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IS IT POSSIBLE TO ESTABLISH A CARTESIAN METHODOLOGY TO DETERMINE THE CENTER OF GRAVITY?

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Exercise Solo Flight

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INTRODUCTION

The introduction of the concept of Center of Gravity (COG) occurred for the first time in US military during the 1980`s, but the concept was first described by Clausewitz, in his book *On War*. Nevertheless it was Van Moltke who used Clausewitz`s ideas in the Prussian War (1866-1870) for the first time. Once Moltke declared his success was due to Clausewitz, Germans, Austrians and other European countries started to study his work, including COG definition and its use in warfare. According to Vego the original term in German, *schwerpunkt* meant literally “weight (or focus) of effort”, rather than COG¹ which brought the first confusion to use this concept.

In spite of all misunderstanding of its original concept, the COG is linked to the correct identification of the military problem in an Operational and Strategic environment. If you do not correctly identify it, you will not be able to properly solve the problem. As Cybernetic warfare theorists brought the idea of certain frameworks that could predict adversary behavior, we tend to believe that there is a Cartesian way to model the COG. On the other hand, Clausewitzian thinkers such as John Boyd and Alan Beyerchen revisited his ideas and believe that chaos, complexity and unpredictability will prevail². Accordingly there is no Cartesian way to establish the COG, and operational planners are forced to rely on the Operational Art, the study of previous campaigns and in the military genius as Clausewitz pointed out, therefore the idea that the COG should be used as an abstract concept appears.

The purpose of this essay is to analyze the concept of the COG and methods utilized to identify it. It will be argued that there is no complete Cartesian methodology to establish the COG. The methodology that will be used is the identification of applied theories through bibliography research and experiences in the syndicate discussions.

¹Milan Vego, “Clausewitz`s schwerpunkt – Mistranslated from german, misuterstood in English”. Military Review Jan-Fev (2007), 101.

²Antoine Bousquet, *The Scientific Way of Warfare. Order and Chaos on the Battlefields of Modernit* (London: Hurst publishers, 2009), 196.

The first section of this essay will analyze the concept of the COG as expressed in the Clausewitz book *On War* and will also consider academic and military COG interpretations, focusing on the definitions proposed by Strange and Echevarria. It will also address the question of using single or multiple COG`s. The second section will analyze the mechanisms and methods used by academics such as Strange, Eikemeir and Buttler to identify the COG.

COG CONCEPT

Prior to establishing a methodology to determine the COG, it is fundamental to define the COG, a very difficult and controversial task without a precise answer. Nevertheless, I will present my particular and humble impression. Afterwards existing interpretations of academic, military and doctrinal definitions will be briefly explored.

After searching for an original COG definition in *On War*, the most relevant references to a possible definitions, are contained in the passages below:

A center of gravity is always found where the mass is concentrated most densely. It presents the most effective target for a blow; furthermore, the heaviest blow is that struck by the center of gravity.³

... one must keep the dominant characteristics of both belligerents in mind. Out of these a certain center of gravity develops, the hub of all power and movement, on which everything depends. That is the point against which all our energies should be directed.⁴

The first passage is found in chapter twenty-seven of book six, concerning the Defense of a Theater of Operations (TO), therefore it can be argued that the COG only presents the most effective target against the military forces which is fighting to defend a TO.

During my research I did not find this concept in book seven (The attack). Was he not concerned with this concept as it applies to offensive operations? In fact I believe he was, because

³Michael Howard and Peter Paret. *Clausewitz, Carl von, 1780-1831. On War. Translation of: Vom Kriege.* (New Jersey: Princeton University Press, 1989), 485.

⁴*Ibid*, 595.

the second passage is found in chapter four of book eight, concerning the Defeat of the enemy. Given that offensive operations is prerequisite to defeat the enemy, furthermore is essential, I interpreted that Clausewitz saw the COG with an offensive approach in this passage. Therefore I conclude he saw it differently depending on the posture adopted by military forces, considering defensive or offensive operations. Ratifying my point of view, according to Vego study of german military concept of *schwerpunkt*, Germans used different meanings of it for planning the defense or the attack during World War II.⁵

There are many concerns with book six of *On War*, once it was planned to be revised by Clausewitz, nevertheless there is no clear evidence that he was unsatisfied with this passage. As he had stated in his notes for revision, he was concerned to clearly use the concept that “war is nothing but the continuation of policy with other means”⁶ in the revision of the first six books, although he also observed that books eight and seven, still needed revision and would also influence in the revision of book six.⁷ We can conclude that book eight was closest to its final version than book six.

Now let’s examine an older translation of the same passages, according to Graham:

As a center of gravity is always situated where the greatest mass of matter is collected, and as a shock against the center of gravity of a body always produces the greatest effect, and further, as the most effective blow is struck with the centre of gravity of the power used, so it is also in war. ... the great point is to keep the overruling relations of both parties in view. Out of them a center of gravity...will form itself.⁸

If we look for the Graham translation of *Vom Kriege (On War)*, according to Howard and Paret we should first bear in mind that, apart from its dated style, it contains a large number of

⁵ Milan Vego, “Clausewitz’s *schwerpunkt* – Mistranslated from german, misuterstood in English”. *Military Review* Jan-Fev (2007), 104.

⁶ Michael Howard and Peter Paret. *Clausewitz, Carl von, 1780-1831. On War. Translation of: Vom Kriege.* (New Jersey: Princeton University Press, 1989), 69.

⁷*Ibid.*

⁸Joseph L. Strange and Richard Iron. “Center of Gravity. What Clausewitz really meant” *Joint Force Quarterly* 35 Autumn (2004), 24.

inaccuracies and obscurities, because they were based on German texts that contained significant alterations from first version of *Vom Kriege*.⁹

Nevertheless the authors did not comment specifically about these inaccuracies and obscurities, but they affirmed that they had not hesitated to translate the same term in different ways if the context seemed to demand it¹⁰. I assess that this has happened to the term *zentrum*, meaning literally “center”, not “hub”, as described in quoted passages of Howard and Paret translation.

Comparing both translations we should not focus on its differences, we should use what is similar, but what is similar is the mathematical approach of the COG as “where the mass is concentrated most densely” or “the greatest mass of matter”. Nevertheless, these passages are found in book six, which is not an elaborate book. Therefore I conclude it is not possible to determine what Clausewitz really meant with the COG, we should move forward from this discussion.

According to Lee, the evolution of the COG definitions by military doctrine of the services, since the 1980`s, enables discrimination between three classes of definitions: one focused on the notion of critical vulnerabilities, the second focused on the aspect of strength and the final one focused on a source of strength.¹¹

Lee summarized the initial differences in military doctrine, whereas some thinkers aimed to attack directly the COG, no matter if it was a strength or a vulnerability, until Joint doctrine managed to conciliate both definitions, using the term “source of strength”¹², where you can find a critical vulnerability, and strike it, destroying or neutralizing the COG indirectly.

⁹Michael Howard and Peter Paret. *Clausewitz, Carl von, 1780-1831. On War. Translation of: Vom Kriege*. (New Jersey: Princeton University Press, 1989), XI.

¹⁰*Ibid.*

¹¹ Major Seow Hiang Lee, “Center of Gravity or Center of Confusion. Understanding the Mystique”. Air Command and Staff College. Wright Flyer paper n 10 (1999), 8.

¹² Rudolph M. Janickzek, “ A Concept at the Crossroads: Rethinking the Center of Gravity” Strategic Studies Institute, October (2007), 3.

That definition became the most accepted kind in military doctrine, including actual US Joint Military, Canadian Armed Forces, Brazilian Armed Forces and many other Western militaries and was originated by Dr. Strange 1996`s definition as: “Primary sources of moral or physical strength, power and resistance.”¹³

Nonetheless, Dr Strange`s definition was challenged by Echevarria point of view which considered the COG as a “focal point, rather than source of power...they can be said to possess centripetal forces of a sort, which act to hold systems or structures together.”¹⁴

Echevarria focuses on physical concepts examples of COG, as the boomerang, the wrestler and the combatant to illustrate his point to relate the COG to the loss of balance in a conflict. I agree with this analogy considering that he used unchangeable facts to illustrate it, nevertheless the idea of centripetal force was inspired in the example of Blucher`s defeat in Silesia in the 1814 Napoleonic Campaign,¹⁵ which is neither immutable nor enough to be justified.

Strange reviewed his COG concept focusing in the possible mistranslations of Clausewitz and argued the value of moral COG and the adversarial element. I assess that he has changed his idea of the COG as a primary source of power, aiming again in the strength aspect of it based on its effects, not in their capabilities, which is aligned with Echevarria thoughts. But in the end I evaluate he offers a more confusing definition: “They are dynamic and powerful physical and moral agents of action or influence with certain qualities and capabilities that derive their benefit from a given location or terrain”.¹⁶

Finally, once there is no way to evaluate what Clausewitz meant with the COG concept, we could use Echevarria idea of “focal point”. On the other hand I evaluate that there is no clear reason to abandon the idea of “source of power”, once Strange`s initial definition were consistent

¹³ Joe Strange, *Centers of Gravity & Critical Vulnerabilities: Building on the Clausewitzian Foundation so that we can all speak the same language*. Marine Corps University. Perspectives on Warfighting, n 4 (1996), 43.

¹⁴ Antulio J. Echevarria II, *Clausewitz & Contemporary War*. (Oxford: Oxford University Press, 2007), 184.

¹⁵ *Ibid*, 181.

¹⁶ Joseph Strange and Richard Iron. “Center of Gravity. What Clausewitz really meant.” *Joint Force Quarterly* 35 (Autumn 2004), 27.

and adopted by many western Armed Forces doctrines. Therefore I conclude that depending on the situation we should choose which one we apply, bringing more flexibility to military doctrine.

One additional and important issue to define the COG is concerned with the question of unique versus multiple COG`s. Clausewitz`s work is clear asserting that is highly desirable to have a single COG which is the point against all our energies should be directed, although there are very few cases where it would not be realistic to reduce several centers of gravity to one.¹⁷

Modern airpower theorists alike Colonel John A. Warden had defined the COG as multiple ones with his “Five ring models”, which according to Wells had diluted its meaning and did not focus on a single main effort, taking the risk to put energy and resources where it is not necessary.¹⁸ On the other hand Lee argues that once the true COG is not always found, sometimes it is hidden during the planning of a campaign, there should be developed multiple perceived COG`s, allowing that further analysis during the campaign could uncover the hidden COG, eliminating the false COG`s during a evolving process, sustained with continuous feedback.¹⁹

I conclude that Airpower theorists did not follow the Clausewitzian concept which is based in land warfare experiences, and I disagree with this approach even though we could risk identifying a false COG, because further than waste resources we also can expose our own COG trying to target many enemy ones.

We can change the COG once we perceive a mistake or a new fact under covering it during the campaign, but we can not start with many of them and eliminate them in the process, because further than lost its value, each possible COG will demand branch plans, needing too much time and effort of planners, that could be redirected to planning in order to protect our own COG and to better analyze a single enemy one, using the Strange methodology as we will discuss in the next section.

¹⁷Michael Howard and Peter Paret. *Clausewitz, Carl von, 1780-1831. On War. Translation of: Vom Kriege.* (New Jersey: Princeton University Press, 1989), 597.

¹⁸Colonel Gordon M. Wells, “The Center of Gravity Fad: Consequence of the absence of an Overarching American Theory of War”. *Landpower Essay*. No 01-1. March (2001), 3.

¹⁹Major Seow Hiang Lee, “Center of Gravity or Center of Confusion. Understanding the Mystique”. *Air Command and Staff College. Wright Flyer paper n 10* (1999), 27.

IDENTIFYING THE COG

According to Eikemeir there is no practical method established in US Joint doctrine to determine the COG. It only recommends academic systems of system approach with a Political, Military, Economical, Social, Intelligence and Infrastructure (PMESII) analysis.²⁰

Furthermore, Eikemeir adds that identifying a COG is not a scientific issue, rather it is an art, therefore there is no precise method to establish it, nevertheless there are techniques and heuristics that help identify potential solutions, by using logical and disciplined process rather than a brainstorm process, based on guessing and debate.²¹

On the other hand Buttler proposed a “Godzilla” methodology to establish the COG, based in an analysis of critical factors considered essential for the accomplishment of the specific military objective. Deriving from these critical factors we will have critical strengths. Among those we will evaluate which is essential to achieve the objective, not necessary the strongest or largest, which will be the COG.²² The methodology is simply to remove one of the critical strengths at a time and to assess if it prevents the objective to be achieved. The problem with this methodology is that you can conclude that more than one critical strength prevent it, furthermore you can even conclude that all strengths do it.

Briefly summing Dr Strange methodology to establish the COG, he uses three additional concepts addressed in a logical and linear approach: Critical Capabilities (CC), Critical Requirements (CR) and Critical Vulnerabilities (CV), known as the CG-CC-CR-CV concept.²³

I assess that he did not prescribed any clear methodology to determine the COG, rather than that he provides a list of possible COG`s that in my prospective will further pass through a validation test. For each COG he will identify its CC, which has CR, that could have CV or not.

²⁰Colonel Dale C. Eikemeir, “Centers of Gravity. Changing the way we think”. *Marine Corps Gazette*, Nov (2010), 98.

²¹*Ibid.*

²²James P. Buttler, “Godzilla Methodology. Means for determining Center of Gravity”. *Joint Forces Quadriennial*, 72 1st Quarter (2014), 28.

²³Joe Strange. *Centers of Gravity & Critical Vulnerabilities: Building on the Clausewitzian Foundation so that we can all speak the same language.* (Marine Corps University. Perspectives on Warfighting, n 4, 1996), 3.

During this process he will eliminate the candidates which have not any CV. Besides the decision of what candidate will be the COG is a matter of a planner judgment.

Mendel and Tooke suggested a model, where the potential COG is submitted to a test against the criterion of whether imposing one`s will or not.²⁴ So if the test is valid and the ways are feasible you proceed to the campaign. The problem is that it does not define what you can select to be a possible COG.

Another advocate of a methodology to establish the COG are Tecuci, Boicu and Comello whom prescribed the use of Artificial Intelligence (AI) to analyze it, using a decision support software called “Disciple-COG” to refine Strange CC-CR-CV methodology, but aiming to determine the Strategic COG only.²⁵ We insert strategic data in this system, including the COG candidates which will be tested automatically according to the strategic data provided and to Strange methodology.

In the end of the day, I conclude that the use of AI is restrained to what we assess of the strategic environment to be the system answers, which are selected based on our judgment. The advantage is that the system will always ask the same questions based on military experts knowledge, which will make our reasoning systematic, on the other hand it will not permit us to analyze a military situation where you do not have two antagonist forces. Thus, I assess that the use of AI will not truly brought a Cartesian methodology to determine the COG.

The strategic framework of ways, end and means proposed by Eikemer²⁶ to identify the COG is also confusing, because it uses the Critical Capability concept proposed by Strange that is result of the COG, so what comes first?

²⁴Jeffrey A. Harley. “Information, Technology and the Center of Gravity”. (Naval War College Review, winter 1997), 82.

²⁵Gheorghe Tecuci, Mihai Boicu, Jerome J. Comello. *Theory and application of Cognitive agents. Agent-assisted Center of Gravity Analysis.*(George Mason University Press: Fairfax, 2008), V.

²⁶Colonel Dale C. Eikemeir, “A Logical Method for Center of Gravity analysis”. *Military Review* (Sep-Oct 2007), 62.

The COG is the doer²⁷, able to achieve the end state by itself, but sometimes there are more than one doer, thus there is no effective one, once there is no single resource with inherently capability to achieve the end state. Therefore, depending in the situation, all offensive military forces can be the doer. In this case, what is the point to direct all our forces against all offensive military forces? It will not provide a more efficient way to plan our campaign.

Furthermore, I argue that whenever you have two antagonist military forces without capability gaps and with similar size and strength, we tend to consider all military forces as an Operational COG, but this consideration is associated with the interpretation of the COG as a source of power or strength. Therefore, in these cases the Echevarria concept is a better option. Thus I conclude that we should use the Echevarria COG concept when we assess that we have two belligerent with similar military capabilities.

The Strange methodology to establish the COG is based in the concept of the COG as source of power, which was later reviewed by his author; nonetheless he did not offered any revision of his methodology. To use Echevarria concept of the COG as focal point, although more adequate as a definition is also problematic, because he proposed a very abstract method to find it based in three steps:

Determine whether identifying and attacking a CoG is appropriate for the type of war we are going to wage.... Determine whether the adversary's whole structure or system is sufficiently connected to be treated as a single body... Determine what element has the necessary centripetal force to hold the system together.²⁸

In the end of the day, what will define the COG is the last step without any clear guidance being provided by Echevarria, just one example concerning the conflict of US against Al Qaeda. I assess that the initial steps are concerned with the applicability of the COG, which is not the purpose of this essay.

²⁷Colonel Dale C. Eikemeir, "Centers of Gravity. Changing the way we think". *Marine Corps Gazette*, Nov (2010), 100.

²⁸Antulio J. Echevarria II, "Clausewitz's Center of Gravity: Changing our Warfighting Doctrine-Again!" United States Army War College Press, (2002), 16.

Finally after deeply research articles and theories I did not found any complete Cartesian methodology to establish the COG, therefore I agree with Eikemeir statement that we can only use a methodology to organize our thinking. As deeper as we try to implement a mathematical or cybernetic model, it will not prevent that in the end abstract and human thinking prevails.

CONCLUSION

What Clausewitz really thought about the COG is not possible to be known, but he saw it differently depending on the posture adopted by military forces, considering defensive or offensive operations.

Echevarria and Strange brought different prospective to the COG concept, but they did not invalidate each other. Depending on the situation the military planner can pick one of those, or even try both, which will give them more flexibility to solve the military problem. Nevertheless Strange original definition as “Primary source of power” is more consistent than his new version and Echevarria definitions.

The COG is not static, it can be changed, but it can not be multiple, because if we did so, we would lost the unity of effort, bringing wasted energy to solve the problem, which could be better used by planners.

Strange did not prescribed any clear methodology to determine the COG, rather than that he provides a list of possible COG`s that will further pass through a validation test. The decision of what candidate will be the COG is a matter of a planner judgment.

Any attempt to use AI or Cartesian thinking to establish the COG will always finish with a human judgment. They will just help us not to forget any detail and to use past experiences in our thinking.

In the specific case of two antagonist military forces with similar capabilities and strength, it is more adequate to use Echevarria COG concept, if not we will tend to assess that all offensive military forces are the COG.

Finally I did not found any complete Cartesian methodology to establish the COG and I evaluate it is not possible to do so. Therefore, although definitions are useful to reason our thinking, the abstract concept of the COG prevails, highlighting the importance of the experience and the genius of military planners.

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