**Ph.D. Research Proposal Summary**

Relative Combat Power and Force Ratio

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1. **Introduction**

+ In this research I will try to find **the explanatory power of force ratios** along with other relative combat power factors (leadership, morale, maneuver, firepower and protection) for the outcome of the battle.

+ I would like to **develop a mathematical model** which will also attempt to explain the nonmaterial factors of war of morale and leadership with quantitative analysis.

+ I would like to study this topic because I was a staff officer in Turkish Army and our way of military training includes doctrine that advises some sort of action according to force ratios. One general acceptance was if you have 3:1 force ratio you may plan to attack.

+ It is my initial judgement that force ratios are too deterministic, and needs to be analyzed. Because there are armies in history fight and win the war although they have less manpower or means to fight.

**2. What does literature says?**

+ Key historic writers who have addressed force ratios:

* Sun Tzu: “art of offensive strategy: when 10:1 surround, 5:1 attack, 2:1 divide, 1:1 engage or elude, if force ratio is less then enemy, capable of withdraw”.
* Clausewitz: “*if superiority reach the point where it is overwhelming*, superiority of numbers will be the most important factor in the outcome of an engagement, so long as it is great enough to counterbalance all other contributing circumstances”.
* F.W.Lanchester: **N-square law** as “*the fighting strength of a force is proportional to the square of its numerical strength multiplied by the fighting value of individual units*.

+Major projects of the field:

* **Soviet** approach (1960): **Correlation of Forces and Means**; an objective indicator of combat power to determine the degree of superiority of one side over another.
* **T.N. Dupuy: Quantified Judgment Method** (1985); outcome of a battle is predicted using a multiplicative-additive formula in which various factors relating to the strength and firepower of the fighting parties as well as the circumstances are taken into account.
* **Stephen Biddle: Military Power** (2004)**;** Biddle treat the subject with systematic manner and used material and nonmaterial variables, backed up with a combination of empirical evidence and careful deductive reasoning. His research methodology combines recent historiography with formal doctrinal theory, case method, statistical analysis, and simulation experimentation. He argued that, material factors alone cannot explain capability. He advanced analysis of this with one key nonmaterial variable: **force employment**, or the doctrine and tactics by which armies use their materiel in the field.
* **Connable and others** (2018)**:** Will to Fight; in this comprehensive research, co-researchers provide a detailed explanation of “will to fight” and a model designed to support assessment of partner forces and analysis of adversary forces. They accept that morale, cohesion and discipline is associated with the “will to fight” but they argue “morale” especially is ill-defined. Their model provides US army military planners to assess the “will to fight” dimension of the units rather than a mathematical model that tries to explain the factors affecting the war results.

+ Thesis:

* Kevin Smith: **quantitative decision aids; explains** two schools of thought; moral and quantitative. He says these are not competitors rather complimentary.
* Faruk Yigit: Force ratio is a valid estimator of battle outcome, after analyzing 600 battles of CDB90FT data set.
* Muzaffer Coban: He analyzed the same but updated data set of CDB90G with classification trees. He says “objective variables (force ratio) are alone not sufficient to classify battle outcomes while relative variables, such as leadership, have a strong relationship with it.

**3. What is the gap I Identified?**

+ Although the concept of force ratio is well explained theoretically and its explanatory power within the relative combat power factors is analyzed systematically (Biddle, Dupuy and others), morale and leadership factors are not analyzed thoroughly due to its qualitative nature.

+ Judgements up to now relies limited data set, max battles analyzed to make deduction was 660 battles of CDB90G dataset, which has real data flaws.

**4. What is my research questions?**

* What is the degree of explanatory power of force ratios and other relative combat power factors on the outcome of the battles fought between state actors that fought after 2nd world war?
* What is the leverage of morale and leadership on the outcome of these battles?

**5. What will be the research methodology?**

+ I will combine at least two types of methodology: case studies and statistical analysis.

**+** 1st type will be a quantitative research. I will collect numerically enough samples of battles from history in order to make scientific judgements for the population.

+ **Data’s to be used:** From below databases and others, I am planning to make a comprehensive database with the help of Python Pandas Data Analysis Tool. This database will be the base from which we will further investigate.

* U.S. Concepts Analysis Agency’s updated version of the historical combat data set: 660 battles from Netherlands War of Independence in 1600 and Israel-Lebanon War in 1982.
* Peter Brecke’s Conflict Catalog and A Guide to Intra-State Wars: 3708 conflicts from 1400 A.D. to the Present in Different Regions of the World.
* Jeffrey S. Dixon and Meredith Reid Sarkees’s A Guide to Intra-state Wars: 300 civil wars waged from 1816 to 2014.
* University of Michigan’s Correlates of War Dataset.

+ Variables are explained below. It is my initial conceptualization that personnel morale and leadership have different and exponential effect than other factors that’s why I thought that they need to be analyzed as intervening variables.

* Dependent variable: outcome of the battle.
* Independent variables: Relative combat power factors except morale and leadership.
* Intervening variables: Morale and Leadership

**+ Models to be used:**

|  |  |
| --- | --- |
| Name of Model | Reason |
| Linear regression | This model will yield the percentages of independent and intervening variables effects on variation in the outcome of the battle. |
| Predictions (not intended, up to potential Advisor’s recommendations) | Applying machine learning algorithms (Logistic regression, decision trees, K Means Clustering and others) to data set to make predictions for future war scenarios. |

**+ Initial null hypothesis** to be tested: “to win battle an army has to has greater force ratio than the opponent”.

+ This methodology is the most appropriate for the proposed topic because; well defined variables together with llinear regression model is best to reach R² values. These values will tell us how much of variation in battle outcomes can be explained by taking relative combat power factors into account.

**6. Conclusion:** This study I think will be important because it will propose a model like Depuy’s one. But it will further exploit the computing power which major thinkers and researchers lack because of the period they study this topic. Especially machine learning algorithms proposes very fruitful analysis opportunities, waiting to be discovered. I t is my intention to continue this study on King’s College with this pattern after my PhD study.

**7. References:**

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