**Book Reviews**

**Aircraft in Warfare, the Dawn of the Fourth Arm**

**Frederick William Lanchester**

**London, 1916**

**CHAPTER V: Principle of concentration. The N-Square Law**

* **Principle of concentration:**
  + As Clausewitz refers to bringing as many troops as possible to decisive point as 1st principle of Strategy, Lanchester similarly asserts that one of the great questions at the root of all strategy is that of “concentration”; concentration of all whole resources of belligerent on a single purpose or object, and concentration of the main strength of his forces, at one point in the field of operations (p.39).
  + But unlike Clausewitz he refers material side of concentration as not of principle of strategy rather a scientific phenomenon to be used in tactical operations (p.39). For him concentration has two sides, namely moral and material. He analyses controlling factors of it with the sense of contrasting natures of conditions of ancient and modern warfare.
* **The Conditions of Ancient and Modern Warfare Contrasted (p.40-41):** 
  + According to him in ancient times no matter how much strength strategy brings to the theatre of operations, ultimately men will find only men to wield its weapon. Instead of this direct nature of olden times defence, he argues, defence of modern arms is indirect: enemy is prevented from killing you by your killing him first. “As a consequence of this difference, the importance of concentration in history has been by no means a constant quantity”.
  + Under the old conditions it was not possible by any strategic plan or tactical maneuver to bring other than approximately equal numbers of men into the actual fighting line. Under the present-day conditions all this changed. With modern long-range weapons the concentration of superior numbers gives an immediate superiority in the active combatant ranks. Here he implies that concentration in old times rather difficult to achieve although it was not impossible.
  + In the ancient condition where man is opposed to man, and assuming the combatants to be of equal fighting value and conditions are equal, “duels” will make up the fight and there will be equal numbers killed.
* **Modern Conditions Investigated (p.41):**
  + In the modern conditions, with the same assumptions, each man will in a given time score, on an average, a certain number of hits that are effective, so, the number of men knocked out per unit time will be directly proportional to the numerical strength of the opposing force. He gives also mathematical equation of this like that.
  + He formulates this as:

Text

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b, r: numerical strength of blue and red

t: time

c, k: constants, (c=k if the fighting values of the individual units of the force are equal)

* **Weakness of a Divided Force** (p.43-46)**:** 
  + He gives graphical explanation of “divided forces” weaknesses. He analyses situations and concludes that if a superior strategy compels one part to fight in two parts, results would be like the conditions explained below;
    - In a 1:1 force ratio, one could defeat the divided side,
    - In a 1:1 force ratio without division of forces battle would prolong,
    - In a 1: √2 superior force ratio, if inferior force divides superior one, the battle end with no winner.
* **Validity of Mathematical Treatment** (p.46-47)**:**
  + After analyzing these force ratios, he further asserts that “the direct numerical comparison of the forces engaging in conflict is almost universal”. He further goes and asserts that “counting the pieces as of value, and to deny the more extended application of mathematical theory, is illogical and unintelligent.”
* **Fighting Units not of Equal Strength** (p47)**:**
  + He made these force ratio analyses with the assumption of fighting strengths of two sides are equal. In mathematical terms c=k.
  + At this point he asserts that “this condition is not necessarily fulfilled if the combatants be unequally trained or of different morale or if their weapons are of unequal efficiency.
  + He asserts that while we cannot judge on these two factors but we can calculate weapons efficiency.
* **Influence of efficiency of weapons** (p.48)**:**
  + He asserts that “any difference in the efficiency of weapons may be presented by a disparity in the constants c and k in equations”.
  + With a Blue force of 500 that use rifle and lose 100 man would eventually be equal force of Red with 1000 man that use breech-loader gun with 200 casualties. Here we have different constants and Lanchester shows this again with mathematical equation.

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M, N = representing the efficiency or value of an individual unit of Blue, Red Force

* + He explains this formulation as “fighting strengths of the two forces are equal when the square of the numerical strength multiplied by the fighting value of the individual units are equal.
* **Outcome of this investigation: the n-square law and its proof (p.48-50)**
  + Within this law he defines **the fighting strength of a force**: it is proportional to the square of its numerical strength multiplied by the fighting value of its individual units.
  + Thus, (referring to fig. 5b) he made conclusion of divided forces: sum of squares of two portions of the divided forces are for all values equal to the square of the other (not divided) force.

Diagram, engineering drawing

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* + **Simple proof of this law arising from equations 1 and 2:** Let the numerical values of the blue and red represented by b and r, then in a small interval of time the change in b and r is represented by db and dr of such relative magnitude that db/dr=r/b or

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* + If we draw the squares on b and r and represent the increments db and dr as small finite increments, we see at once that the ***change of area*** of ***b²*** is *2b db*, and ***change of area*** of ***r²*** is *2r dr* which according to foregoing (1), are equal.
  + Therefore, the difference between the two squares is constant. q represents the numerical value of the remainder of the blue force after annihilation of the red.

b²-r² = constant ------> b²-r²=q² ---------> b²=q²+r²

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* + Example of this is an army of 50K giving battle in turn to two armies of 40K and 30K respectively, equally well armed; then the strengths are equal, since 50K²=40K²+30K². But if divided force fight in one part then the army of 50K will be overwhelmed.
* **Example involving weapons of different effective value:** 
  + He gave an example with this assumption: 1 man employing machine-gun can punish a target to the same extent in a given time as 16 riflemen. He analyzes number of men armed with machine-gun necessary to replace a battalion (1000 men strong) in the field?
  + From n-square law: **N r² = M b² -🡪 16\*r²=1\*1000²-🡪r²=√1000²/16 = 1000/4=250** or one quarter the number of the opposing force (p.50).
  + According to him this example exhibits at once the utility and weakness of the method. Basic assumption is that the fire of each force is definitely concentrated on the opposing force. Thus, the enemy will concentrate on the 1 machine-gun operator the fire that would otherwise be distributed over four riflemen. And so, on an average he will only last for one quarter the time, and at 16 times the efficiency during his short life he will only be able to do the work of 4 riflemen in lieu of 16 (p.51).
  + When, on the other hand, the circumstances are such to preclude the possibility of such concentration the value of the individual machine-gun operator becomes 16 riflemen. The same applies when he is opposed by shrapnel fire or any other weapon which is directed at a position rather than individual. So, he concludes that one might pay attention to these variations when assessing the theory (p.51). According to him these variations are less common in naval then in military warfare; the individual unit -the ship- is always the gunner’s mark. He points out that aircraft is more similar to navy ship (p.51).
* **The Hypothesis Varied-modifying initial hypothesis to harmonise with the conditions of long-range fire (p.51-52):** 
  + Assumption: fire concentrated on a certain area known to be held by the enemy, and take this area to be independent of the numerical value of the forces, then, with notation as before, we have;

-db/dt = b\*Nr\*constant

-dr/dt = r\*Mb\*constant ----->M db/dt = N dr/dt --->or the rate of loss is independent of the numbers engaged, and is directly as the efficiency of the weapons.

* Under these conditions the fighting strength of the forces is directly proportional to their numerical strength; there is no value in concentration, qua concentration, and the advantage of rapid fire is relatively great. This is more likely to ancient warfare.
* **An Unexpected Deduction (p.52):**
  + Better for numerically superior force to come to close quarters,
  + Blue force of 100 men with machine-gun vs red force of 1000 men with rifle
  + 1st assumption: both forces are spread over a front of given length at long range.
  + Red force loses 16 men to the blue force loss of 1 man. Red lose.
  + If red come closer enough for each individual have mark, red would lose half to come closer, **but would win, by n-square law: 600²\*1>100²\*16**
* **Examples from history (p.53):**
  + Principle: on the field of battle “concentration” matter of the most vital importance.
  + Controlling factors both in strategy and tactic.
  + Attacking of opposing force before concentration gained: defeat of Napoleon in Italy campaign.

**CHAPTER VI: The N-Square Law in its Application**

* The N-Square Law in its Application to a Heterogeneous Force (p.54-55):
  + **chapter V summary:** Fighting strength of a force, so far as it depends upon its numerical strength, is best represented by the square of the number of units.
  + Where individual fighting strengths of the component units (land, navy or air) may be different, it has been shown that if a numerical fighting value can be assigned to these units, the **fighting strength of the whole force** is as the square of the number multiplied by their individual strength. Nr²=Mb²
  + Where the component units differ among themselves, as in the case of a fleet that is not homogeneous, the measure of the total of fighting strength of a force will be the ***square of the sum of the square roots of the strengths of its individual units.***
* **Graphical Representation** (p.55)**:** 
  + The strengths of a number of separate armies of forces successively mobilized and brought into action are represented by the lines a,b,c,d,e, and aggregate fighting strength of these armies are given by the lengths of the lines A,B,C,D,E, each being the hypotenuse of a right-angle triangle, as indicated.
  + Thus, two armies a and b, if acting separately (in point of time), have only the fighting strength of a single force or army represented numerically by the line B.

Diagram

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* **N-square law in naval warfare (p.57-58):**
  + N-square law applies to military operations;
    - on land: there may be special conditions to the hypothesis whereby its usage maybe masked.
    - naval warfare: however, the conditions strictly conform to basic assumptions. Thus, when battle fleet meets battle fleet, there is no advantage to the defender analogous to that secured by the entrenchment of infantry.
  + In a naval battle every shot fired is aimed at one enemy’s ship; there is no firing on the mass.
  + Old conditions (1000-yard effective range): advantage could be taken of concentration within limits. 18th century tactics makes it apparent that with any ordinary disparity of numbers (probably in no case exceeding 2 to 1) the effect of concentration must have been not far from that indicated by theory.
  + With a battle-fleet action at the present day the conditions are still more favorable to the weight of numbers, since with the modern battle range-some 4 to 5 miles- there is virtually no limit to the degree of concentration of fire.
  + Further than this, there is in modern naval warfare practically no chance of coming to close quarters in ship-to-ship combats, as in old days.
  + Thus, the conditions are to-day almost ideal from the point of theoretical treatment. Numerical superiority of ships of individually equal strength will mean definitely that the inferior fleet at the outset has to face the full fire of the superior.
  + The same observations will probably be found to apply to aerial warfare when air fleets engage in conflicts, more especially so in view of the fact that aeroplane in three dimensions of space instead of being limited to two, as in the case with the battleship. This will mean that even with weapons of moderate range the degree of fire concentration possible will be very great.
* **Individual value of Ships or Units (p.59):** 
  + Deciding the value of individual units is difficult.
  + Fighting value of ship depends not only to armament but also to protective armor. Question of fleet strength can never be reduced quite a matter of simple arithmetic.
  + May be gauged by the weight of its “broadside” or more accurately, taking into account the speed with which the different guns can be served, by the weight of shot that can be thrown per minute.
  + Another basis may to compare energy per minute for *broadside fire*, which represents, the horsepower of the ship as a fighting machine.
  + Similar means of comparison for aeroplane, though it may be that the *downward fire* capacity will be regarded as of vital importance.
* **Applications of the n-square Law (p.59-61):**
  + The **n-square law** tells us at once the price or penalty that must be paid if elementary principles are outraged by the division of battle fleet into two or more isolated detachments.
  + If battle fleet separated into 2 equal parts, increase would require to be fixed at approximately %40 percent – that is to say, in relation of 1 to √2; more generally the solution is given by a right-angled triangle.

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* **British Naval Tactics in 1805 (p.62):**
  + Not form in a line-of-battle parallel to the combined fleet
  + Break the line, envelop rear, overpower with groups of ships, isolate enemy and cut off.
  + First tactics according to Lancaster, advantages of fire concentration.
  + Van cannot help rear
* **Nelson’s Memorandum and Tactical Scheme (p.63, 64):**
  + British formed 2 main columns.
  + One of the main columns was to cut the enemy’s line about the centre,
  + Other to break through about 12 ships from the rear,
  + Smaller column being ordered to engage the rear of the enemy’s van 3 or 4 ships ahead of the centre, and to frustrate, every effort the van might make to help centre or rear.

Diagram

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* **Nelson’s Tactical Scheme Analysed (p.65-66):**
  + Nelson planned to envelop the half of -23 ships- combined fleet with 32 ships. This, according to n² law would give him superiority of fighting strength of almost exactly 2 to 1[[1]](#footnote-1).
  + Strength of British in arbitrary n² units:32²+8²=1088
  + Combined fleet: 23²+23² = 1058
  + British advantage:30, remaining British ship: √30=5.5 ships
  + If they had engaged in older times tactics:
  + strength of combined fleets 46²=2116
  + strength of British fleets: 40²=1600, Balance in favor of combined fleet would be 526, in ship terms √516= 23.
  + Thus, we are led to appreciate the commanding importance of a correct tactical scheme. If old-time method of attack had been adopted, British could not avert defeat.
  + First: Definite statement of cutting the enemy into two equal parts – according to n-square law the exact proportion corresponding to the reduction of his total effective strength to a minimum
  + Second: the selection of a proportion, nearest whole number equivalent to the √2 ratio of theory, required to give a fighting strength equal to tackling the two halves of the enemy on level terms, and the detachment of the remainder, the column of 8 sail, to weaken and impede the leading half of the enemy’s fleet to guarantee the success of the main idea.

**CHAPTER VII: Attack by Aeroplane on Aeroplane. The Fighting Machine and Its Armament**

* **Attack by Aeroplane on Aeroplane (p.67-68):**
  + Lancester emphasize that in the 1St World War period main duty of aeroplane was reconnaissance, but he foresaw that by the next war they will be used to attack each other.
  + He says that, with the technology by this time, it is not easy to attack to aeroplane on the air. So, it is not easy to give casualties to enemy.
* **The Fighting Machine as a Separate Type (p.68-69):**
  + Long distance reconnaissance flights or strategic scout should not be deemed fighters, but tactical scout should be engaged by enemy so it has to defend itself or some other fighters defend scout planes.
  + So, he foresaw need of rendering the tactical reconnaissance type capable of taking the offensive, so that it may establish its ascendency over the similar craft of the enemy.
  + But he emphasizes heavily armed fighting machine will provide air supremacy. Until this time tactical scout is playing double role (recce and fighting).
* **The Question of Armament; Treaty Restrictions (p.70-72):**
  + Int the specification of a fighting type of aeroplane the consideration is means of attack. These fall two main categories:
    - fire-arms (machine-gun, mitrailleuse) and
    - gravitational weapons (bombs, grenades etc.)-ill suited to conditions of aircraft.
  + Light artillery may be mounted, but only the very smallest calibre -namely, the “one pounder” can be considered suitable for present day machines.
  + The use of smaller size of projectiles is prohibited by treaty obligation. Any explosive projectile less than 1 lb. weight (400 gr) is banned by the Declaration of St.Petersbourg of 1868.

**CHAPTER VIII: Rapidity of Fire and Its Measure**

* **Rapidity of Fire and Its Measure (p.77-78):**
  + Index of fighting value: rapidity of gun-fire from aeroplane or dirigible depends on nature of target.
  + Some cases: number of projectiles per minute is most important factor, as, for example, in attacking any object in which hit is hit whether the projectile be large or small.
  + Other cases: where the mischief done is in any reasonable relation to the weight of the projectile, the total weight of projectiles discharged per second affords better criterion.
  + In view of comparatively fragile nature of aircraft, it is doubtful whether the energy equivalent of the discharge will ever be of the importance which it in the case of the battleship, where the destruction of the enemy depends to a very large extent upon the number of foot-tons with which he is assailed.
  + Thus, it is doubtful whether a factor representing the hp of the offensive armament would, as applied to the fighting aeroplane, will have any useful significance.
  + Not probable, fighting machine have complete bullet proof protection, at short range. So unimportant which bullets used in its destruction. Weight and size is only important when a single hit is sufficient to carry away an important structural member which would have been penetrated without great injury by a bullet of ordinary size.
  + So long as we are dealing with ordinary rifle, pistol or mg fire, we are concerned merely with the ***number of bullets that can be discharged per unit time***. This number express **value of armament.**
* **Measure of Fire Value in the case of Explosive Projectiles (p.78-79):**
  + In the context of throwing explosive projectiles, it is impossible to maintain any direct basis of comparison.
  + Effectiveness of the shell fire depends upon the conditions (range must be known, time-fuse mechanism perfect, nature of target).
  + Granted that necessary conditions exists, destruction wrought by any given type of explosive projectile maybe taken as, in a measure, proportional to its weight. However, there are cases where 3 lb. high explosive maybe effective than 18 lb. if hit at the motor.
  + Comparing the relative value of armament of diverse type for aeroplane (mg or small artillery) we need to examine the service for which the armament is required; it is impossible to institute a direct quantitative comparison which would be generally applicable.

**Military Power**

**Stephen Biddle**

**2004**

**Preface**

Biddle argues that although many scholars and policy makers believe future wars will be predominantly different from the past ones he argues that continuity rather than change prevails in the character of warfare. He further argues that real causes of battlefield success is stable since World War I, although there were many technological developments. Contary to many scholars and policy makers who believe that gross numerical strength and material resources are the main sources of the prevailing the battlefield, he argues that both material and non-material factors interact to produce success on the battlefield. He dubbes the paerticular nonmaterial variable as “force employment” and details how it interacts to produce battle outcome. (Biddle, 2006, p. ix). Preface ix.

**Chapter 1 Introduction**

He argues that altough the questions like “what causes victory and defeat in battle?” are life-and-death questions, the answers often fall short. He takes World War I, World War II, 1973 Arab-Israel War and Gulf War as example and states that in the whole of these wars, results baffled the participants. Nobody expected four year stalement and trench war which exhausted many resources in World War I, nobody expected German swift victory in France in World War II, nobody expecte Israeli defeat and help request in 1973, and finally nobody could have estimated such a minimum casualty of Coalition Forces in Gulf War(Biddle, 2006, pp. 1–2).

His points for the methodology in analyzing the subject is remarkable. He says that, most analyses are either rigorious but narrow, or broad but unrigorious. He asesses that mathematical models are emphasizing material factors alone, meanwhile “holistic assessments” takes into account factors such as strategy, tactics, morale, combat motivation, or leadership or as well as just material but treating these varaibles less systematically. He further assesses that “real progress demands rigor and breadth: a systematic treatment of both material and nonmaterial variables”. To conduct such an treatment he proposes “one key nonmaterial variable: force employment”, and he defines this as “the doctrine and tactics by which armies use their material in the field” (Biddle, 2006, p. 2)

Since he assesses that there are number of patterns of force employment, he prefers to held a particular pattern of it. And he dubbs this pattern as “the modern system”. According to him modern system “has been pivotal in the 20th century and is likely to remain so”. (Biddle, 2006, p. 2)

He argues that “since at least 1900, the domianant technological fact of the modern battlefield has been increasing lethality. Even by 1914, firepower had become so lethal that exposed mass movement in the open had become suicidal. Subsequent technological change has only increased the range over which exposure can be fatal. To perform military missions in the face of this storm of steel requires armies to **reduce their exposure**, and since 1918 the central means of doing so has been modern system employment”.(Biddle, 2006, pp. 2–3)

His treatment of the subject of modern system is like intervening variable for the outcome of the battle. He suggests that numbers matters only if they can be exploited by modern-system force employment(Biddle, 2006, p. 3). Hew proposes two examples of this argument, one is Iraqi Army in Gulf War, although they seem to be powerful by numbers, they have been mismanaged, and lost the war, and the second is North Vietnamese Army, although weak in numbers, mananeged properly and made unexpected resistance in the war. According to him these results challenged a wide variety of standard views. (Biddle, 2006, p. 3)

He advises to be more cautious on the propositions of Revolution in Military Affairs which indicates that long-range precision air and missile strikes will dominate future warfare while ground forces role would be limited by scouts etc. He says that overgeneralization of the results of Gulf War may lead to make false policy decisions(Biddle, 2006, p. 4).

**What is Military Power?**

He claims that war outcomes is not product of military power alone. And this military power can mean different things in different context like offence or defence etc. He proposes that if capability is the ability to succeed at an assigned mission, different states will thus assess capability very differently for the same forces. And he further states that no single concept of “military capability” can apply to all conflicts in all places and times(Biddle, 2006, p. 5).

In his analysis he picks the **mission of controlling territory** in mid- to high-intensity continental warfareto evaluate capability. He than selects three criteria to assess success in these missions: the ability to destroy hostile forces while preserving one’s own, the ability to take and hold ground, and the required time. He than offers offensive and defensive definitions of capability. He defines offensive military capability as “the capacity to destroy the largest possible defensive force over the largest possible territory for te smallest attacker casualties in the least time; and he defines defensive military capability with conversing the offensive one: “the ability to preserve the largest possible defensive force over the largest possible territory with the greatest attacker casualties for the longest time. (Biddle, 2006, p. 6)

He then selects the unit of analysis as “operation”. And he expands as the operation as a series of interconnected battles resulting from a single prior plan. These interconnected battles in a single theater constitute a campaign. He gaves the example of Normany Campaign which constitutes Operations EPSOM, GOODWOOD and COBRA. By mid- to high-intensity conflict he means in between of guerilla warfare and global thermonuclear war, namely regional conventional wars such as Afghanistan War, while excluding the two extreme ends. (Biddle, 2006, p. 6)

**Methodology**

He states that since there is no overarching methodology to explain capabilty, he combines historiography with formal theory, case method, statistical analysis, and simulation experimentation. (Biddle, 2006, p. 9)

His emphasis on history part is the role of doctrinal adaptation for the wars course and outcome. And the formal theory facilitates to overcome the limites and complex interconnecting claims of the historiography by using mathematical language to describe relationships. Though, this also has limites, because it abstracts away real issues in sake mathematical clarity. So he places history first. And harness these claims with mathematical analysis. (Biddle, 2006, p. 9)

He tests this approach with three methods. First one is **case study** to provide maximum theoretical leverage. Then he applies a **small-n- ase method** to characterize the variables, like force employment which he claims never had been tried before. To generalize the results he compliments the case studies with a series of **large-n statistical analyses**. He inserted the new variable of force employment with ***treating it indirectly via enabling assumptions and proxy variables***. He also includes ex ante experiments via a simulation tool, changing key features while holding all other aspects constant to deduce a more systematic framework which is not experienced by real time fights. (Biddle, 2006, p. 10)

Biddle then pass to ideas about capability and states that these ideas fall into three broad classes which are numerical preponderance, technology, and force employment.

**Numerical Preponderance**

To explain briefly the preponderance explanation of military capability, he uses famous quotation of Napoleon who said “God is on the side of the big battalions.” He states that association of victory with material preponderance underlies the widespread perception that economic strength is a necessary precondition for military strength, and effects the national strategy making equaly with politic-military considerations. In the end most of these preponderance arguments claims only that numerical superiority determines capability. (Biddle, 2006, p. 14)

He then gives some detail accounts of this approach and mentions about **“density”** term of especially Liddle Hart and Mearsheimer. He summarizes these scolars approach and states that “density matters rather than just force size: the higher the “force-to-space” ratio, the greater the defender’s relative advantage, and vice versa”. (Biddle, 2006, p. 14)

*Basil Liddle Hart, The ratio of troops to space, Military Review 40, April 1960,*

*Mearsheimer, Conventional Deterrence, pp.47-48, 181-183.*

He summarizes also briefly the approaches of threshold effects via **“rules of thumb”** from again mainly Liddle Hart and Mearsheimer, saying that most common holds that successful attack requires at least a 3:1 local superiority. He reflects that especially Liddle Hart and Mearsheimer thought which states that these ratios should compare quality-adjusted “combat power” rather than simple troop strength, yet he says, these scholars and writers doesnt provide explanation on how these adjustments will occur. (Biddle, 2006, p. 15)

*Basil Liddle Hart, Defense of Britain (London: Faber and Faber, 1939) pp.54-55*

*John Mearsheimer, Assessing the Conventional Balance: The 3:1 Rule and its critics, International Security 13, 4(Spring 1989), pp.54-89*

He finalises this approach by stating that; in this approach it is relied on simple measures of gross preponderance per se: the greater A’s numerical superiority over B, the greater its relative capability. (Biddle, 2006, p. 15)

**Technology**

He summarizes two approach here. One is systemic theory which holds that changing technology shifts the relative ease of attack and defense for all states in the international system. It says technology’s main effect is not to strenghten state A to state B- it strenghten attackers over defensers or vice versa. They favors that at prior 1914 machine gun made attack almost impossible. This made defensers adventageous. Likewise tank made attack easy(Biddle, 2006, p. 15).

Second school in the technology approach is dyadic technology theory which claims the one who has the technology edge prevails.

On War

Clausewitz

Clausewitz approaches to the war from “hostile intentions” perspective of human psychology and defines it as “an act of force to compel our enemy to do our will”. He also lay down some key principles about the nature of warfare. He mentions “maximum use of force” to reach to disarm the enemy which he describes as aim of the warfare (Clausewitz, n.d., pp. 75–77). His approach to this phenomenon of war explains some degree why it is nearly impossible what are the true reasons behind failure or success in battles. Because there is psychology part of it, and it is nearly impossible to gauge how motivated of the soldiers of both sides.

Again, as Clausewitz puts it neatly, war is not the action of a living force upon a lifeless mass(Clausewitz, n.d., p. 77). From this phrase we understand material factors are moderated by human. Both as a commander who provides leadership and as soldier who makes happen the strategy laid out by the leader.

So, my problem in the very beginning of this research was to understand what degree material and nonmaterial factors effects the outcome of the battle.

Clausewitz’s explanation shed light to this deep and curious question with this phrase: “If you want to overcome your enemy you must **match your effort against his power of resistance**, which can be expressed as the product of two inseparable factors, viz. the total means at his disposal and the strength of his will”. So, a researcher in this field need to measure these efforts and solicit some key patterns. He further states that while means should be measurable, strength of will can only be measured “approximately” by the strength of the motive animating it. Once you accurately estimate power of resistance of opponent you adjust yours. That is, “you can either increase them until they surpass the enemy's or, if this is beyond your means, you can make your efforts as great as possible”. And according to his conceptualization since the sides do the same this situation will take us to an extreme (Clausewitz, n.d., p. 77). He dubs this power of resistance as “will” later(Clausewitz, n.d., p. 78).

From this statement I pick “motivation of the soldiers”. My one variable will be this one.

Clausewitz mentions two factors and he says these are inseparable. So, any research would be incomplete according to him if it lacks one of those two factors. Means, there so many studies in this field emphasizing one dimension while keeping constant of other etc.

My purpose with this study is to integrate “strength of will” part to already in place well studied part of total means part.

Since each side will try their extreme ends on the means and objectives, this will never produce real life understanding of the war. Because of that, Clausewitz proposes some moderations(Clausewitz, n.d., p. 78). By this he means it is nearly impossible to reach this kind of perfection. In other word, realities will force participants to be far more back of the desired means and desired objectives.

There are three reasons which prevents the human to reach such a perfection. First, war is not an isolated act which means resistance of power depends on the human will and this will fall short of perfection. And this according to Clausewitz should be measured with comparing past actions of the sides(Clausewitz, n.d., p. 78). Second reason is war necessitates successive decisions and actions rather than a set of simultaneous decisions and a single action. This nature also moderates the warfare, preventing it to reach extreme. Since these decisions and actions are seen in context, they will provide a measurement for those that follow. Clausewitz makes this judgement because he says it is impossible to mobilise all available means to a single action. Real world calculations will force sides to allocate part of the resources which in turn will make the war successive actions and decisions. He mentions as resources in question as fighting forces, the country, with its physical features and population, and its allies (Clausewitz, n.d., pp. 79). Third reason to prevent to reach to extremes is the thought that every participant should think that there will be some other activities that may recover if loose the battle(Clausewitz, n.d., p. 80).

These real life conditions modifies these three extremes. Since these real life conditions will prevent each side, they will make a judgement the degree of effort. This degree of effort will be based on the phenomena of real world and the laws of probability. From the enemy's character, from his institutions, the state of his affair: and his general situation, each side, using the laws of probability, forms an estimate of its opponent's likely course and acts accordingly (Clausewitz, n.d., p. 80).

The more the law of extremes looses power with real life condition modifications, political object become more important. Clausewitz mentions that political object should be always included in the calculation of probabilites. Because he says it is the original motive for the war. He says the resistance of opponent depends on the penalty you request from him. So if an opponent request so valuable asset, it will face greater resistance. This is another modification. With this feature political object determines both military objective and amount of effort it requires. The political object cannot, however, in itself provide the standard of measurement. It differs time to time and according to people. We can therefore take the political objects a standard only if we think of the influence it can exert upon the forces it is meant to move. The nature of those forces therefore calls for study. Depending on whether their characteristics increase or diminish the drive toward a particular action, the outcome will vary. Clausewitz proposes that relations between political military objectives are calibrating themselves according to degrees of importance and intensity of the war itself(Clausewitz, n.d., pp. 80–81).

1. Though explanation is given like this: 23\*√2=32.5, means since combined fleet is divided, they need √2 plus force to make equation with the UK fleet. I make this deduction to reach 2/1 force equation: 32²=23²+23², thus in the first battle would be fight with 32²=23² this portion. Equals to 1024 vs 529. [↑](#footnote-ref-1)