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LECTURA RECOMENDADA

**El Concepto de Centro de Gravedad: Teorías contemporáneas,
comparación e implicaciones**

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MOTIVACIÓN A LA LECTURA

Este artículo es importante porque nos permite conocer la aplicación de teoría fundamentada y los lentes metodológicos, epistemológicos y ontológicos para describir las teorías contemporáneas prevalentes sobre el concepto de centro de gravedad, originado en los escritos de Clausewitz. Incluye las teorías de John Warden, Joe Strange y Richard Iron, Antulio Echeverría II, Milan Vego, Dale Eikmeier, y Jacob Barfoed.

Qué es el centro de gravedad y cómo encontrarlo son preguntas clave para los estrategas y planificadores militares, desafortunadamente no hay una respuesta simple a esas preguntas o a la cuestión implícita de cómo hacerlo. El propósito de este artículo es clarificar los conceptos y a través de una matriz comparativa brindar una guía que sirva al planificador militar.

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The centre of gravity concept: contemporary theories, comparison, and implications

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ABSTRACT

This article applies grounded theory and epistemological, teleological, ontological, and methodological (ETOM) lenses to describe the prevalent contemporary theories of the centre of gravity concept, originated by Carl von Clausewitz. These include the theories of John Warden, Joe Strange & Richard Iron, Antulio Echevarria II, Milan Vego, Dale Eikmeier, and Jacob Barfoed. The article then compares the theories across 14 deduced theoretical aspects and produces a comparison matrix, that can be used as an analytical tool, and discusses implications as guidance for further research and doctrine development. The article argues that the term “centre of gravity” is polluted, and that the application of the term in military planning and doctrines requires careful attention to the specific theory being applied, so that logical consistency and clear, accurate communication is achieved. Alternatively, the concept may be removed from doctrine altogether, renovated with inclusion of a new unpolluted term, or reconstructed with removal of the centre of gravity, leaving a “critical factor analysis” concept behind. This article also provides a level of granularity to the debate about the concept, that renders critics like Paparone & Davis Jr and Zweibelson partly irrelevant and can provide a more nuanced and qualitative basis for future discussion.

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Introduction

A military strategist’s primary problem is to find the answer to the question, “What should be done?” (Gray 2010, 129). As recently seen in Afghanistan, getting the answer wrong can have devastating consequences. This article focuses on *the centre of gravity concept*; the primary concept in military strategy-making to find the answer to the question raised above.

What is the centre of gravity and how to find it are key questions raised by military strategists and planners. Unfortunately, there is not a single answer to those questions, or the implicit question about what to do with it. When applying the centre of gravity concept, one must make a choice between different theories and doctrines, vulnerable to subjective interpretation, that all have different qualities attached. Therefore, the purpose of this article is to clarify differences between the most prevalent contemporary centre of

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gravity theories in a comparison matrix, and identify implications, that can be used as an analytical tool and guidance for future research or doctrine development in support of the military strategist or planner.

Background

It was in a similar situation to the experience in Afghanistan, the aftermath of its defeat in the Vietnam War, the United States Army spiralled into existential scrutiny, desperately searching for a way of keeping warfighting relevant in the future (Blythe 2018, 43). A renewed interest in both Prussian and Soviet military theory followed. A contemporary publication of a new translation of the opus magnum *On War* by the Prussian military philosopher Carl von Clausewitz (1976), increased the access to his thoughts and military theory, and some of its parts were adopted into US and NATO military doctrines. The concept of the centre of gravity became central to Western doctrine, and has remained so (NATO, 2019b; US JCS, 2020). Since then it has become a generic concept applied in all types of military operations, including inter-agency security operations conducted within a comprehensive approach.¹

On War is divided into eight books. The historian Bernard Brodie claims that the manuscript was a “work in progress” and that Clausewitz only considered Book I and VIII finished to his satisfaction (Clausewitz 1976, 642). In Book VIII, Clausewitz emphasises the importance of identifying the right “centre of gravity” in the opponent to direct the effort against him most effectively (ibid, 595), also known as “good strategy.” Clausewitz also indirectly linked centre of gravity to the commander’s *coup d’oeil* – his ability to see things simply by identifying the entire business of war completely with himself (ibid, 578). According to different sources, the term “centre of gravity” appears about 40–50 times in Clausewitz’s book, most often with no particular or consistent meaning (Clausewitz.com). He discusses it in three different places with different meanings:

- In Book II, *On the Theory of War*, he describes centre of gravity as Blücher’s enterprising spirit (Clausewitz, 163).
- In Book VI, *Defense*, centre of gravity is described as “where the mass is concentrated most densely” (ibid, 485).
- In Book VIII, *War Plans*, he describes the centre of gravity as “the hub of all power and movement, on which everything depends,” though primarily in terms of army, capital or ally (ibid, 595–596).

While Angstrom and Widen (2014, 61) interpret this as examples of centres of gravities at tactical, operational and strategic levels, the inconsistency between the books, together with the translation itself, have been the root causes for debate and diverging theories on the subject.

The consequence of choosing the wrong theory may lead to an unfavourable answer to “what should be done,” causing the entire exercise to become meaningless at best and fatal at worst. As Smith et al. (2015) demonstrate, when they applied three theories or approaches to centre of gravity analysis, each theory led to different centres of gravity for the Islamic State of Iraq and the Levant (ISIL) that would have consequently led to different strategies if it had been applied in reality. Perhaps all of them would have worked, or none of them, but that is not the point for this article.

Purpose

This article will, as briefly touched upon above, describe the most prevalent contemporary theories on the concept of centre of gravity since its introduction in US and NATO doctrine, and establish a comparison matrix and implications that can be used as an analytical tool and guidance for future research or doctrinal purposes. The matrix can be used to place critics, doctrines and praxis in a theoretical framework, but also to identify where empirical discrepancies lie between all involved actors in an integrated, inter-agency planning effort as an aid for further harmonising processes – or as a recommendation for the concept to be imposed a doctrinal death. In the case of the latter, it would not be the first time. Zweibelson (2015) offers strong ontological and epistemological arguments against it, but Paparone and Davis Jr. are most explicit: “The community of military theoreticians should raise anchors and permit dead metaphors, such as centre of gravity, to sink, while setting sail for the explorations ahead” (Paparone and Davis 2012, 74–75). This article provides more nuances of the concept than the mentioned critics have taken into account, partly rejecting their criticisms, and is therefore a contribution to the ongoing academic discussion about the centre of gravity concept within the wider military innovation discourse.

This article will then answer the question: *How can the most prevalent contemporary theories on the centre of gravity concept be described and compared through epistemological, teleological, ontological, and methodological (ETOM) lenses, and what are the possible implications of this?*

This article will first explicate the applied methodology, then analyse the six most prevalent centre of gravity theories through the ETOM lenses in historical order. A paragraph comparing the theories based on the established comparison matrix is then followed by a discussion on the main implications related to doctrinal application, challenges of application, and the potential of an alternative concept.

The main conclusion is that the centre of gravity concept is *polluted* and application in doctrine needs more clarity and precision to mitigate the current weaknesses, as well as a reassessment of the chosen theories. This article also advises to reconsider the centre of gravity concept as a generic concept applied in stabilisation and security operations within a comprehensive approach. Finally, the conclusion points towards further research related to the utility of the centre of gravity concept in theory, doctrine and praxis.

Methodology

This article analyses six centre of gravity theories based on grounded theory (Glaser and Strauss 1967) and described through ETOM lenses: *epistemologically in the meaning*: the frame of reference that shapes the understanding; *teleologically in the meaning*: what the purpose is, *ontologically in the meaning*: what it is; and *methodologically in the meaning*: how the theory prescribes to be applied.

The ETOM perspective is original in its concentrated form and chosen based on Sookermany’s (forthcoming, 2020) chapter “Philosophy of Military Sciences” in *Handbook of Military Sciences*. The chapter recommends analysing military scientific topics from those four perspectives to reveal the scientific substance and provide

a solid theoretical platform for further academic endeavours in the topic. This approach seems to be a valuable scientific method to analyse and better understand the centre of gravity concept, given the mentioned divergent interpretations and criticisms.

The level of detail in the ETOM analysis was a result of grounded theory and established after the initial analysis of the selected theories. The theories were then crosschecked against a spectrum of aspects that had come to light from each theory, to identify to which level of granularity potential differences exist. The result is a total of 14 different aspects, including a theoretical categorisation of the method as being either linear or non-linear (deductive or inductive). This final aspect was included due to the contemporary interest in artificial intelligence (AI) support in military activities, and AI is better suited for deductions than abductions and inductions when there are few data to learn from (Morgan et al. 2020; Larson 2021).

This article has selected the most prevalent centre of gravity theories in the academic debate since the 1980s for a deeper analysis. The selection criteria are influence on doctrine and praxis, and completeness in relation to the chosen ETOM-framework for the analysis. The chosen centre of gravity theories selected for this article are those of John Warden, Joe Strange & Richard Iron, Antulio Echevarria II, Milan Vego, Dale Eikmeier, and Jacob Barfoed. Warden is chosen due to his influence on the 1990–91 Gulf War and subsequently on doctrine development. Strange & Iron’s theory is selected due to the influence of Strange’s structured analysis method in doctrine and subsequent theory development. Echevarria is included due to his critics of doctrine and influence on centre of gravity thinking among US Army officers, doctrine and praxis. Vego is a natural selectee due to his critical academic work on the topic and influence on US Navy officers and joint doctrine. Eikmeier is included due to his critical and constructive contributions in the academic debate and influence on theory, doctrine and praxis. And finally, Barfoed is chosen due to his contribution and influence on NATO doctrine. The criteria of completeness was introduced to limit the number of influential theories and ruled out for example Rueschoff and Dunne’s (2011) contribution to methodology for an “inside-out” identification and analysis, as well as Butler’s (2014) “Godzilla” methodology for validation, although both have been used alongside Eikmeier in praxis by NATO (the authors own experience).

Contemporary theories on the concept of the centre of gravity

Warden’s theory on the centre of gravity

Colonel John A. Warden published in 1988 the book *The Air Campaign* that was the philosophical and theoretical basis he brought with him when tasked to plan the air campaign for the 1990–91 Gulf War to liberate Kuwait from Iraqi occupation (Warden 2000, ix). In his 1995 article “The Enemy as a System” in *Airpower Journal* he laid out his “Five-Ring Model” (Warden 1995) that was a matured version of his theory from the mentioned book.

Epistemologically, the theory he formulates stems from his interpretation of patterns he observed from a wide spectrum of military history, from Alexander the Great to the 1990–91 Gulf War. His reading of Stephen Hawking, systems theory, anatomy and

thermodynamic theory provided him with a set of explanatory analogies. He also read, at least in part, the 1976 Howard and Paret translation of Clausewitz's *On War*, including the part about the centre of gravity in Book Eight.

Teleologically, he relates the centre of gravity concept to his "Five-Ring Model" to understand the actor as a system, or a system of systems, that can aid both strategic and operations design. The theory can then aid in the identification of what is to be decisive to target and protect, assisting in a possible "parallel attack" approach that may rapidly achieve the effect of "strategic paralysis." The theory, he claims, is universally applicable to any conflict or situation, at the strategic, operational, and tactical levels. The only exception to this theory is if an entire population rises to conduct a defensive battle against an invader, somewhat diminishing the theory's potential utility (ibid, 53).

Ontologically, he uses the centre of gravity description from Clausewitz "the hub of all power and movement" and explains it as a term borrowed from mechanics, "indicating a point against which a level of effort, such as a push, will accomplish more than that same level of effort could accomplish if applied elsewhere" (Warden 2000, 7). He claims that the centre of gravity "describes that point where the enemy is most vulnerable and the point where an attack will have the best chance of being decisive" (ibid). Only physical centres of gravity exist, since an actor's morale is human and beyond the realm of the predictable (Warden 1995, 43). Warden defines his five rings to be "centres of gravity, which are also rings of vulnerability" (ibid, 49): leadership, organic essentials, infrastructure, population, and the fielded military (ibid, 44–49).

The leadership or command ring is the function that provides direction for the system, considered as the most critical, as it is the only element of the actor that can "make concessions, [...] make the very complex decisions that are necessary to keep a country on a particular course, and that can direct a war" (Warden 1995, 49). The command communications are also considered a part of this ring (ibid). The organic essentials ring represents "those facilities or processes without which the state or organisation cannot maintain itself" (ibid, 50). Energy products such as electricity and petroleum are considered essentials to modern society, that modern society would dramatically change or even perish if these commodities were no longer available (ibid, 50). The infrastructure ring contains the transportation system that moves civil and military goods and services around the actor's entire area of operations, including roads, railways, bridges, airfields, and ports (ibid). It also contains most of the industry, since little of this category falls within the organic essentials ring, and implicitly represents higher redundancy (ibid). The population ring represents people as individuals, which act differently from culture to culture, and whose reactions are difficult to predict (ibid, 50–51). In Vietnam, the American population was successfully targeted indirectly through military casualties, while the bombing of civilians in Germany and Britain during World War II did not weaken their morale (ibid). The fielded military ring has the function of protecting the other rings, or to threaten those of an enemy (ibid). Warden considers the centres of gravity to be static, meaning that there will always be a five-ring construct of centres of gravity, though the content of these rings may change over time as the situation evolves (ibid, 52–53).

Methodologically, the theory has provided a framework to allocate the names of the centres of gravity. Identification and validation are based on the knowledge and understanding of the actor. Analysis of each centre of gravity is conducted by applying the same five-ring model for each of them, all the way down to the lowest relevant level (ibid, 49–54).

This analysis represents a linear, deductive and reductionist method. However, the establishment of the centres of gravity is based on the understanding of the actor, causing the method to be more intuitive and non-linear.

Strange & Iron's theory on the centre of gravity

Professor Joe Strange and Colonel Richard Iron published in 2005 the article "Understanding Centers of Gravity and Critical Vulnerabilities" in two parts: 'What Clausewitz (Really) Meant by Center of Gravity'² and "The CG-CC-CR-CV Construct: A Useful Tool to Understand and Analyze the Relationship between Centers of Gravity and their Critical Vulnerabilities." They clarify and build on Strange's previous work from 1996, "*Centers of Gravity & Critical Vulnerabilities: Building on the Clausewitzian Foundation So That We Can All Speak the Same Language.*" Their article was a response to the contemporary academic debate about the centre of gravity in US doctrine, but also relates to British and Australian doctrines.

Epistemologically, the theory they describe stems from their interpretation of Clausewitz's original work *Vom Kriege* (1832) and its different English translations, from Graham (1873) to Howard and Paret's (1976) named *On War*. Their interpretation is also based on the Schneider-Izzo essay "Clausewitz's Elusive Center of Gravity" (1987). The contemporary debate with input from US doctrines and Warden's "The Air Campaign" from 1988 (2000, ix), inspired Strange's invention of the CG-CC-CR-CV construct. Their arguments are exemplified through historical cases from the two World Wars, Yom Kippur 1973, The Gulf War 1991, Afghanistan 2001, and Iraq 2003.

Teleologically, they relate the centre of gravity (CG) concept to operations design as an aid to identify what is going to be decisive in the operation (Part 2, 16). Furthermore, the theory assists a possible indirect approach through the deduction of critical vulnerabilities. The theory, they claim, is applicable to any conflict or situation at the strategic and operational levels, but less so at the tactical level.

Ontologically, they define centres of gravity as "physical or moral entities that are the primary components of physical or moral strength, power and resistance" (Part 2, 7). Centres of gravity are characterised by being dynamic, positive and active agents (people in formations and groups, or as individuals); being obvious (physical more so than moral, depending on the richness of one's intelligence); and being powerful and strike effective (if not heavy) blows (Part 1, 15). They point out specifically that the centres of gravity "possess certain characteristics and capabilities, and benefit from a given location or terrain" (Part 1, 15). The centre of gravity is therefore a dynamic, and transitory, force related to the situation in time and space. A part of that situation is also the adversarial aspect. Whether something is a strength or not relates to the adversary or group of adversaries and their strengths and weaknesses; "centers [sic] of gravity are formed out of the relationships between the ... adversaries" (Part 1, 9).

As the definition points out, the centre of gravity can be both a physical and a moral entity. The physical centres of gravity are the "active agents that endeavour to destroy the enemy's capability and will to resist" (Part 1, 9), i.e. the military entity at a specific level of command like an Army, a Corps, a Division, etc. that *is or could be* tasked to

do the decisive action(s). Moral centres of gravity “function as active agents that influence or control physical CG’s [sic]” (Part 1, 10). They have the will to fight and the ability to command the resources to fight (ibid), i.e. the political leader, the political elite (the “king makers”), or a strong-willed population (like the Palestinians or Israelis).

Methodologically, the theory introduces a model for centre of gravity analysis with three additional sub-concepts: *critical capabilities* (CC) (the primary ability or abilities of the centre of gravity within a given context); *critical requirements* (CR) (conditions, resources and means that are essential for a centre of gravity to achieve its CC); and *critical vulnerabilities* (CV) (those CRs or components thereof, that are deficient, or vulnerable to neutralisation or defeat in a way that will contribute to a centre of gravity failing to achieve its CC (Part 2, 7–8)). The CVs are known weaknesses, whether existing, probable, possible or potential. They point out that CVs may be of the silver-bullet type that can end the conflict in a single blow; however, CVs are normally of the lead-bullet type, producing a cumulative effect on the CCs (Part 2, 8). The prescription for the analysis is to select one or more centres of gravity and for each CG deduce CCs, and for each CC deduce CRs, and then for each CR deduce CVs, if there is any.

This analysis represents a linear, deductive and reductionist method. However, the establishment of the centre of gravity is based on an understanding of the actor and the environment acquired through methods that are more intuitive and non-linear.

Echevarria’s theory on the centre of gravity

Professor Antulio J. Echevarria II is a retired US Army officer, and a historian with German military theory as his primary research area (Echevarria II, 2020). In 2000, he published the book *After Clausewitz: German Military Thinkers Before the Great War*, and in 2002 his paper “Clausewitz’s Center of Gravity: Changing Our Warfighting Doctrine – Again!” was published by the US Army War College as his contribution to the contemporary debate. He further published articles in the *Naval War College Review* and the *Air & Space Journal* in 2003, and in the *Joint Force Quarterly* in 2004 to convey his theory to the entire US military community.

Epistemologically, his theory is primarily based on his interpretation of Clausewitz original work *Vom Kriege* (1832) and physics or mechanics as interpreted at that time. His understanding is that Clausewitz’s military centre of gravity and the centre of gravity of the mechanical sciences share many of the same properties (Echevarria 2002, 1). He claims that other theories and doctrines have drifted away from Clausewitz’s original meaning of the concept, forgetting the inspiration Clausewitz took from leading philosophers, scientists, and other thinkers of his day (ibid, 6).

Teleologically, identification and engagement of the centre of gravity is done to achieve a total collapse of the enemy, what may be considered both as an effect and an objective (ibid, 12–13). This makes the centre of gravity a strategic concept to aid the establishment of the strategic “way” within an “ends-ways-means” construct, but only in wars designed to defeat the enemy completely (ibid, 15). However, Echevarria is open to the concept being applied in other wars than those of annihilation, though pointing out that it is neither appropriate nor necessary in all cases (ibid, 15–16).

Ontologically, Echevarria describes centre of gravity as “a focal point”: the point where the forces of gravity converge within an object, or the point an object’s weight is balanced in all directions (ibid, 6). This is a relatively simple calculation for a physically static object, though this is more difficult for more complex moving systems such as human beings or social systems, which must be artificially “frozen” in time and space (ibid, 7). Being a factor of balance in a moving complex system, the centre of gravity is transitory by nature and remains a valid concept only where the enemy possesses sufficient “unity” or “interdependence” to act as a single body (ibid, 10). Echevarria, therefore, claims further that the centre of gravity has a centripetal quality: it represents a single focal point for the entire enemy system, and as such exists on independent levels of war and can be both ideological/psychological and physical by nature (ibid, 12, 14 & 18). He defines centres of gravity as “focal points that serve to hold a combatant’s entire system or structure together and that draw power from a variety of sources and provide it with purpose and direction” (ibid, 19).

Methodologically, the theory prescribes a three-step process to determine a centre of gravity (ibid, 16–19):

- Step 1: Determine whether identifying and attacking a centre of gravity is appropriate for the type of war that will be waged.
- Step 2: Determine whether the adversary’s whole structure or system is sufficiently connected to be treated as a single body.
- Step 3: Determine what element has the necessary centripetal force to hold the system together.

Echevarria further recommends to (ibid, 19–20):

- Refrain from applying the concept to every kind of war; reduce the competition that can occur between centres of gravity and political-military objectives.
- Identify where the connections – and gaps – are in an enemy’s entire structure or system before deciding whether a centre of gravity exists; centres of gravity only apply where a combatant is sufficiently interconnected to act with unity.
- Focus more effort on identifying the specific effect(s) to be achieved by attacking a centre of gravity.
- Continually reassess centres of gravity. However, re-evaluate the need to attack centres of gravity that are extremely transitory.
- Resist “salami-slicing” the adversary into tactical, operational, and strategic centres of gravity. The bulk of the efforts and intermediate objectives should focus on destroying the centre of gravity.

Echevarria claims that the centre of gravity concept “requires the ability to predict, with some reasonable probability, how to achieve at least first and second-order effects, and possibly more” (ibid, 13). Emphasising to avoid prescriptive formulae, the calculation of a centre of gravity should be considered a matter of “strategic judgment” at the highest levels (ibid).

This analysis then represents a linear and deductive method; however, the establishment of the centre of gravity is based on an understanding of the actor and the environment that is gained through a more intuitive and non-linear method.

Vego's theory on the centre of gravity

Professor in Joint Operations at US Navy War College, Milan N. Vego is a historian with both naval and merchant maritime experience. He has authored twelve books and numerous articles, including his monumental work *Joint Operational Warfare: Theory and Practice* from 2007. It is in this book he formulates his theory on the centre of gravity.

Epistemologically, Vego's theory is inspired by the Howard and Paret's 1976 translation of Clausewitz's *Vom Kriege*, recognising that the term "centre of gravity" was a mistranslation based on a misunderstanding (Vego 2007, VII-13). However, Vego's vast knowledge and understanding of military history and joint operations theory in general further inspired him to refine the concept to fit a purpose within operational art.

Teleologically, Vego's centre of gravity concept is designed to enhance "the chance that one's sources of power are used in the quickest and most effective way for accomplishing a given political/military objective" (ibid). The concept supports the following principles of war/operations: objective, mass, and economy of effort (ibid, VII-26). On the precondition that the centre of gravity is directly related to the military objective, the concept is a "highly useful tool for planners at all command echelons, but especially at the operational and strategic levels" (ibid). He further states that "the key to success is to identify the friendly centre of gravity and protect it, and to identify the enemy's centre of gravity and then attack it with the requisite determination" (ibid, VII-13). Vego is only relating the concept to military combat against an enemy to be annihilated through destruction, defeat, or at least neutralisation (ibid), but he claims it can be applied in all types of operations, i.e. from major combat operations to counter insurgency and stabilisation. It can also be applied at the strategic, operational and tactical levels of war; however, the utility is reduced with reduced complexity at the lower tactical levels (ibid, VII-26).

Ontologically, Vego defines centre of gravity as "a source of massed strength – physical or moral – or a source of leverage whose serious degradation, dislocation, neutralization [sic], or destruction would have the most decisive impact on the enemy's or one's own ability to accomplish a given political/military objective" (ibid, VII-13). He emphasises that "massed" should be understood as "massed effect," and is not about physical concentration of military units but the ability to concentrate the effect of their weapons (ibid). Furthermore, the physical centre of gravity relates to the military, while the moral centre of gravity relates to the non-military leadership of a state or another organisation, or its ideology and legitimacy. The last type, "source of leverage," could be the hostage for the hostage-takers (ibid). It is the situation and the objective that determine a centre of gravity, not the other way around; every objective has a corresponding centre of gravity (ibid, VII-21&24). Centres of gravity exist at all levels of war, and there are multiple centres of gravity at each level, although there is often only one at the strategic and operational levels (ibid, VII-25). The centre of gravity is also dynamic and reflexive, related to an aspect of the nature of war: the competition between opposing wills. It changes with the factors of forces in space and time, the ever-changing relative strengths and weaknesses of the opposing force, and the progress

of a campaign with several intermediate objectives in phases, stages and steps, effectively distinguishing between current and potential centres of gravity (ibid, VII-20-25).

Vego established the overarching concept of “critical factors” that he divides into two subgroups: critical strengths and critical weaknesses. It is within this concept Vego puts the centre of gravity and critical vulnerabilities (see Figure 1).

He defines critical strengths as friendly or enemy capabilities considered essential for accomplishing a given or assumed military objective, while critical weaknesses are those sources of power that are considered essential for the accomplishment of the objectives but are at the same time grossly inadequate to perform their intended function or task. Critical vulnerabilities are those elements of one’s military or non-military sources of power open to enemy attack, leverage, or exploitation (ibid, VII-15-16). In most cases, critical vulnerabilities related to critical weaknesses, though critical strengths can be vulnerabilities in certain situations if they lack sufficient protection or support (ibid, VII-16).

As Figure 1 shows, the theory also distinguishes between tangible and intangible critical factors; however, the figure can be misleading at this point. Vego claims that any centre of gravity is composed of a combination of tangible and intangible sources of power (ibid, VII-18). Whether one or the other is predominant is directly related to the nature of the conflict or war and the objective to be accomplished; and, as illustrated in Figure 2 and 3, the more the objective is non-military in its content, the more intangibles fall within the scope of a given centre of gravity (ibid). Therefore, in a high-intensity war, intangible elements of a centre of gravity are primarily present at the national- and theatre-strategic levels, while in operations other than war intangible elements of the centre of gravity are well represented even at operational and tactical levels (ibid). To further clarify the composition of a critical strength and a centre of gravity, Vego

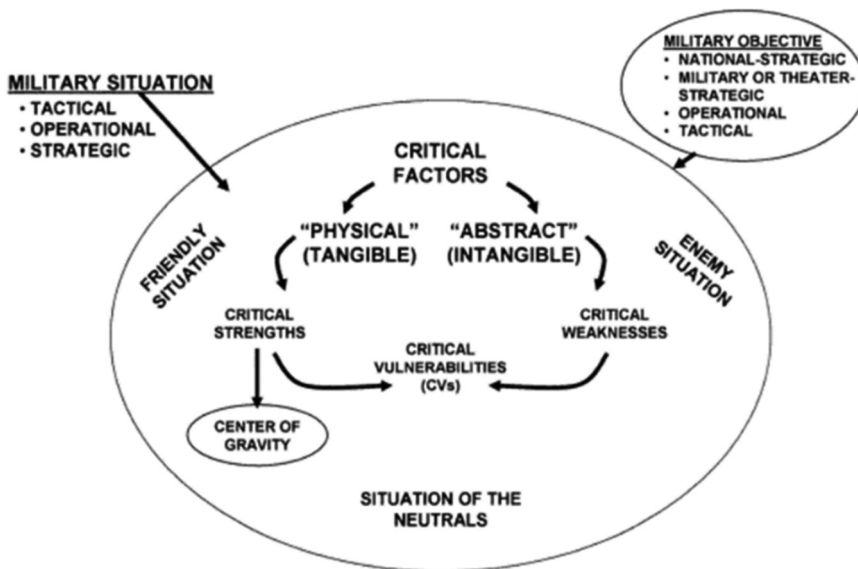


Figure 1. Vego's concept of critical factors and centre of gravity (ibid, VII-15).

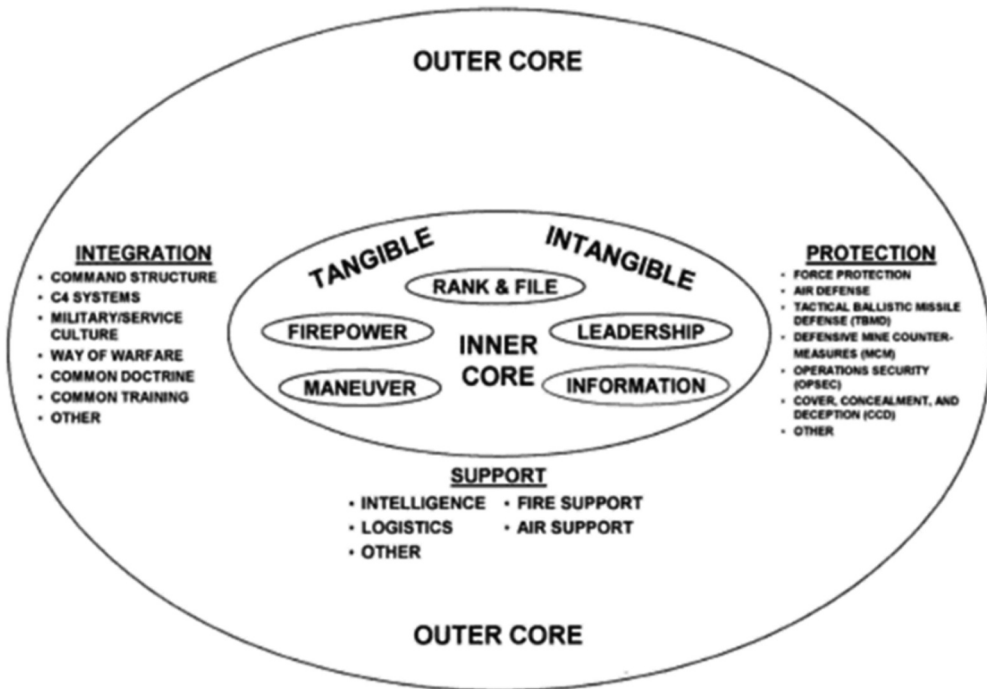


Figure 2. Vego's composition of a military centre of gravity (ibid, VII-19).

introduces the elements of *integration*, *protection*, and *support or sustain* as integral parts, and distinguishes between an “inner core” and “outer core.” Regarding a centre of gravity, the main source of power can be arbitrarily called the “inner core,” while all other elements can be grouped as the “outer core” (ibid, VII-17). The following figures illustrate the difference in composition between a military and non-military centre of gravity:

Methodologically, Vego emphasises that an analytical process by itself cannot ensure that a centre of gravity will be properly determined, but relies on the knowledge, understanding, and (most importantly) the judgment and wisdom of the commanders and their staff for selecting the proper methods and procedures for attacking and protecting it (ibid, VII-14). He further points out that “despite all the enormous advances in information technologies, there is a limit to what can be technically transmitted and, even more important, to what the human element can possibly digest and use in making a sound decision” (ibid). Therefore, the key is to focus on the critical factors in the military situation related to the objective. The enemy's critical strengths and weaknesses cannot be properly determined if one does not fully understand the enemy's society and military culture, political traditions and social customs, or if one has an exaggerated sense of one's own superiority (ibid, VII-17). A similar understanding of oneself as a precondition is therefore the key to avoiding mirror-imaging – an extremely difficult thing to do – in the process of analysis (ibid).

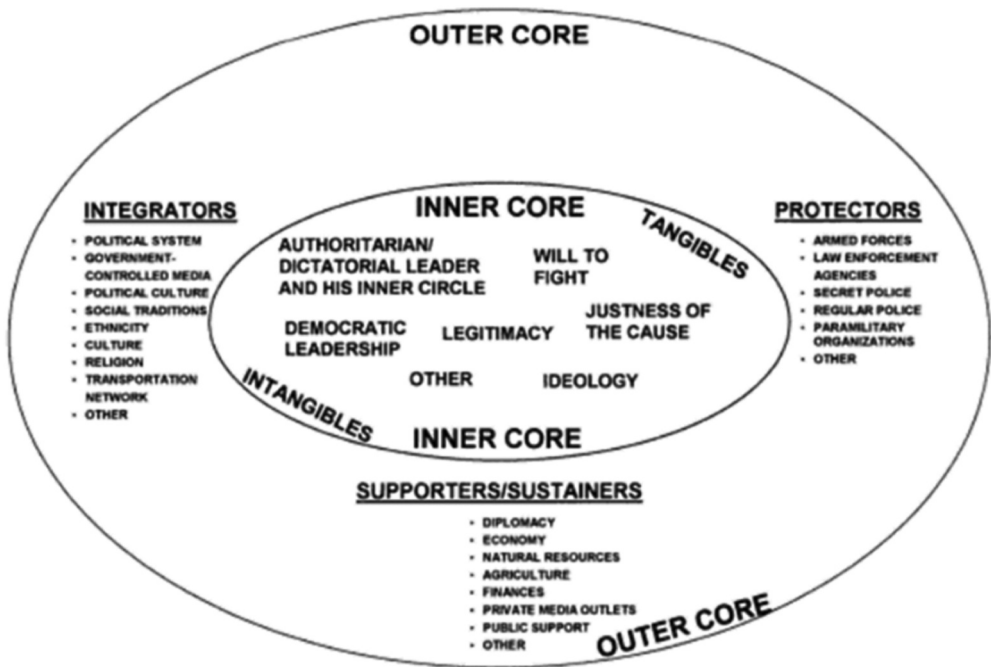


Figure 3. Vego's composition of a non-military centre of gravity (ibid, VII-18).

This method is based on an intuitive and non-linear approach in the establishment of the centre of gravity; however, the presentation of critical factors, critical strengths, critical weaknesses, critical vulnerabilities, and centres of gravity follows a linear, deductive and reductionist logic.

Eikmeier's theory on the centre of gravity

Dale Eikmeier retired as a US Army Colonel after service in Europe, Asia, the Pacific, and the Middle East, and participation as air defence artillerist and joint and strategic planner in the operations Desert Shield, Desert Storm, Enduring Freedom and Iraqi Freedom (Small Wars Journal). He has taught at the School of Advanced Military Studies, the US Army War College, and the Army Command and General Staff College (ibid). His Master in Military Arts and Sciences monograph from 1998 was optimistically named "The Center of Gravity Debate Resolved," and he later published several articles in Military Review and Small Wars Journal disseminating, expanding, explaining and defending his theory on the centre of gravity concept. However, it was in his book chapter "Modernizing the Center of Gravity Concept – So It Works" (Eikmeier 2012) that he gathered his work into a concentrated form.

Epistemologically, Eikmeier's theory builds on systems theory (Peter M. Senge, 1990), Strange's centre of gravity theory, Arthur F. Lykke's "ends, ways and means" strategy theory (1989), and is further inspired primarily by Strange & Iron, and Vego's theoretical contributions (Eikmeier 2012, 133–168). (This means that indirectly Clausewitz also influences

him). On the other hand, Eikmeier's theory is also shaped by opposing views in the contemporary debate (primarily Echevarria), and US and NATO doctrine. His own experience as a practitioner of operational art and strategy has also clearly been a handrail in his work.

Teleologically, Eikmeier seeks an operational art concept, or analytical tool, that has high utility for the military planner in the operational design process. It supports identification of possibilities for both direct and indirect approaches (ibid, 160). His theory is universally applicable, but the greater the complexity the greater utility in the concept (ibid, 153–154). For practical purposes, Eikmeier claims that the utility is primarily at the strategic and operational levels, and not so much at the tactical level (ibid, 154). The utility lies in identification of decisive points or conditions and targets that can aid the formulation of an operational (direct or indirect) approach.

Ontologically, Eikmeier defines the centre of gravity as “the primary entity that inherently possesses the critical capabilities to achieve the objective” (ibid, 142). He emphasises that this definition meets four criteria necessary for the utility of the concept: *clarity*, *logic*, *precision*, and *testability*. The centre of gravity is characterised by being the primary “doer” to achieve an objective, and is the entity supported by other means (ibid). Therefore, it is the challenge of achieving the objective within a complex, dynamic, and competitive environment that defines the centre of gravity, and dictates its dynamic nature (ibid, 154–156). Although he recognises that the adversary holds a key role in determining the centre of gravity, it is secondary to the objective (ibid, 156).

The centre of gravity is furthermore a physical, tangible entity that can be targeted, while abstract and intangible moral factors are considered to reside inside physical entities (ibid, 143). Abstract factors in their intangible form can be found among the critical factors: *critical capability*, *critical requirement* and *critical vulnerabilities*. Eikmeier defines critical factors as follows (ibid, 164): critical capabilities are “primary abilities essential to the accomplishment of the objective which merits a centre of gravity to be identified as such.” Critical requirements are “essential conditions, resources and means the center of gravity requires to perform the critical capability.” critical vulnerabilities are “critical requirements or components thereof which are deficient or vulnerable to neutralization, interdiction or attack in a manner achieving decisive results.”

Methodologically, Eikmeier makes a distinction between identification and analysis of the centre of gravity. In his six-step “ends, ways and means” method, the first four steps identify the centre of gravity, while the last two analyse it (ibid):

- (1) Identify the organisation's desired ends.
- (2) Identify “ways” or actions that can achieve the desired ends. Select the way or ways the organisation is most likely to use. That selection is the critical capability or capabilities. The “ways” are the organisation's critical capabilities.
- (3) List the organisation's means or resources available or that are needed to execute the critical capability.
- (4) Select the entity from the list of means that inherently possesses the critical capability. This is the centre of gravity.
- (5) From the remaining means, select those that are critical for the execution of the critical capability. These are the critical requirements.

- (6) Identify those critical requirements that are vulnerable to adversary actions, known as critical vulnerabilities.

The critical requirements and vulnerabilities can then be used as a starting point for determining decisive points or conditions in the operational design (ibid, 159).

This analysis represents a linear deduction, but it is based on a non-linear understanding.

Barfoed's theory on the centre of gravity

Doctor and officer in the Danish Air Force Jacob Barfoed published in 2018 the article “A COG Concept for Winning More Than Just Battles” in the *Joint Force Quarterly Journal*. The article reflects the essence of his theory on the centre of gravity from several previous publications as part of his PhD work and his concurrent participation in the NATO AJP-5A writing team on the subject. Writing for a primarily American audience, the article uses the United States as an example to explain the theory, though it is applicable to any actor.

Epistemologically, according to Barfoed, the theory is inspired primarily by Strange and Eikmeier, and builds on Strange's concept of moral and physical centres of gravity (Barfoed 2018, 123). Theoretical influence also stems from a myriad of centres of gravity and strategy theorists such as Clausewitz, Fuller, Liddel-Hart, Warden, Schelling, and Pape, as well as from the Effects Based Operations (EBO) concept.

Teleologically, his motive is to improve the usefulness of the concept for strategic and operational planners. The purpose of his theory is to provide a method to not only link actions and effects to objectives, but to link national (or any actor's) strategic objectives to operational and tactical objectives (ibid, 116 and 123). Furthermore, the theory assists the choice between a direct or indirect approach in the courses of action developed, and the establishment of rules of engagement and limitations (constraints and restraints) (ibid, 121). The theory, he claims, is applicable to any conflict or situation and actor, at strategic, operational, and tactical levels (ibid, 118).

Ontologically, he defines the centre of gravity as “an entity that is the primary component of physical or moral strength, power, and/or will to fight at a given level of command” (ibid, 116). He claims that, at the national strategic level, both moral strength (will) and physical strength (ability) centres of gravity exist and are physical entities that vary in purpose (ibid, 117). At the lower levels of command, he claims, only physical strength centres of gravity normally exist (ibid). The actor's strategic will centre of gravity can be affected through persuasion or coercion; influencing the actor's strategic ability centre of gravity will affect the actor's ability to carry out his or her overall strategy (ibid). Influencing an actor's operational centre of gravity affects his or her ability to achieve operational objectives with the current course of action (COA) (ibid). The physical strength centres of gravity are therefore directly linked to a chosen strategy or course of action, and are dynamic and transitory depending on the situation in time and space. If an actor pursues a hedging strategy with two or more strategies simultaneously, that utilise different physical strengths that are capable of achieving the actor's objectives by themselves, then multiple centres of gravity can exist simultaneously (ibid, 118).

He further claims that centres of gravity have *critical capabilities* (what the centre of gravity can do in context of the actor's mission); *critical requirements* (means, resources, and conditions essential for a centre of gravity to perform its critical capabilities); and *critical vulnerabilities* (deficient, missing, or otherwise contextually vulnerable critical requirements) (ibid, 117–120).

More specifically, his *strategic will* centre of gravity is defined as “the primary entity that inherently possesses most of the following critical capabilities: determines – and can alter – policy and strategy; commands the resources and means required to achieve strategic objectives; and inspires and provides moral cohesion and the will to fight” (ibid, 117). In other words, this is the actor's politically strategic decision-making entity, typified in a strong political leader, a ruling elite, or a strong-willed population (or segment of it) determined to prevail (ibid). He thereby rules out ethnic nationalism, ideology or religion, or alliance cohesion as candidates for centres of gravity, defining them instead as critical requirements.

His *strategic ability* centre of gravity is defined through his general definition for ability centres of gravity at all levels of command to be “the entity representing the primary physical strength that an actor depends on to carry out his intent and achieve his objectives at a given level of command” (ibid). Strategic ability centres of gravity can then include a coalition military task force, a particularly strong element of national military power, a national security force, a political group's military arm, or even a strong non-military entity in the event that the main strategic effort is not a military one (ibid). The strategic ability centre of gravity is not necessarily nested within the strategic will centre of gravity, but is chosen and controlled by it as part of the actor's practice of strategy (ibid). Operational (ability) centres of gravity are normally central elements or constituent parts of strategic ability centres of gravity, and can include an armoured corps, an air component command force, a maritime task force, a national police force, or a regional network of insurgent cells (ibid).

Methodologically, the theory is summarised in 25 steps that cover both the strategic (steps 1–16) and operational levels (steps 17–25) (ibid, 120–123). The precondition for the identification and validation of the strategic will centres of gravity is a sufficient understanding of the relevant environment, including all significant actors. For each actor, the first question is whether it has a political leader who possesses all the critical capabilities listed above in the strategic will centre of gravity definition (ibid, 117). If some of the listed critical capabilities are weak or missing for the actor's political leader, the support from the primary entity that possesses the weak or missing capabilities becomes a critical requirement for the political leader who is still the centre of gravity (ibid). Alternatively, the political leader is a marionette that possesses few or none of the critical capabilities for the centre of gravity, and the real strategic will centre of gravity is then the entity that actually possesses most of the critical capabilities, or the political leader shares the critical capabilities with one or more people who, as a group, is the centre of gravity (ibid). A final option is a strong-willed population that cannot be thwarted, deflected, or diluted by a political leadership, but rather dictates the policy themselves, and then constitutes the strategic will centre of gravity (ibid). Notice that the validation of the centre of gravity is included in the identification.

For identification and validation of the strategic ability centre of gravity and lower level physical strength centres of gravity, the precondition is a sufficient understanding of the objectives and alternative strategies and courses of action for each actor

(*ibid.*). The analyst must then determine what is the primary entity used in the strategy or course of action to achieve the objective(s): does it possess the most critical capabilities required to achieve the objective(s)? And, if it is defeated, does this defeat the strategy or course of action at that level of command? (*ibid.*, 118). An actor may use different strengths (centres of gravity) for different strategies or courses of action, so the physical strength centres of gravity will have to be analysed for every strategy and course of action (*ibid.*). Since the strategy or course of action will probably change as the situation develops, it is an iterative process to determine the current physical strength centre(s) of gravity for each actor.

Once the centres of gravity and their inherent critical capabilities are identified and validated, the analysis can determine critical requirements and vulnerabilities. The conclusion of the analysis is the identified implications for the actor the analysis represents. This may include conditions, effects, actions, rules of engagement, limitations, and information requirements (*ibid.*, 120).

This analysis represents a linear deduction; however, the establishment of the centre of gravity is based on understanding of the actor and the environment in a more intuitive and non-linear way.

Comparison

From an overarching epistemological perspective, the theories on the concept of centre of gravity are predominantly based on an “American Great Power” perspective. Although not all the theorists are Americans, the origin of the concept is from a time of competition between the European Great Powers. The Howard & Paret translation of Clausewitz is also an Anglo-American interpretation. Clausewitz is still directly and indirectly the source of inspiration for all the theories, and the latest theories of Eikmeier and Barfoed build on the previous ones, except for Echevarria’s. Furthermore, all the theories emerge from American military academic institutions. Cognitive linguists George Lakoff and Mark Johnson refer to this underlying paradigm as the “Anglo-American analytic philosophy” (Lakoff et al., 2003; Paparone and Davis 2012; Eikmeier 2017).

From a teleological perspective, there are some variations. While all the theories are directed toward being an aid for the strategist or operations planner to find the most efficient way to achieve the overarching objective, they diverge in the applicability of the concept. Strange & Iron, Eikmeier and Barfoed claim that their theories have universal application across all types of operations, while Echevarria and Vego see the concept primarily as a tool in wars of annihilation. The theories also diverge in the application of the concept at different levels of command. Echevarria stands out by claiming the concept’s independence from any level; the others claim applicability to primarily the strategic and operational levels due to complexity, though less so on the tactical level.

From an ontological perspective, centre of gravity is variously defined as a strength, a vulnerability, and a focal point. The theories also claim that centres of gravity can relate to both the adversary and the objective, that they are both tangible and intangible, and there can be one or multiple centres of gravity at the same level at the same time, though each theory allows for different combinations. Yet all of the theories agree that the centre of gravity is dynamic, adapting to the changing character of the situation (though Warden can easily be misunderstood to define the centre of gravity as static, i.e. when

it is defeated, the war is won). Furthermore, all but Echevarria have a supporting construct of critical factors, though Vego's construct differs significantly from Strange, Eikmeier and Barfoed, and Warden's is a hybrid approach where the five rings are both centres of gravity and "critical factors" of a centre of gravity (though he does not use this term).

From a methodological perspective, Warden's Five-Rings theory provides a rough framework for both identifying and analysing the centres of gravity. There is also a clear development of the Strange & Iron method in Eikmeier's and Barfoed's theories, the latter building on the former while increasing the level of granularity and clarity in both identification and analysis. Vego's construct provides a detailed framework to fill in as a combined identification and analysis, while Echevarria's theory only identifies the centre of gravity and does not analyse it.

All the theories are based on induction for both identifying and analyse the centres of gravity. Although the headlines indicate a deductive analysis, it can seldom be more than "guesswork" to know what other actors have deduced. The only centre of gravity that is analysed with deduction is one's own. Therefore, Vego's warning about the danger of a self-mirroring bias when conducting induction is timely, with his emphasis on the need for a multi-perspective understanding of the operations environment and its actors, in combination with a humble and hubris-free approach to the analysis. The overall theoretical basis for all the theories is a linear and rational approach (deductive), while utilising non-linear and complex processes (inductive) that create difficulties for contemporary AI and machine learning to replace humans (Larson 2021) to apply the centre of gravity concept.

Discussion

The comparison of the theories demonstrates that the term "centre of gravity" is *polluted*, with many different meanings across teleological, ontological, and methodological aspects. This terminological pollution is however clearly not a unique case (see e.g. Hew Strachan's famous article on "The lost meaning of strategy" (Strachan 2005)). What is unique, is that when the centre of gravity concept is applied it has far more influence on strategy than the meaning of strategy itself, for the simple reason that the centre of gravity concept provides an answer to the primary strategic question "what should be done?" (Gray 2010, 129). There are three obvious areas related to pollution of the concept worthy of greater attention: *Doctrinal application*, *challenges of application*, and the potential of *an alternative concept*.

Doctrinal application

In NATO (2019a, xi) it is stated that "Allied forces require clearly understood and widely accepted joint doctrine to plan, execute, assess and sustain operations." To ensure that the centre of gravity concept is clearly understood, NATO doctrine (2019b) spends half a page in the main body and a 15 pages annex to define and explain the centre of gravity concept and its application. In comparison, US doctrine (US Joint Staff 2020) only offers five pages of explanation. In addition, while NATO relies on one consistent theory (Barfoed), the US doctrine seems to combine primarily Vego's theory "to identify" with Strange & Iron's theory "to analyse" the centre of gravity. The teleological, ontological, and methodological

differences between Vego's and Strange & Iron's theories carries a risk of inconsistency and logical flaws in the doctrinal application with even higher risk of flaws in practice. However, as touched upon in the introduction, not only clarity, but also choice of theory matters in doctrinal application. To exemplify a consequence of the difference in US and NATO doctrines for the centre of gravity concept, a hypothetical and superficial analysis of the recent US and NATO defeat in Afghanistan follows.

When President Ashraf Ghani left Kabul on 15 August 2021, almost all armed resistance against the Taliban ceased (BBC 2021). This bears the characteristic of the removal of a strategic centre of gravity. Therefore, in this example, President Ghani is labelled as a strategic centre of gravity. According to common doctrine, he should have been protected (although this still leaves open the difficult question of how this protection should have been made effective). Ontologically, the US centre of gravity is "a source of power" (US Joint Chiefs of Staff 2020, GL-6), while the NATO centre of gravity is "an entity" (NATO 2019b, 3–5); the former being far more abstract and diffuse than the latter. Both doctrines also provide guidance about what the strategic centre of gravity can be. The US doctrine offers the following options for a centre of gravity at the strategic level: "... a military force, an alliance, political or military leaders, a set of critical capabilities or functions, or national will." (US Joint Chiefs of Staff 2020, IV-22). And the NATO doctrine exemplifies a "strategic will" centre of gravity: "... a strong political leader, a religious leader or organization wielding decisive political power, a ruling elite, and a strong-willed population (or a segment of it) determined to prevail" (NATO 2019b, B-2). Both doctrines include "political leader" as a potential strategic centre of gravity, but while the US has an "all in one" description, NATO has divided the strategic centre of gravity into two (will and ability). Therefore, the application of NATO's theory may have led to the identification of the President as the "strategic will" centre of gravity, and for example the Afghan National Army (ANA) as the "strategic ability" centre of gravity. Such a division seems far more unlikely to appear with the application of the US doctrine, and a more likely outcome would have been ANA as the strategic centre of gravity, missing out on the President. Which doctrine was followed, if any, both or another, is unknown to this author at this moment, but the differences in doctrine are indicative of how the application of different theories can play a crucial role in the making of strategy. Anyway, it is an irony of fate that introduction of the centre of gravity concept was motivated by the desire to avoid future US defeats similar to Vietnam, but it did not prevent a similar outcome in Afghanistan.

Challenges of application

The 1990–91 Gulf war was the first time the centre of gravity concept was applied by the US in war since its introduction in doctrine (US Army 1986, 10). Saxman (1992, 38) wrote about the challenges the US experienced at the time: "Although the services have accepted a common joint definition for center of gravity, there is yet no common understanding among the services, and sometimes within the services, on what the concept means and how it should be employed." He further concluded that the then "current operational utility of the concept in joint campaign planning is very limited" (ibid). While Operation Desert Storm was a predominantly joint operation, subsequent military operations have been characterised by more multi-nationality and inter-agency, leading to NATO

introducing the Comprehensive Approach,³ first applied in Afghanistan. NATO is still emphasizing an approach to strategy-making and operations planning that foster enhanced cooperative planning (NATO 2018) and even integrated civilian-military planning (NATO 2021a, 1–4). There is no reason to believe that including civilians, lacking the military officer's education in the use of the centre of gravity concept, leads to a more common understanding of the concept than that described by Saxman, if any sort of common understanding is produced at all. If there is no unified understanding of the concept, the concept obviously becomes flawed in application. Therefore, it should be considered whether the concept should still be applied to all types of operations, or should only be reserved for warfighting or combat operations. On the one hand, the centre of gravity concept has proven its utility in at least the 1990–91 Gulf War, the 2001–02 invasion of Afghanistan, the 2003 invasion of Iraq, and in the 2011 war against Libya. On the other hand, in the stabilisation and security operations that followed the warfighting, the utility of the centre of gravity concept seems to diminish, and it is in stabilisation and security operations the civil-military cooperation is critical to achieve common objectives. Hence, the centre of gravity concept may be a better concept for winning wars than building peace.

An alternative concept?

The centre of gravity concept is clearly not a perfect universal tool for strategy-making, but is there an alternative, or is the strategist or planner better off without the concept? The concept underpins the principles of war that provide direction, efficacy, and efficiency; objective, unity of effort, concentration of force/mass, and economy of force (Alger 1975). There is no other single concept that has this utility, so the only option would be to remove it with loss of some value. While Zweibelson advises a removal, a doctrinal death, the only ontological and epistemological weaknesses he points out seems rooted in his own interpretation of Clausewitz and some of the aspects of terminological pollution this article reflects (Zweibelson 2015). A removal without a replacement would leave space for more intuition, the commander's *coup d'oeil*, that strengthen an environment where the rationality of power trumps the power of rationality (Flyvbjerg 2003), and increase the danger of groupthink.

One pragmatic alternative that is sometimes discussed is to agree upon one consistent theory and rename the concept, but this has earlier been discarded since the term is too deeply ingrained in the military lexicon (Saxman 1992, 39). However, in his translation of military theory into a theory for business strategy, Bungay (2011, 107) has renamed “centre of gravity” to “the source of competitive advantage.” While being ontologically descriptive, it is probably not a term that has competitive advantage over “centre of gravity” in the military doctrine communities. Until a catchier term pops up, the polluted centre of gravity term, with its ambiguous metaphorical symbolism, is likely to continue to exist and frustrate Paparone and Davies Jr.

Another pragmatic alternative is an only partial removal of the centre of gravity concept; only removing the centre of gravity from the concept, and leaving the critical factor analysis behind. In the example from above, President Ghani would then not be a centre of gravity, but a critical requirement and a vulnerability for the Afghan government. After all, he was never a “strong” political leader as NATO doctrine suggests for a “strategic will” centre of gravity, so many readers may

already have disagreed with that example at this point. The only thing history tells us in this regard is that the President was a “single point of failure” for the Afghan government at that time.

On the other hand, he was perhaps not the only one. There may have been a chain of single points of failure further down the chain of command. All the single points of failure are critical vulnerabilities in a critical factor analysis. According to common doctrine, these critical vulnerabilities should be targeted in enemies, and protected in friendly actors. The President should then have been protected, either as a centre of gravity or as a critical vulnerability, so in this case there is no practical difference with or without a centre of gravity. Anyway, the fact that the centre of gravity concept did not save the US and NATO in Afghanistan does not automatically mean that there is something substantially wrong with the concept itself. It may just have been a flawed employment of it, a human error. The problem of staving off defeat in Afghanistan may also ultimately have been insurmountable. However, the centre of gravity concept provides a priority in direction of effort that will be missing if replaced solely by a critical factor analysis, and then be less clear in answering “what should be done” to support strategy-making. On the contrary, the strategist or planner may not wish to be too concrete, too early in the strategy-making process, and would benefit from only a critical factor analysis, keeping the door open for the possibility of a hedging strategy approach with several alternative centres of gravity.

All these three areas of concern related to the terminological pollution of the centre of gravity concept deserve a deeper examination in relation to an assumed forthcoming scrutiny of the US and NATO endeavours in Afghanistan and could be decisive for the future of the centre of gravity concept in US and NATO doctrines.

Conclusion and Implications

This article has described and compared the most prevalent contemporary theories about the concept of the centre of gravity through ETOM lenses, based on grounded theory. This has included the theories of John Warden, Joe Strange & Richard Iron, Antulio Echevarria II, Milan Vego, Dale Eikmeier, and Jacob Barfoed. The comparison matrix⁴ (Table 1) provides a holistic “key word” overview of the analysis, but is also a simplification of the theories and is therefore a supplement and not a substitute analytical tool to the full text theories.

The comparison of the theories demonstrates that the term “centre of gravity” is *polluted*, with many different meanings across teleological, ontological, and methodological aspects. That conclusion implies three obvious areas of attention: *Doctrinal application, challenges of application*, and the potential of *an alternative concept*.

First, mitigation of a terminological pollution is the responsibility of the doctrines that apply the concept, requiring careful attention to the specific theory being applied, to achieve logical consistency and clear, accurate communication. Second, a special challenge naturally occurs when the concept is applied in a joint, multinational and/or inter-agency integrated planning effort within a comprehensive approach, potentially producing different understandings of the concept, if any understanding is produced at all. If there is no unified understanding of the concept, the concept obviously becomes flawed

Table 1. Comparison matrix of centre of gravity theories.

Factor/Theorist	Col. Warden	Prof. Strange & Col. Iron	Lt.Col./Prof. Echevarria	Prof. Vego	Col. Eikmeier	Lt.Col./Dr. Barfoed
Epistemology	Background US Air Force, pilot, MA from Texas Tech, and National War College	PhD in History & British Army	US Army and PHD in history	Yugoslavian Navy, merchant fleet and historian. Professor at US Naval War College.	US Army, BA in Political Science, MAs Management, Military Art and Science	Danish Air Force, US Air Force Command and Staff College, PhD from US Air War College
Theoretical basis	Military history, Clausewitz, systems theory	Clausewitz	Clausewitz Mechanics Systems theory	Clausewitz	Systems theory Strange, Lykke, (Iron, Vego)	Primarily Strange and Eikmeier, but also Clausewitz, deterrence, compellence and coercion theory (Schelling, Pape) and Effects Based Operations (EBO)
Teleology	Purpose/ motivation To aid strategic and operations design: - Decisive attack/protect - Parallel attack	To aid operations design: - Decisive - Direct vs indirect approach	To aid the strategic "way" to total collapse of the enemy	To enhance the chance that one's sources of power are used in the quickest and most effective way for accomplishing a given political/military objective	To improve the utility of the concept for the military planner	To improve the utility of the concept for the military planner. To link national strategic objectives to operational objectives, and link actions and effects to objectives. To win the war and peace, not just battles.
Application	Universal	Universal	Primarily wars of annihilation	Primarily wars of annihilation, but also other types of military operations	Universal	Universal
Levels	Strategic, operational, tactical	Strategic, operational, tactical	Independent	Strategic, operational, less at tactical	Strategic, operational, less at tactical	Strategic, operational, less at tactical

(Continued)



Table 1. (Continued).

Factor/Theorist	Col. Warden	Prof. Strange & Col. Iron	Lt.Col./Prof. Echevarria	Prof. Veگو	Col. Eikmeier	Lt.Col./Dr. Barfoed
Ontology						
Definition	The hub of all power and movement [...] or a vulnerability [...] a point against which a level of effort, such as a push, will accomplish more than that same level of effort could accomplish if applied elsewhere	Physical or moral entities that are the primary components of physical or moral strength, power and resistance	Focal points that serve to hold a combatant's entire system or structure together and that draw power from a variety of sources and provide it with purpose and direction	A source of massed strength – physical or moral – or a source of leverage whose serious degradation, dislocation, neutralization, or destruction would have the most decisive impact in the enemy's or one's own ability to accomplish a given political/ military objective	The primary entity that inherently possesses the critical capabilities to achieve the objective	An entity that is the physical or moral strength, power, and/or will to fight at a given level of command
Primary relation	Organisation of the actor	Adversary	Adversary	Objective	Objective	Objective – the strategy/ course of action (COA)
Static or dynamic	Static, but diminish if entire people rises.	Dynamic	Dynamic	Dynamic	Dynamic	Dynamic
Physical nature	Tangible	Tangible	Tangible and intangible	Tangible and intangible	Tangible	Tangible
Numbers	Multiple at each level	Multiple	One	Multiple	Multiple	Multiple
Supporting construct	Five-Ring Model (each ring is a center of gravity): 1. Leadership 2. System essentials 3. Infrastructure 4. Population 5. Fielded military (protector of the other rings)	Critical factors: - Capabilities (CC) - Requirements (CR) - Vulnerabilities (CV)	Nil.	Critical factors: - Strengths - Weaknesses - Vulnerabilities Inner core: - Tangibles Outer core: - Integrators - Protectors - Support	Critical factors: - Capabilities (CC) - Requirements (CR) - Vulnerabilities (CV)	Two strategic COGs: - Will (political) - Ability (military) One operational COG - Capability (military formation) Critical factors: - Capabilities - Requirements - Vulnerabilities

(Continued)

Table 1. (Continued).

Factor/Theorist	Col. Warden	Prof. Strange & Col. Iron	Lt.Col./Prof. Echevarria	Prof. Vego	Col. Eikmeier	Lt.Col./Dr. Barfoed
Methodology	Understand the actor Fill in the content/names in the Five-Ring Model	Select	3 steps: - Appropriate in the type of war? - Single entity? - What single element has the necessary centripetal force to hold the system together?	Understand the enemy. Determine the critical factors. Select from a critical strength based on judgment and wisdom.	Ends – ways – means (4 step): - Identify ends - Identify ways - List means - Select the mean with the inherent CC to achieve the end Validity test: - supported/supporting	- Understand oneself and relevant actors in the environment. - Identify the actors political- strategic decision-making entity (will COG). - Identify the objective and the primary physical strength to achieve it for each strategy/COA and level. (25 steps)
Analysis of the centre of gravity	Apply the Five-Rings Model for each sub-system	COG: CCs – CRs – CVs	Nil.	Determine the inner and outer core elements.	2 steps: - Determine critical requirements - Identify vulnerabilities	3 steps: - Determine critical requirements - Identify vulnerabilities - Draw conclusions
Theoretical basis	Linear, based on a possibly non-linear understanding.	Non-linear selection, linear analysis.	Linear approach, but non-linear in nature	Linear approach, but non-linear in nature	Linear deduction, but based on non-linear understanding	Linear deduction, but based on non-linear understanding

in application. Therefore, it should be reconsidered whether the concept should still be applied to all types of operations, including stability and security operations, or should only be reserved for warfighting or combat operations.

Finally, on the one hand, the concept of the centre of gravity may be removed from military doctrine and cause the concept a doctrinal death. On the other hand, there are two other more pragmatic alternatives that could be considered. The first is to replace the term “centre of gravity” with a new and unpolluted term with a clear teleology, a complete ontological description, and a methodological prescription, effectively just renovating the current concept. The second is an only partial removal of the centre of gravity concept, only removing the centre of gravity from the concept, and leaving the critical factor analysis behind, effectively reconstructing the concept to a “critical factor analysis” concept.

Further research on the topic is recommended, especially in relation to an assumed forthcoming scrutiny of the US and NATO endeavours in Afghanistan. The research could include analysis of relevant doctrines, such as the “Joint Publication 5–0: Joint Planning” (US Joint Chiefs of Staff 2020), to determine their clarity across the 14 aspects in the comparison matrix and the theory or theories they applied. The same could be done for service doctrines and handbooks, such as “Allied Command Operations Comprehensive Operations Planning Directive COPD” (NATO 2013, 2021a). Finally, research could be done on the application in praxis across the various types of operations, to determine the real utility of the concept and what needs to be done with it or its application. A historian might also have interest in analysing Clausewitz’s original work against the 14 aspects.

Notes

1. NATO aims to improve on these areas in future operations. See NATO homepage, https://www.nato.int/cps/en/natolive/topics_51633.htm (accessed 13 January 2021).
2. This part was first published by Strange and Iron as a separate article in 2004.
3. Comprehensive Approach combines political, civilian and military instruments of power (NATO 2021a)
4. This comparison matrix is inspired by Miha Šlebir (2020).

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