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Newport, R.I.**

Center of Gravity within the Ill-Structured Problem

by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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04 May 2012

Paper Abstract

Our currently military planning processes center around Clausewitz's theory of a center of gravity. We spend countless hours debating in an attempt to find the true center of gravity of which all our actions should be directed toward in order to achieve the stated objective. It is important to note that Clausewitz developed his center of gravity concept out of his own experiences mostly during the Napoleonic War, a time in which traditional armies met on the battlefield pitting their forces against one another. This paper explores the center of gravity concept and whether or not it applies to today's socially complex, ill-structured problems as it did within the context of a traditional force-on-force conflict, or what would be referred to as a structured problem.

What the theorist has to say here is this: one must keep the dominant characteristics of both belligerents in mind. Out of the characteristics 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.

– Carl von Clausewitz
On War

Introduction

The theory of the enemy's center of gravity as suggested by the Prussian military theorist Carl von Clausewitz in his magnum opus, *On War*, continues this day to generate spirited debate among students and faculty within the classrooms of military education institutions, as it is sure to do among joint force commander staffs as they plan for real-life contingencies. In all likelihood, Clausewitz had little, if any, comprehension of the far-reaching effects his theory of an enemy center of gravity (COG) would have on today's military planning process. What is indisputable, however, is that the concept has become an integral part of the U.S. military's war-fighting doctrine and the centerpiece to operational art. Furthermore, merely understanding your enemy's COG is not enough. Doctrine requires knowledge of the friendly center of gravity as well. This idea, too, is rooted within Clausewitz's theory of a center of gravity. As the quote at the beginning of this paper states, he said, "One must keep the dominant forces of *both* belligerents in mind . . . That is the point against which *all* our energies should be directed."¹ Clearly he meant we needed to understand our own center of gravity so that we may take the necessary precautions to protect it from the enemy. "The essence of a campaign plan is a focused effort against an enemy's center of gravity while protecting one's one."²

¹ Clausewitz, *On War*, 595-596

² Eikmeier, *Center of Gravity Analysis*

Joint Publication (JP) 5-0, *Joint Operation Planning*, clearly states the critical role of COG analysis: “One of the most important tasks confronting the joint force commander’s staff during planning is identifying and analyzing friendly and adversary COGs. A COG is a source of power that provides moral or physical strength, freedom of action, or will to act.”³ Milan Vego’s textbook *Joint Operational Warfare: Theory and Practice*, goes further to say, “The concept of a center of gravity is, along with the determination of the ultimate and intermediate objectives, the *most* critical part of any military planning process.”⁴ It is little wonder, then, that COG analysis is often the subject of debate and the focal point of planning involving all services of the United States Military. Our doctrine teaches us in the planning process that all actions should have either a direct or indirect effect on the enemy’s COG and that, “a COG is always linked to the objective.”⁵ Given the relationship between objectives and COGs, it is understandable why such focus and importance is given to the concept of the center of gravity. After all, once we destroy or significantly degrade our enemy’s COG, his ability to defeat us is hypothetically taken away, and we may impose our will on him.⁶

However, during the era in which Clausewitz wrote *On War*, written mostly after the Napoleonic wars between 1816 and 1830, war was determined mainly by direct action between the forces of one rational actor and the forces of another. What mattered most was the number and quality of troop engaged on the battlefield. That plus, the skill with which those troops were employed decided the outcome. In this context, the analysis of rational force-on-force conflict, the concept of the center of gravity is completely valid. For Clausewitz, once France’s COG, Napoleon’s Army, was defeated, victory was assured.

³ CJCS, *JP 5-0*, III-22

⁴ Vego, *Joint Operational Warfare: Theory and Practice*, IX-90

⁵ CJCS, *JP 2-0*, II-65

⁶ Hartig, *Elements of Major Operations and Campaigns*

Within this context, a bipolar conflict between two conventional forces, our military planning process was born. However, the concept of a singular center of gravity becomes much more obscure as more complex problems are encountered, a situation which is often described as ill-structured. Modern day, conflicts are often not fought between two rational actors pitting their forces against one another. “Today, military planners are often facing social problems; counterinsurgency, humanitarian assistance, and countering ideological support to terrorism are some examples.”⁷ It is within this realm of conflict that military planners frequently face the ill-structured problem. When facing ill-structured problems, joint force commanders and their staffs must recognize that the concept of a traditional enemy center of gravity is unlikely to present itself as it does within the confines of a structured problem. If they are not careful they will only succeed in identifying a “faulty” COG or a COG that rapidly shifts and will subsequently wonder why actions toward the (supposed) COG are not having the desired effects or producing any consequence toward the objective. Rather than spending hours, if not days, attempting to define an elusive and ever-evolving entity, military strategists would be wise to focus their efforts on defining an achievable desired end state (or steady state) and identifying the enemy’s critical capabilities as well as the critical requirements he relies on.

Ill-Structured Problems

The first thing a Joint Force Commander and his staff need to understand is that ill-structured problems are different from traditional, conventional force-on-force, structured problems in many ways. Comprehending this is the first step toward the realization that planning for ill-structured problems needs to be different than planning for structured problems, including the conceptual use of the enemy’s center of gravity. We are all familiar

⁷ Hartig, *Problem Solving and the Military Professional*, 6

with structured problems. They present themselves as self-evident; we understand what the problem is and usually agree on what the solution needs to look like. There may be more than one solution to the problem (different courses of action), but the desired end state or objective will be clearly definable and agreed upon by all.⁸ In contrast, Training and Doctrine Command Pamphlet (TRADOC) 525-5-500, “The U.S. Army Commander’s Appreciation and Campaign Design,” offers the following as an explanation as to what an ill-structured problem is:

Ill-structured problems are the most interactively complex, non-linear, and chaotic – and therefore the most challenging. Unlike structured problems, professionals will disagree about how to solve this type of problem, what should be the end state, and whether the desired end state is even achievable. At the root of this lack of professional consensus is the difficulty in agreeing on the structure of the problem. Unlike structured problems, it is not clear what action to take, because the nature of the problem itself is not clear.⁹

Although ill-structured problems often have no obvious form and are not as self-evident as structured problems are, they typically share a number of characteristics that can help leaders determine when they are faced with such problems. TRADOC 525-5-500 offers 11 characteristics of ill-structured problems.¹⁰ While all characteristics are essential to understanding the nature of ill-structured problems, four directly challenge our traditional thinking on how we should view the concept of the enemy’s center of gravity:

1. Ill-structured problems have no ‘stopping rule’. This is perhaps the most challenging characteristic of an ill-structured problem for a Joint Force Commander and his staff to comprehend. The idea of not having a defined end state or clear objective to meet is doctrinally inconceivable to many. However, it is a universally accepted truth that ill-

⁸ Department of the Army, *TRADOC 525-5-500*, 9

⁹ *Ibid.*, 9

¹⁰ TRADOC 525-5-500 identifies 11 characteristics of ill-structured problems based on Horst Rittel and Melvin Webber. “Dilemmas in a General Theory of Planning”, *Policy Sciences* 4, Elsevier Scientific, Amsterdam, 1973, 155-169.

structured problems have no preconceived end state or predefined objective. “The planner must seek a ‘good enough’ solution based on maintaining equilibrium around some acceptable condition. Unfortunately, our doctrine [centered around the center of gravity concept] continues to focus on developing an end state for every plan.”¹¹ As stated earlier, during our current planning process the center of gravity can only be determined after an objective has been defined because they must have a direct relationship. It stands to reason therefore, that it will be nearly impossible to define the true COG of our adversary within the paradigm of an ill-structured problem because a clear objective to accomplish in order to consider the mission complete will be hard, if not impossible, to define. “Work on an ill-structured problem will continue until strategic leaders judge the situation is ‘good enough,’ or until national interest, will, or resources have been diverted or exhausted.”¹² The argument may be made that this is precisely what happened in Vietnam, leading to our other than graceful exit. To a lesser extent, this is the driving factor leading to our redeployment from Afghanistan; it is not an objective-based redeployment, but rather one that has been predicated on popular support and political appetite. This is not to say that ill-structured problems cannot be solved, or come to a satisfactory conclusion. It is simply to suggest that we may not know what the desired end state or objective looks like until we reach it. Consequently, if an enemy COG was present, it is unlikely to present itself as the COG until after it has been destroyed or severely degraded.

2. Ill-structured problems are interactively complex. These nonlinear problems are largely defined by the interactions between one or more systems. “[Ill-structured] problems are socially complex because people have tremendous freedom of interaction. Since

¹¹ Greenwood and Hammes, *War Planning for Wicked Problems*

¹² Department of the Army, *TRADOC 525-5-500*, 11

interactively complex problems are non-linear, a relatively minor action can create disproportionately large effects.”¹³ “The same action performed at different times may create entirely different results. It is very difficult if not impossible to predict what will happen.”¹⁴ This becomes extremely problematic for the joint force commander and his staff because “our military planning process often lays out detailed plans for well over the first 100 days of a conflict.”¹⁵ Most of this time period is likely to encompass actions taken against the supposed COG identified during the planning process. It is extremely likely that within the construct of an ill-structured problem, those 100 days’ worth of actions, taken either directly or indirectly toward the enemy’s supposed COG, would have unintended effects, many of which are likely to have no effect whatsoever on the stated objective. “JP 5-0 notes that measurable results to a particular action may not appear for some time. [Within an ill-structured problem] this lag time complicates assessment enormously, because in the meantime the operational command may have executed other actions, which will make assessing cause and effect even more difficult.”¹⁶ It would become extremely frustrating to be planning actions toward what has been identified as the enemy’s COG only to have results fail to reach expectations and have little to no effect on the desired end state.

3. There is no immediate and no ultimate test of a solution to an ill-structured problem. “The perceived quality of a solution to an ill-structured problem can change over time. Yesterday’s solution might appear good today, but disastrous tomorrow as the unintended effects [of actions] become clearer.”¹⁷ To the planner this would be important to understand because as effects (both intended and unintended) begin to influence the ill-

¹³ Department of the Army, *TRADOC 525-5-500*, 11

¹⁴ Greenwood and Hammes, *War Planning for Wicked Problems*

¹⁵ *Ibid.*

¹⁶ Department of the Army, *TRADOC 525-5-500*, 11

¹⁷ *Ibid.*

structured problem, the social balance of the problem is likely to shift, having a direct impact on what is perceived to be the center of gravity. For example, what seemed to be a logical conclusion for the enemy's center of gravity on day three of the planning process may not make the same sense during the execution phase or even sooner. Attempting to pinpoint an adversary's COG within an ill-structured problem would require continual assessments and updates. The resulting campaign would be in a constant state of flux with regards to the center of gravity, thereby requiring a continual shift in the focus of actions and undoubtedly resulting in little to no operational effect. More likely to happen in this instance, though, is that the joint force commander declines to change the center of gravity, resulting in a campaign plan with actions directed toward an enemy COG that is no longer relevant to the stated objective. (I suppose that if one were to wait long enough, it would be entirely possible for the stated COG to become relevant once again within an ill-structured problem.)

In the end defining an enemy's center of gravity within an ill-structured problem may be a challenge too great, and I purpose that valuable time during the planning process ought not be wasted in a feeble attempt to do so. Some would even argue that determining the center of gravity within a structured problem in and of itself may prove to be a challenging endeavor. Jan Rueschhoff and Jonathan Dunne in a Joint Force Quarterly article titled, *Centers of Gravity from the "Inside Out"* make the argument that our current military doctrine does not establish an analytical process to determine a COG, specifically referring to the JOPP. They state, "The lack of doctrinal guidance on developing and employing COGs wastes planners' time and provides few tangible benefits."¹⁸ They further argue that under the current planning process, leaders and staffs spend too much time in lengthy discussions that often hinge on character traits rather than any analytical process, "Planning teams can

¹⁸ Rueschhoff and Dunne, *Centers of Gravity from the "Inside Out"*, 120

take hours – if not days – arguing over what is and is not the enemy’s COG. This contest of wills is often decided by whoever is the strongest personality on the planning team.”¹⁹ For example, during the Gulf War the ground component planning staff of U.S. Central Command (CENTCOM) spent more hours attempting to identify the Iraqi COG than planning how to defeat it.²⁰ The time that may be required to define the enemy’s COG within a structured problem leads us directly to another challenge in defining the enemy’s COG within an ill-structured problem, as described by TRADOC 525-5-500:

4. There is no definitive way to formulate an ill-structured problem. When dealing with an ill-structured problem, planners will agree that a problem exists, but they will disagree on how to frame the problem or how to define it. “Ill-structured problems rarely have a single cause, and different stakeholders will see the relationships between the causes and their importance differently.”²¹ Even with a structured problem, when the definition of the problem is clear, planning teams can take hours to debate what is and is not the enemy’s COG. Not surprisingly, planning teams facing an ill-structured problem, when the very definition of the problem is not clear or agreed upon, are likely to waste enormous amounts of valuable time in an attempt to define the enemy’s center of gravity. When the planning team is pressured to define an enemy COG in order to satisfy a planning requirement, whoever is able to best articulate his or her view will most likely decide what the enemy’s COG is, and the result is likely to be a faulty COG analysis. Without question a faulty COG analysis will, at best, adversely affect operations, waste critical resources, and incur undue risk.²² From that point on all efforts in the planning process would be directed toward

¹⁹ Rueschhoff and Dunne, *Centers of Gravity from the "Inside Out"*, 121

²⁰ Lee, *Center of Gravity or Center of Confusion: Understanding the Mystique*, 18-19

²¹ Department of the Army, *TRADOC 525-5-500*, 10

²² Rueschhoff and Dunne, *Centers of Gravity from the "Inside Out"*, 121

defeating the identified COG, using direct or indirect methods, in order to defeat our adversary. However, even if the joint force commander is successful in defeating or destroying the identified COG, it is likely that the enemy will not be defeated, nor will the stated objective be met. That is not to say that if a “true” COG exists and is subsequently defeated, our enemy will not be defeated. It is to say, however, that what is likely to be identified as the enemy’s COG within an ill-structured problem is as Clausewitz would say, “[*not*] their hub of power and movement, on which *everything* depends.”²³ What the identified COG is more likely to be is what the Navy Planning Process refers to as a critical strength of the enemy²⁴.

Counterargument

Most will agree that the center of gravity is too important of a concept to not be incorporated into the planning process. It is after all, as previously stated in JP 5-0 that finding the enemy’s center of gravity is one of the most important tasks during the early stages of planning.²⁵ It is critical to understand that the purpose of identifying the enemy’s center of gravity during the planning process is not to identify the one point of attack of which our enemy is certain to be destroyed. It is, however, intended to focus efforts and actions in order to achieve the most decisive operational impact as possible toward the stated objective. As stated before, within the context of linear problem this makes sense and the concept of Clausewitz’s center of gravity is appropriate. It is within this construct our linear planning process was designed from and best utilized to attack. However, when dealing with an ill-structured problem, one that is not linear, that is interactively complex, and may not have a clear objective, the concept is much harder to comprehend and there cannot be a

²³ Clausewitz, *On War*, 595-596

²⁴ CNO, *Navy Planning (NWP) 5-01*, C-2

²⁵ CJCS, *JP 5-0*, III-22

single center of gravity. In their report, *The Influence Component of Counterterrorism, A Systems Approach*, Paul Davis and Brian Jenkins from the RAND Corporation have this to say on how we should fight with an enemy without a definable center of gravity:

Because al Qaeda has no well-defined “center of gravity,” the United States should conduct a broad-front, sustainable campaign against the many components of the terrorist system. With no way of knowing in advance which part of the effort may prove to be the most successful, the United States needs to wage a simultaneous campaign along many fronts. This is quite different from ordinary warfare and may seem inefficient, but there is no choice.²⁶

Within the confines of an ill-structured problem joint force commanders and planners need to divorce themselves from the traditional center of gravity concept. Actions need to be planned to target the enemy’s critical strengths. These actions, just as actions toward a COG, can be either direct, pitting strength against strength, or indirect, attacking vulnerabilities linked to critical strengths. What is often at issue is the fundamental question of whether or not we need a separate planning process to deal specifically with ill-structured problems.

“Many theorists believed that “in general, the processes used to solve ill-structured problems are the same as those used to solve well-structured problems” more recent research has indicated that we use different cognitive approaches, depending on the nature of the problem.”²⁷ Although the Joint Operation Planning Process remains an indispensable model for the problems posed by structured problems, “it fails to provide the advanced cognitive tools necessary to solve the complex, ill-structured problems common to contemporary operations.”²⁸ Design has been introduced as the vehicle to help military planners deal with the ill-structured problem. U.S. Army Field Manual (FM) 5-0 defines design as, “a methodology for applying critical and creative thinking to understand, visualize, and describe

²⁶ Davis and Jenkins, *The Influence Component of Counterterrorism, A Systems Approach*

²⁷ Simon, *Decision Making and Problem Solving*

²⁸ Cardon and Leonard, *Unleashing Design, Planning and the Art of Battle Command*, 2

complex, ill-structured problems and develops approaches to solve them.”²⁹ Although it sounds as if design is going to save us all from the ill-structured problem this author believes it still falls short of what is required to successfully plan within an ill-structured problem.

Planning for an ill-structured problem, according to FM 5-0:

Design is neither a process nor a checklist. It is a critical and creative thinking methodology to help commanders understand the environment, analyze problems, and consider potential approaches so they can exploit opportunities, identify vulnerabilities, and anticipate transition during a campaign.

In other words design is the tool available to frame the problem. This is a critical step when dealing with ill-structured problems and immensely important. However, when it comes to detailed mission planning, Army Doctrine as well as Joint Doctrine still use a linear planning process which requires an enemy center of gravity to be identified. JP 5-0 says the following about operational design:

Operational design supports operational art with a general methodology using elements of operational design for understanding the situation and the problem. The methodology helps the JFC and staff to understand conceptually the broad solutions for attaining mission accomplishment and to reduce the uncertainty of the complex operational environment.³⁰

However, one of the elements of operational design as describe in JP 5-0 is center of gravity.

Recommendations

I offer the following recommendations that may be taken in order to be more successful in confronting ill-structured problems:

Divorce ourselves from the traditional concept of a single center of gravity when dealing ill-structured problems. Doctrine will have to change in order to facilitate this, the Navy Planning Process is perhaps the best construct to adjust, Appendix C of NWP 5-01: *Center of Gravity Analysis*, describes an analytical process to identify the enemy’s center of

²⁹ U.S. Army, *Field Manual (FM) 5-0, The Operations Process*, 3-1

³⁰ CJCS, *JP 5-0*, III-2

gravity. Step one of this process is to define the overall objective (if the objective is not clear then substitute the enemy or intermediate objective). Step two is to identify critical factors of the objective, ie what are the critical factors of the enemy? Critical factors are defined as critical strengths and weaknesses of the objective / enemy, not a single source of power, but rather a network of capabilities. Step three would typically identify the center of gravity from the enemy's critical strengths. I propose that within the ill-structured problem this step be skipped and we would continue to identify critical requirements and critical vulnerabilities of the critical strengths. These may provide indirect methods of attacking our enemy's critical strengths. It is these capabilities of our enemy we should focus our efforts on.

Understanding the result is likely to be a broad spectrum approach across multiple lines of operations. Once these critical strengths are defeated or degraded we should find ourselves within reach of a desired end state that is acceptable.

Recently there has been an increasing awareness within the military that problems facing military planners today are in fact different than those faced in the past. An understanding that ill-structured problems are different is beginning to take hold as evidenced by U.S. Army TRADOC 525-5-500 and the incorporation of design in Service and Joint Publications. However Design as described in JP 5-0, still guides planners to define our enemy's COG, we need to adjust the design process so it is clear to joint force commanders and their staffs that a COG is not a requirement, it may be present but not always. Design needs to frame the problem, which it does an excellent job of, but it also needs to force planners to focus on the problem's critical strengths in order to "lead" them away from the concept of a single COG. After framing the problem for the joint force commander operational design currently gives way to our linear planning process in which an enemy

COG is a necessity to doctrinally plan. Instead of relying on the COG to direct actions toward the desired end state, actions need to be focused on the enemy's critical strengths, requirements, and vulnerabilities. Otherwise planners are sure to spend countless hours in an attempt to define one.

Education within military institutions should put more emphasis on design based problem solving. In the modern world of today we are sure to face more and more ill-structured problems so it would make sense that we need to train to them. Planning exercises within ill-structure problems need to be incorporated at all levels of command and training. It will do us little good if the joint force commander understands how to attack the ill-structured problem if no one on his staff does, or at least it will be an extremely frustrating process. The will hold true if a joint force commander doesn't understand how to confront an ill-structured problem and his staff does. Furthermore, in the interest of solving ill-structured problems, or at least dealing with them more efficiently we must be able to recognize an ill-structured problem when we see one. Training-development at all levels is critical in that it will ensure the leaders of tomorrow are equipped to think critically about the ill-structured problems we are sure to face in the future..

Conclusion

Ill-structured problems are dynamic, and ever evolving with great speed. "Dealing with this kind of problem has been described as 'trying to change a tire on a moving truck' and places an enormous burden on the joint [force] commander and his staff."³¹ To be successful in dealing with ill-structured problems, planners will need to continuously frame the problem and ask the question, "What is different today from yesterday?" In the process updating the enemy's critical strengths, requirements, and vulnerabilities in order to ensure

³¹ Greenwood and Hammes, *War Planning for Wicked Problems*

actions being taken are relevant to the desired end state. “Failure to do this can cause a campaign plan to be irrelevant in coping with the ill-structured problem.”³²

It is curious to think that in today’s world of ever increasing complexity of changing social dynamics, inter-state terrorism, and humanitarian disasters that our military planning process centers on the center of gravity concept conceived nearly 200 years ago. I am not to suggest that the center of gravity concept is no longer valid, it certainly has utility within the construct of a traditional force-on-force conflict, such as the conflicts Clausewitz was akin to. However, in order to meet the challenges of ill-structured problems within today’s environment we must be capable of critical thought and adapt our behavior to how we approach such problems. Central to this is how we think about the concept of a center of gravity and how it may or may not apply within the construct of an ill-structured problem. Within our current lexicon a center of gravity must be defined for the enemy as well as for friendly forces. We should adapt our current military planning process to not hinge on a singular center of gravity but rather focus on what the enemy’s critical strengths, weaknesses, and requirements are and then execute a broad spectrum approach utilizing all elements of national power, especially when faced with an ill-structured problem. “Many of Clausewitz’s ideas—friction in war, culmination of the attack, the roles of chance and uncertainty—have a quality that transcends his day makes them relevant to our own. The COG concept is one of them. However, we must apply it judiciously.”³³ Perhaps Clausewitz understood better than us the limitations of his own theories when he said,

We wanted to show that every age had its own kind of war, its own limiting conditions, and own peculiar preconceptions.

-Carl von Clausewitz, 1832

³²Greenwood and Hammes, *War Planning for Wicked Problems*

³³ Echevarria II, *Clausewitz's Center of Gravity: Changing our Warfighting Doctrine-Again*, 21

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