in historical combat, as follows:

German vs. Russian Battles:

World War I:	5 battles
World War II:	8+ battles

Israeli vs. Egyptian Battles
(26 battles, 1967 and 1973 wars)

Israeli vs. Syrian Battles
(21 battles, 1967, 1973, and 1982 wars)

Israeli vs. Jordanian Battles
(5 battles, 1967 war)

For each of these cases, the CEVs are to be estimated separately for the troops of each nation for attack and defense. In this estimation HERO is to use its standard methodology for estimating CEVs, but with two qualifications:

a. The hypotheses presented in Chapter 9 of Numbers, Predictions, and War* are to be omitted, and

b. Calculations are to be made both with and without estimated differences in force quality.

The results of the estimations are to be presented in a table showing nationality of attackers and defenders, and the relative CEVs.

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*T.N. Dupuy, Numbers, Predictions, and War, New York, 1979; revised edition, Fairfax, Va., 1984.

The purpose of the work is to compare the CEVs so estimated with independent estimates of relative effectiveness performed in the past by DOAE.

Preparations for Analysis

The calculation of CEVs is a process which is a direct result of analyses of historical battles or engagements by means of the Quantified Judgment Model (QJM), a proprietary combat simulation developed by HERO over a period of nearly 20 years. Previous work done by HERO in calculating and estimating relative CEVs of forces in historical combat had been performed in a number of different studies, done over a period of several years, for a variety of clients. During this period the QJM has been in a process of dynamic development in which a number of refinements and modifications have been introduced into the methodology. While these refinements and modifications have not changed the fundamental concepts or procedures of the QJM, they have resulted in several relatively minor procedural changes, some directly affecting calculations of CEVs.

To assure consistency in the comparisons requested by DOAE, therefore, it was deemed necessary by HERO to undertake a thorough review of all past CEV calculations before proceeding--utilizing a single, common methodology--with the specific tasks laid out by DOAE in the terms of reference. This review was outside the provisions of the contract with DOAE, was conducted by the use of limited resources available to HERO, and was completed over a period of several months.

Additionally, there are some problems connected with the two procedural qualifications which DOAE included in the terms of reference. The first of these (the hypotheses from Numbers, Predictions, and War), is dealt with at some length in Chapter 3 of this report. Since it is believed that the hypotheses have been generally substantiated, the calculations and analyses presented in Chapter 2 of this report reflect the application of the hypotheses, where these are applicable. In Chapter 3 these calculations are repeated without the hypotheses, and a comparison is made of the effects of including, or omitting, these hypotheses.

The second of these procedural qualifications requires that "calculations are to be made both with and without estimated differences in force quality." It is assumed that this qualification is the result of a misunderstanding of the CEV calculation procedure. The purpose of the calculations is to analyze the combat engagement data, derived from whatever sources, in order to determine what that data reveals as to the relative force quality of the opponents in the engagement. Thus the calculations are made, initially, without any consideration of what they may reveal as to force quality. No subsequent calculations, relevant to the purpose of this report, are then made with differences in force quality considered.

Participants

The following members of the HERO Staff participated in the formulation of this report, and in the work required to prepare for it:

T.N. Dupuy, Col., USA, Ret., principal analyst
Marilyn Quinn, principal assistant
Charles F. Hawkins
Richard Anderson
Arnold C. Dupuy

The undersigned assumes full responsibility for this report and its contents.

T.N. Dupuy
Executive Director, HERO
President, DMSi

COMPARISON OF DIFFERENCES OF RELATIVE COMBAT EFFECTIVENESS OF NATIONAL FORCES IN DEFENSIVE AND OFFENSIVE POSTURES

Chapter 1

CALCULATING RELATIVE COMBAT EFFECTIVENESS

The Quantified Judgment Model

Basic Concept of the QJM*

The Quantified Judgment Model was developed from the following basic assumptions:

- Historical battlefield relationships among men, weapons, and environmental and operational variable factors can be represented in a conceptually simple algorithm.

- When standard numerical values for weapons and variable factors (determined by applying historically-conditioned professional military judgment to a historical data base) are entered, the algorithm will faithfully represent the outcome of historical combat.

In simplified form, this representation of historical combat outcomes is shown by a ratio, as follows:

$$\text{Outcome} = \frac{Pr}{Pb} = \frac{Sr \times Vfr \times Qr}{Sb \times Vfb \times Qb} \qquad (1)$$

when: P = Combat power

S = Force Strength (combinations of men and weapons adapted to the circumstances of the battle being analyzed)

Vf = Quantified variable factors (terrain, weather, posture, mobility, etc.) for the circumstances of the battle

Q = Consolidated intangible variable factors representing force quality based on human performance (leadership, training, morale, etc.)

r = An identifier for Red forces

b = An identifier for Blue forces

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*The basic concept of the QJM is presented in Ibid. See also T.N. Dupuy, Understanding War: History and Theory of Combat, N.Y., 1987, for various refinements since 1979.

There is no known methodology for calculating the quality of a military force. Therefore, by convention, in the QJM the combat power of a force is calculated as though the qualitative values of the forces are both equal, and both equal to 1.0. Since we know that such equality is extremely rare, the combat power, and the combat power ratio, so calculated are theoretical values:

$$\text{Theoretical Outcome} = Pr/Pb = (Sr \times Vfr)/(Sb \times Vfb) \quad (2)$$

To avoid confusion by having two sets of different values for Pr, Pb, and Pr/Pb, equation (1), for the actual outcome of a battle is generally rewritten as follows:

$$\text{Outcome} = Rr/Rb = (Sr \times Vfr \times Qr)/(Sb \times Vfb \times Qb) \quad (3)$$

By combining these two equations we have:

$$\text{Outcome} = Rr/Rb = (Pr \times Qr)/Pb \times Qb) \quad (4)$$

Battle outcomes can also be represented by a combined measurement of specific results in terms of missions accomplished, ground gained or held, and casualties in relation to starting strengths of both sides. Again a ratio will be the suitable means for such representation.

$$\text{Outcome} = \frac{Rr}{Rb} = \frac{MFr + Espr + Ecasr}{MFb + Espb + Ecasb} \quad (5)$$

when: R = Result value for one side

MF = Mission Factor, evaluated systematically by expert judgement

Esp = Spatial effectiveness: performance in gaining or holding ground, calculated from an empirical formula

Ecas = Casualty effectiveness, calculated from an empirical formula involving both sides' strengths and casualties

Calculating the Value for CEV

Equations (4) and (5) take different approaches to represent mathematically the same thing (battle outcome). In the right sides of these equations, values are known, or can be calculated from known data, for all components except the Qs, which are composites of intangibles.

As noted above, there is no known methodology for calculating the value of these qualitative composites of intangibles. However, it is possible to ascertain the relative combat effectiveness of two opposing forces by comparing the theoretical outcome of a battle, where it is assumed that the forces are equal in quality, with the actual outcome of the battle, when the qualitative differences will have manifested themselves. The first step in this

procedure is to relate the force qualities of the opponents (Qr and Qb) to a relative combat effectiveness value, CEV, as follows:

$$Qr/Qb = CEVr, \text{ or } Qb/Qr = CEVb \tag{6}$$

In other words, CEVr is the reciprocal of CEVb.

Equation (4) is then

$$\text{Outcome} = Rr/Rb = (Pr \times CEVr)/Pb = (Pr/Pb) \times CEVr \tag{7}$$

With adequate data on a battle the theoretical outcome is calculated by means of equation (2) to get a value for Pr/Pb. Similarly the Rr/Rb value is calculated by means of equation (5). Substituting these calculated values in equation (6) we can solve for CEVr as follows:

$$CEVr = (Rr/Rb)/(Pr/Pb) = 1/CEVb \tag{8}$$

In this fashion it has been possible to calculate the CEV values for each side in each of about 200 historical engagements which HERO has analyzed by means of the QJM over the last ten to fifteen years.

Using Lethality to Calculate CEVs

Analysis of several hundred historical engagements has demonstrated* that the CEVs of two forces in a battle or engagement can also be determined from a comparison of strength and casualty data, by means of the following formula:

$$CEVr = \sqrt{Lr/Lb} \tag{9}$$

Where: Lr = Inherent lethality of the Red force
Lb = Inherent lethality of the Blue force

L (Lethality) is calculated as follows:

$$Lr = \frac{Kr}{usr \times rur \times hur \times zur \times \sqrt{szr}} \tag{10}$$

$$Lb = \frac{Kb}{usb \times rub \times hub \times zub \times \sqrt{szb}} \tag{11}$$

When: K = the hit rate per 100 troops.

us = posture factor as it affects defender's force stength (for the attacker the value is 1).

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*This is discussed in Understanding War (op cit), pp. 221-235.

ru = terrain factor as it affects defender's force strength (for the attacker the value is 1).

hu = weather factor as it affects attacker's force strength (for the defender the value is 1).

zu = season factor as it affects attacker's force strength (for the defender the value is 1).

sz = strength-size factor (personnel)

The calculation of Kr (when Red is the attacker) is as follows:

$$Kr = \frac{\text{defender casualties (CASb) x 100}}{\text{attacker troop strength (Nr)}} \qquad (12)$$

Calculation of Kr (When Red is the defender) is as follows:

$$Kr = \frac{CASb \times 100}{Nr} \qquad (13)$$

A word or two of explanation about this procedure and these equations is in order.

As Clausewitz wrote, "defense is the stronger form of war."* Thus the inherent capability of the force which is on the defensive to inflict casualties (i.e., the inherent lethality of the force) is enhanced, to differing degrees, depending on the extent of preparation by the defender. On the basis of historical analysis in the early development of the QJM, it was determined that the inherent capability or lethality of the defender is multiplied by a factor of 1.3 for hasty defense, a factor of 1.5 for prepared defense, and a factor of 1.6 for fortified defense.

Other environmental variables (like weather, terrain, and season) have different effects on the capabilities (or lethalities) of attacker and defender.

It has also been determined that--other things being equal--the casualty rates of military forces increase inversely with their strengths. In other words, under identical circumstances, a smaller force will suffer proportionally greater casualties than will a larger force.** From study of hundreds of historical engagements factors to represent this "strength-size" effect

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*Carl von Clausewitz, On War, translation by Michael Howard and Peter Paret, Princeton, 1976, p. 358.

**This phenomenon was noticed and reported by American miltary historian Theodore Ayrault Dodge about a century ago. See, for instance, his Caesar, Boston, 1892, Vol II., p. 781.

have been developed.* In brief this is a manifestation of the phenomenon that underlies the Lanchester Equations: casualties are more concentrated when hostile fire is focussed on a small force than when the same fire is distributed over a larger force.

With respect to lethality, this phenomenon operates in reverse. The smaller force, having proportionally more targets than the larger force, has its inherent lethality enhanced by some relationship between the strength ratios of the two forces. This relationship is apparently--based upon the results of the study referred to above--the ratio of the square roots of the strength-size factors of the two forces.

The inherent lethality of the two opposing forces, then, can be calculated by applying to the hit rates of the two opponents, the appropriate factors discussed above, as shown in equations (10) and (11). This, in turn, permits calculation of the CEV as shown in equation (9).

An Example

A force of 36,000 troops attacks a force of 20,000 troops in a hasty defense. The attacker takes 2,000 casualties; the defender takes 1,500. The terrain is rolling, mixed; the weather is wet, light, temperate; the month is October.

$$K\ (\text{attacker}) = \frac{1500}{36000} \times 100 = 4.17$$

$$K\ (\text{defender}) = \frac{2000}{20000} \times 100 = 10$$

$$La = \frac{4.17}{hu\ (0.9) \times zu\ (1.05) \times \sqrt{sza\ (0.85)}}$$

$$= \frac{4.17}{0.87}$$

$$La = 4.80$$

$$Ld = \frac{10}{us\ (1.3) \times ru\ (1.45) \times \sqrt{szd\ (1)}}$$

$$= \frac{10}{1.89}$$

$$= 5.31$$

$$CEVa = \sqrt{\frac{4.80}{5.31}}$$

*See Understanding War, Chapter 14, particularly pp. 186-189.

CEVa = 0.95

CEVd = 1.05

Relationship of CEVs

The above discussion provides two ways of calculating the relative combat effectiveness values of two opposing forces: equations (8) and (9). If the historical data is accurate, presumably, the results of these two equations should provide identical results. In fact, using identical historical data, the CEV values calculated for an engagement are usually very close to each other. But identity (while sometimes achieved) would, in fact, be surprising. Equation (8) gives a value based upon consideration of advance rate of the attacker, the relative combat power of the two sides, assessments of the relative mission accomplishment of each, and the casualty rates of each. Equation (9) is produced solely from considerations of the numerical strengths and the casualty rates of each side.

Thus, it would be expected that the results of these two equations would differ to some extent, even with perfect data. If the data is less than perfect, then the discrepancy between the two CEV calculations could be more significant. Which, then, of these two theoretically valid CEV calculation methodologies should be used?

Since the analyst is using the best data available to him, and since there is no known way of assessing which of these methodologies provides the most reliable results, it has been decided to take the arithmetic mean* of the two CEV values as the best possible reflection of the relative combat effectiveness of the opposing forces. By convention, the CEV calculated by means of the QJM formula, and the (R/R)/(P/P) relationship, is designated CEVq. The CEV calculated by means of the ratio of lethalities is designated CEVl. The arithmetic mean is called the Adjusted CEV, or CEVad.

The CEVad is determined in two steps. The average of CEVqa (the QJM calculation of the attacker's CEV) and CEVla (the lethality calculation of the attacker's CEV) is determined. This is compared with the average of the defender's CEVs. If CEVq and CEVl are close, the average CEV for the attacker and the average for the defender should be reciprocals. If they are not, the averaging process is repeated, using the reciprocal of the defender calculation with the attacker average, and the reciprocal of the attacker calculation with the defender average. If necessary this process is repeated until reciprocals are obtained. These, then, are CEVada and CEVadd.

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*It has been suggested that the geographic mean might be more suitable. Spot checks suggest that there is in practice little difference between the arithmetic mean and the geometric mean.

Chapter 2

COMBAT EFFECTIVENESS IN THE HISTORICAL BATTLES

Part One

THE GERMAN VS. RUSSIAN BATTLES

A. World War I Battles

Several years ago the principal author of this report wrote a book exploring the phenomenon of consistent German combat effectiveness superiority in ground combat in modern warfare.* In Appendix C of that book are shown aggregated statistics of German performance in 15 major battles of World War I, clearly demonstrating the German superiority in casualty-inflicting performance in those battles. Five of the battles were between Russians and Germans in 1914 and 1915. These are the five battles for which DOAE has requested CEV analyses:

Tannenberg, August 26-29, 1914
Masurian Lakes, September 9-14, 1914
Lodz, November 11-25, 1915
The Winter Battle, February 7-21, 1915
Gorlice-Tarnow (Breakthrough Phase), May 2-4, 1915

Appendix A contains detailed summaries of the relevant statistics and QJM analyses of these, and all other battles and engagements considered in this report.

Two of these battles (Tannenberg and Lodz) began as Russian attacks, but concluded as German counterattacks. The other three were German attacks against Russian forces in defensive posture. Shown below, in Figures 1 and 2, are the tabular results for these two sets of battles in terms of the adjusted average CEVs calculated for each of them.

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*T.N. Dupuy, A Genius for War; The German Army and General Staff, 1807-1945, New York, 1977; republished, Fairfax, Va., 1984.

Figure 1

Russian Attack, German Defense/Counterattack

	German CEV	Russian CEV
Tannenberg, 1914	3.51	0.29
Lodz, 1914	2.14	0.47
Average	2.83	0.38

Figure 2

German Attack, Russian Defense

Masurian Lakes, 1914	2.69	0.38
Winter Battle, 1915	4.51	0.22
Gorlice-Tarnow, 1915	4.20	0.24
Average	3.80	0.28

Caution

It must be recognized that the QJM was designed primarily to analyze tactical combat at the division level. (Division-level engagements rarely last more than two or three days, and almost never more than six days.) The model also gives good results for corps battles of relatively limited duration.

The five battles of this set involve multi-corps field armies, or even army groups, in extensive operations of from three to fifteen days in duration. While the QJM analyses appear to be fully consistent with the highly-aggregated historical facts, HERO cannot claim the same historical reliablity for these analyses as it can for the 200-odd battles and engagements in its QJM Data Base.

With the total set of battles for this analysis limited to five, with subsets of two and three respectively, the statistical reliability of any apparent differences in the average CEVs in the two sub-sets must be questionable.

Analysis

The limited set of battles does not include any in which the Russians were on the offensive, and the Germans on the defensive, for the duration of the battle. It is likely, therefore, that the division of the set into two categories is somewhat artificial. Nevertheless, given the objective of this study, that distinction was made.

The German CEV seems to have been somewhat higher when the Germans had the advantage of complete initiative with offensive posture (an average CEV of 3.80), than when they were forced to adjust their offensive activities to the original Russian initiative in defensive-offensive battles (average CEV of 2.83).

The one thing that is undeniable, however, is the tremendous combat effectiveness superiority of the German Imperial armies over those of Czarist Russia in these five battles.

B. World War II Battles

A major difficulty in performing QJM analyses of German-Russian battles in World War II is the dearth of Russian casualty data. There is a rich Soviet literature on World War II, including volumes of statistical data. Based upon comparison with German records and reports, the Russian data is generally quite reliable. But it rarely includes Soviet casualty data--although estimates or confirmed casualty data for the Germans is given freely. Undoubtedly this reflects a deliberate refusal by the Government of the USSR to allow publication of Soviet casualty data for World War II. Presumably it is the result of sensitiveness about the great disparity between German casualty rates and the much higher loss rates of Soviet forces. Where data is obtainable, the Soviet rates vary from four to ten times higher than those of opposing German forces, whether the Soviets were attacking or defending, or whether they won or lost.

The disparity in casualty rates, of course, is a manifestation of the much higher German relative combat effectiveness. Using either the standard QJM method or the relative lethality method for calculating CEVs, the German superiority averaged almost 3.0/1.0 in 1941, and was still in the range of about 1.8/1.0 in late 1944 and early 1945.

It may be wondered how the Soviets could possibly have won the war if they were so greatly outperformed by the Germans. The answer is quite simple. As the Germans penetrated more deeply into Russia, the Soviets were able to marshal to oppose them a numerical superiority greater than the German CEV superiority. As this numerical superiority enabled them to push the Germans back, the Soviets were able to maintain overwhelming numerical superiority over the depleted Germans, even as Soviet lines of communications lengthened.

Despite the difficulty in obtaining reliable Soviet casualty statistics, HERO has analyzed some eleven World War II Eastern Front battles. It is believed that the Soviet casualty data shown for these battles in Appendix A is reasonably accurate. The battles listed there are:

Rovno, June 22-27, 1941
Leningrad, January 12-18, 1943
Kursk-Oboyan I, July 4-5, 1943
Kursk-Oboyan II, July 6-10, 1943
Kursk-Oboyan III, July 11-13, 1943

Kursk-Oboyan IV, July 14-15, 1943
Kursk-Prokhorovka, July 12-13, 1943
Belgorod-Kharkov, August 3-5, 1943
Nikopol I, January 31-February 1, 1944
Nikopol II, February 2-3, 1944
Nikopol III, February 4-5, 1944

Figures 3 and 4 show the CEV comparisons for Soviet forces and German forces, for both offensive and defensive Soviet postures.

Figure 3

Russian Attack, German Defense

		German CEV	Russian CEV
Leningrad,	1943	1.86	0.54
Kursk-Prokhorovka,	1943*	1.35	0.74
Belgorod-Kharkov,	1943	2.52	0.41
Nikopol I,	1944	1.71	0.59
Nikopol II,	1944	1.75	0.57
Nikopol III,	1944	2.78	0.36
Average		2.00	0.54
Average (without Prokhorovka)		2.12	0.49

* Both sides were attacking intermittently but intensively at Prokhorovka.

Figure 4

German Attack, Russian Defense

		German CEV	Russian CEV
Rovno,	1941	3.97	0.25
Kursk-Oboyan I,	1943	2.97	0.34
Kursk-Oboyan II,	1943	4.12	0.24
Kursk-Oboyan III,	1943	3.86	0.26
Kursk-Oboyon IV,	1943	4.37	0.23
Kursk-Prokhorovka,	1943*	1.35	0.74
Average		3.44	0.34
Average (without Prokhorovka)		3.86	0.26

* Both sides were attacking intermittently but intensively at Prokhorovka.

Analysis

Analysis

The overall results of comparing Russian and German CEVs in World Wars I and II are remarkably similar.

When the Russians were attacking, the German CEV superioritity (average CEV between 2.00 and 2.84) was considerably less than when they were attacking Russians in defensive posture (average CEV between 3.44 and 3.80). This can be attributed to one (or possibly both) of two causes: (1) an error in the CEV calculation methodology, or (2) a force with superior combat effectiveness is able to take maximum advantage of that superiority when it has the initiative.

Two facts provide a basis for considerable confidence in the QJM calculation methodology. There was substantial consistency between the results of the two very different methods of CEV calculation. Furthermore, one of these methods was directly related to the historical ability of the Germans to inflict casualties consistently on the Russians at a far greater rate than the Russians were able to inflict casualties on them.

Therefore, there seems to be a good reason for assuming that a force with a marked superiority in combat effectiveness will benefit most from that superiority in offensive combat.

This finding must be reconciled with the demonstrated ability of the Russians, in World War I and World War II--as well as in earlier wars--to fight most effectively when in defensive posture. Presumably, however, the significance of what appears to be an undeniable tactical fact must be assessed in terms of strategic and operational implications. The Russian high command could rely upon the stolidity and reliability of the Russian soldier on the defensive, despite the considerable tactical superiority of the opponent. This explains the successful--even though terribly costly--strategy which brought Russia eventual success over far more skillful--but less numerous--opponents in wars against Charles XII and Napoleon, as well as against Hitler.

Part Two

ISRAELI VS. EGYPTIAN BATTLES

Most of the data in the QJM analyses of the 1967 and 1973 Arab-Israeli wars is originally derived from a book written by the principal author of this report, or from research connected with the preparation of that book.* The QJM analyses themselves, however, were performed in a variety of studies for various agencies of the US Government.

A. 1967 War

The eleven battles or engagements of the Sinai Campaign of the 1967 Arab-Israeli War (popularly known as "The Six-Day War") all took place in a period of four days, from June 5 through June 8, 1967. One of those battles was fought in the Gaza Strip between Israeli forces and a Palestinian division under Egyptian command. While listed below, it is not included in the subsequent analysis. Those battles were:

Rafah, June 5
El Arish, June 5/6
Gaza Strip, June 5-7
Abu Agheila, June 5/6
Bir Lahfan, June 5/6
Jebel Libni, June 6
Bir Hamma, June 7
Bir Hassnah, June 7
Mitla Pass, June 7/8
Bir Gifgafa, June 8
Nakhal, June 8

Figures 5 and 6 show the results of comparing the relative CEVs of Egyptians and Israelis in the two instances of Egyptian attack, and in the eight examples of Israeli attack.

Figure 5

Egyptian Attack, Israeli Defense

	Israeli CEV	Egyptian CEV
Mitla Pass	2.78	0.36
Bir Gifgafa	2.70	0.37
Average	2.74	0.37

*T.N. Dupuy, Elusive Victory; The Arab-Israeli Wars, 1947-1974, New York, 1978.

Figure 6

Egyptian Defense, Israeli Attack*

	Israeli CEV	Egyptian CEV
Rafah	2.47	0.40
Abu Agheila	3.13	0.32
El Arish	2.51	0.40
Bir Lafahn	3.53	0.28
Jebel Libni	2.72	0.37
Bir Hama	3.78	0.26
Bir Hassnah	3.31	0.30
Nakhl	4.21	0.24
Average	3.21	0.32

*Gaza Strip omitted, since the Arab forces there were poorly armed and poorly organized Palestinians under Egyptian command; Israeli CEV was 4.11.

Analysis

The Israeli combat effectiveness superiority over the Egyptians was similar to, although somewhat less marked than, that of the Germans over the Russians in World Wars I and II.

With only two instances of Egyptian attack, the CEV averages for this sub-set must be statistically questionable. Nevertheless, as was the case in comparing the Germans to the Russians, it will be seen that when the Israelis had the initiative, they apparently were able to get the maximum benefit out of their superiority.

As was the case with the Russians, there seems to be no question that the Egyptians were more reliable on the tactical defensive than on the offensive. But in this war that was of little significance, in the light of the Israeli total dominance of the sky above the battlefield, and their effective use of airpower to disrupt, harass, and destroy Egyptian ground units.

B. 1973 War

The Egyptians were much better prepared for this war than they had been for the 1967 war. They also had the benefit of very effective Soviet-supplied air defense weapons that prevented the Israelis from dominating the skies as much as they had in 1967. The first few days of this campaign were dominated by Egyptian offensive operations, save for one near-disastrous Israeli attack at Kantara-Firdan, where Egyptian reliability on the defense particularly manifested itself.

On the ninth day of the war, however, the Israelis seized the initiative, to retain it until the UN cease-fire finally became effective. It is nevertheless worth noting that in the two final major battles of the war--Ismailia, and Suez City--the Israelis were repulsed by steady, reliable Egyptian defenders.

The battles and engagements were:

Suez Canal Assault, North, October 6
Suez Canal Assault, South, October 6
Second Army Buildup, October 7
Third Army Buildup, October 7
Kantara-Firdan, October 8
Egyptian Offensive, North, October 14
Egyptian Offensive, South, October 14
Deversoir (Chinese Farm I), October 15/16
Chinese Farm (II), October 16/17
Deversoir West, October 18
Jebel Geneifa, October 19-21
Ismailia, October 19-22
Adabiyah, October 21-22
Shallufa I, October 21-22
Suez, October 23/24
Shallufa II, October 23/24

Comparisons of CEVs when the Egyptians were on the offensive, and when they were on the defensive, are shown in Figures 7 and 8.

Figure 7

Egyptian Attack, Israeli Defense

	Israeli CEV	Egyptian CEV
Suez Canal Assault, North	1.46	0.69
Suez Canal Assault, South	1.69	0.59
Second Army Buildup	1.30	0.77
Third Army Buildup	1.64	0.61
Egyptian Offensive, North	2.74	0.37
Egyptian Offensive, South	3.03	0.33
Average	1.98	0.56

Figure 8

Egyptian Defense, Israeli Attack

	Israeli CEV	Egyptian CEV
Kantara-Firdan	1.64	0.61
Deversoir (Chinese Farm I)	2.18	0.46
Chinese Farm (II)	2.34	0.43
Deversior West	2.18	0.46
Jebel Geneifa*	4.37	0.23
Ismailia	2.56	0.39
Shallufa I*	4.31	0.23
Adabiyah*	4.00	0.25
Suez	2.85	0.35
Shallufa II*	4.60	0.21
Average	3.10	0.36
Average (without Jebel Geneifa, Adabiyah, and the Shallufas)	2.29	0.45

*These four engagements were fought against largely disorganized, Third Army rear area troops.

Analysis

The pattern of Israeli-Egptian relative combat effectiveness in 1973 is very similar to that of the 1967 war. Particularly noteworthy is the fact that, despite greater Egyptian readiness, and the great initial advantage provided by the Egyptian achievement of surprise, the average relative combat effectiveness superiority margin of the Israelis was about the same as it had been in 1967. It is possible to argue from the data--depending on interpretations--that the gap had narrowed slightly, or that it had widened slightly. However, if there was any change in real CEVs, it was minor.

Also evident--although possibly not so clearly marked, again depending on interpretation of the data--is the greater margin of CEV superiority when the more effective force has the initiative.

Part Three

ISRAEL VS. JORDAN

In the first of the modern Arab-Israeli Wars, that of 1947-1948--known in Israel as the War of Independence--Jordan (then Transjordan) was the only one of the Arab nations that fought on approximately equal terms against Israel. This was undoubtedly due, in large part, to the fact that the Transjordanian Army--known as the Arab Legion--was under the command of a British general, and most of its major units were also commanded by British Regular Army officers.

A. 1967 War

By the time of the 1967 War the British officers were all gone, but the British legacy was still strong. The Jordanian performance against the Israelis was respectable, but the combination of Israeli combat effectiveness superiority--even though less marked than against the Egyptians and the Syrians--combined with total Israeli domination of the skies over the battle area--brought about a total Israeli victory in less than four days.

There were five major battles or engagements, with the Israelis on the offensive in all of them. These were:

Jerusalem, June 5-7
Jenin, June 5-6
Kabatiyah, June 6
Tilfit-Zababida, June 7
Nablus, June 7

Figure 9 below shows the relative combat effectiveness values for these battles, in all of which the Jordanians were in defensive posture.

Figure 9

Jordanian Defense, Israeli Attack

	Israeli CEV	Jordanian CEV
Jerusalem	1.58	0.64
Jenin	1.29	0.78
Kabatiya	1.73	0.58
Tilfit-Zababida	2.10	0.48
Nablus	1.72	0.58
Average	1.68	0.61