Gravity-free Decision-making: Avoiding Clausewitz's Strategic Pull

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Executive Summary

While many elements of Carl von Clausewitz's seminal work *On War* are entrenched within most Anglo-Saxon military doctrines, practices and methodologies for strategic planning, none have taken such a grip upon military institutions as his 'centres of gravity' precept. The American military academia in particular have invested significant time and resources into debating the value of the centre of gravity, yet it continues to appear questionable in both application to real world scenarios and dubious in complex, adaptive environments for gaining greater understanding. Clausewitz's concept requires us to approach not just the methodological structures of the concept in doctrinal or theoretical form, but to take deeper philosophical and sociological queries into how we think about our thinking.

We must consider the justifications behind the language, methods, principles, and metaphors that comprise this centre of gravity. This paper takes relevant interdisciplinary approaches from rival philosophical schools — sociology, organisational theory, complexity theory, and semiology — to provide readers with a broader and often abstract perspective on how the centre of gravity fits, or does not fit into modern military strategy and problem-solving. Have we become slaves to a construct that we do not even realise now from where it started, or why it appeals to us at core institutional levels? Can we make sense of difficult military contexts as they unfold in time without forcing upon it the 'centre of gravity' structure, and if we were free to experiment with alternatives, would our organisations be willing to?

The author

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Introduction

I hate the sort of technical language that leads us to believe we can reduce the individual case to a universal, to the inevitable. Strategists manipulate these terminologies as if they were algebraic formulae.[1]

Carl von Clausewitz

A complex adaptive system has no single governing equation, or rule, that controls the system. Instead, it has many distributed, interacting parts, with little or nothing in the way of a central control.[2]

John Holland

Any proposal to remove 'centres of gravity' from military practice and doctrine becomes a rather quixotic quest, in that the justification to challenge core military concepts is often trumped by institutionalisms. The centre of gravity now occupies a central role in military strategy and planning, and thus is entrenched in many service doctrines, procedures and planning methodologies. Yet the past 13 years of conflict have offered a release valve of sorts to foster serious discussion on what works, what does not, and perhaps what never really worked in the first place.

Does 'centre of gravity' in any applied methodology, doctrine or practice provide added value? Do we also need to probe deeper and move beyond methodologies to consider our entire world view and the philosophies and logics that make centres of gravity so alluring? Either way, those disciples of Carl von Clausewitz's centre of gravity applications (in previous as well as modern interpretations) are likely to remain highly sceptical of any challenges to remove or dismantle the centre of gravity. Further, even a successful 'remove the centre of gravity' argument generates an iterative cycle of 'the centre of gravity (with modifications) is the best of other faulty

models' defence. Replacing the centre of gravity implies, for advocates of retaining the current military decision-making process, merely a substitution of the existing centre of gravity concept with a replacement that performs the same function under a different name.

Challenging centre of gravity also represents a challenge to the entire knowledge system our military institution has constructed. Such analytical tools epitomise habits of mind conditioned by professional military education, doctrine and practice. The mere notion of replacing or removing it threatens the overarching campaign construction, associated targeting cycles, and the governing cause-and-effect logic for applying military force to opposition. The centre of gravity as a concept has itself morphed into self-referent meanings within the dominant military sense-making paradigm; it has become its own centre of gravity within the traditional military planning process.[3]

A paradigm is 'the broadest unit of consensus within a science and serves to differentiate one scientific community from another. It subsumes, defines and interrelates the exemplars, theories, methods and instruments that exist within'.[4] Proponents of a 'centre of gravity-centric' planning process within the military fend off centre of gravity criticism and maintain centre of gravity-centric structures by encouraging any replacements to 'look like a centre of gravity, talk like a centre of gravity, walk like a centre of gravity'. Instead of replacing centre of gravity-like concepts with supposedly better ones, this paper will frame the larger debate and consider both the vulnerability of the centre of gravity as a military concept, and the vulnerability of our institutionalisms, preferred paradigm and implicit decisions on how we construct our knowledge. Ultimately, to answer the question 'if the centre of gravity does not work, then what?' requires us to challenge a far broader field in which the centre of gravity operates as a central pillar for military sense-making.

A ‘COG’ in the machine designed to make more COGs

A brief explanation of a ‘centre of gravity’ is necessary. Carl von Clausewitz, a nineteenth-century Prussian military theorist, wrote his diverse thoughts on warfare during the Age of Enlightenment and the dawn of the Industrial Age. One concept he offered in his posthumously assembled work in the original German was *Schwerpunkt*. Many argue that the correct translation ‘heavy point’ or ‘main point’ evolved in military doctrine into ‘centre of gravity’ and was given a wide assortment of formal and informal applications.[5] Modern centre of gravity theory dictates that centres of gravity exist at each level of war (yet another implicit choice), and must be properly identified and targeted during planning processes.[6] Ultimately, the Clausewitzian standard is to ‘attack the enemy centre of gravity directly with one’s own centre of gravity as soon as practicable’.[7] Attacking and defending non-centre of gravity related targets are secondary concerns, while improper centre of gravity identification is potentially disastrous.

While applied to multiple campaigns, operations and conflicts over the past decade plus of war, whether centres of gravity assist sense-making in the military profession remains dubious; indeed they may well degrade that process instead.

With volumes of theory, doctrine and countless graduate dissertations placing a persistent microscope over the works of Carl von Clausewitz, it remains readily apparent that today’s military professionals can only ‘agree to disagree’ on centres of gravity.[8] Doctrine remains fractured and confusing across joint, service and often institutional lines.[9] The unsettling nature of the centre of gravity concept itself is a trigger for asking whether we need it or it needs us.

Centres of gravity are not just misapplied and outdated, they are (except in the most simplistic situations) generally worthless, as this paper will argue. They consume resources, time and intellectual capital only to continue to misinterpret and misunderstand a real world that has never been simple enough to obey centre of gravity principles. Today, the complex and dynamic environments we encounter summarily reject the centre of gravity construct, and it may be our own organisational constructs, values and preference for a singular world view (paradigm) that prevent us recognising a misapplied concept. This in turn prevents us eliminating it from decision-making when the situation decidedly rejects the concept.[10]

Finally, this paper will not devolve into the 'replace the centre of gravity with another centre of gravity-like concept' that reinforces the very cognitive structures that make the centre of gravity so seductive. Instead, it will describe why the centre of gravity does not work, will not work, and can only be made to appear useful retrospectively given the use of hindsight and historical cherry picking.[11] Hindsight is the antithesis to planning.

There are many valid criticisms of the centre of gravity construct in terms of translation, metaphoric value, authorship interpretation and modern application. This paper will avoid trotting over familiar terrain and instead offer several new propositions that illustrate, in tandem with existing critiques, how the centre of gravity construct should be eliminated from most future military applications.[12] A major tension exists between the movement to over-simplify warfare and the opposing perspective in which complexity and adaptable environments defy efforts to reduce, simplify or predict their emergent direction.[13] Clausewitz himself, in describing this paradox, wrote that 'everything in war is very simple, but the simplest thing is difficult … [t]his tremendous friction, which cannot, as in mechanics, be reduced to a few points, is everywhere in contact with chance, and brings about effects that cannot be measured'.[14] Yet Clausewitz wrote at a time in which warfare and ideas reflected nineteenth-century Western societies.[15] The world has changed and, more importantly, the way we make sense of it has changed.[16]

The simple, the complicated and the ugly

In one of his other famous maxims, Clausewitz used a physical metaphor that 'war is nothing but a duel on a larger scale … a picture of it as a whole can be formed by imagining a pair of wrestlers'.[17] Like his mechanical metaphor for gravity centres, the duelling/wrestling metaphors in this case were probably useful for his initial audience of nineteenth-century Prussian military officers.[18] While Clausewitz stressed throughout his works the complex and adaptable nature of warfare (he used the terms 'fog' and 'friction' to describe this aspect), in the past few decades US military theorists and doctrine writers have tended to argue over competing methods, definitions and translations, conducted in a scientifically structured and reductionist manner.[19] They do this instead of addressing some deeper institutional concerns that might explain why centre of gravity efforts fail, as if a centre of gravity 'Holy Grail' solution exists. Once unlocked, the centre of gravity magical solution should objectively function as a planning key and generate centre of gravity solutions for all future military problems (of course when done correctly).[20] This seems to ignore major distinctions between types of problems.

There are many different types of problems that confront a military force. Organisational theorists and sociologists offer a broad categorisation (depicted in Figure 1) in which problems may be simplistic, intricate, complicated or complex. Some even offer the notions of 'chaotic' or 'chaoplexic' to discuss complex adaptive systems, although this paper will streamline these into the four primary categories.[21]

The major distinctions between a simplistic (often associated with a 'closed') and complex system are themselves also intricately connected. Complexity features non-linearity, an 'open system' expansion of growth, self-organisation and the concept of 'emergence'.[22] A simplistic system features linear, often predictive behaviours with a limited number of actors and connections. The hard sciences

Simple:	Only 1x type of solution.	We can understand all parts of the system, and even predict future states with a high degree of accuracy.	**Example:** a bullet's trajectory; radioactive decay rates; playing Tic-Tac-Toe.
Intricate:	Only 1x type of solution, although there may be many steps, and some steps may need to be in a certain order.	Although we may lack all the details, we fully understand the behavior and structure of the system, and can predict future states accurately.	**Example:** filling a crossword puzzle; finding Waldo; assembling furniture from IKEA; performing basic math.
Complicated:	Multiple solutions, including new ones. Some solutions seem better than others.	We understand some parts, and some rules that appear to govern the system, but we cannot keep track of interaction or anticipate future states well.	**Example:** playing chess; sending a probe to the moon; resourcing the logistics of a large organisation; managing a city's traffic grid.
Complex:	Continuously changing solutions; what worked before may fail now. Any action impacts the system including efforts to 'solve' things.	We observe only snapshots and incomplete slivers of the system. The system changes, at times radically; we cannot fully understand or anticipate change.	**Example:** all major human activity including warfare, economies, religion, social structures, technological innovation, language.

Figure 1: Different types of problems

covet simple (linear) systems because they are reducible, with the many parts, once disassembled, equal to the whole.[23]

Consider in Figure 2 precisely where on the spectrum the Napoleonic Wars, from which Clausewitz drew military inspiration, might be placed compared to unfolding conflicts in 2014 such as Syria, Ukraine, Nigeria or Somalia. This is not to suggest that the Napoleonic era of warfare on which Clausewitz based his theory (and his notion of centres of gravity) is simplistic in comparison to twenty-first century conflicts; however both the world and our understanding of the world have changed and expanded over time. With more actors, combinations, relationships and accelerated actions due to technological revolutions, there are situations today that have the potential for greater levels of complexity than previously. Again, this in no way implies that Napoleonic conflicts are simpler than modern conflicts. However, the rapid speed of emergent technologies such as the internet is redefining not just the nature of warfare, but potentially the nature of human civilisation. Should we limit ourselves to employing nineteenth-century centre cognitive processes to try to make sense of it all? Has our outlook on how knowledge works expanded as well?

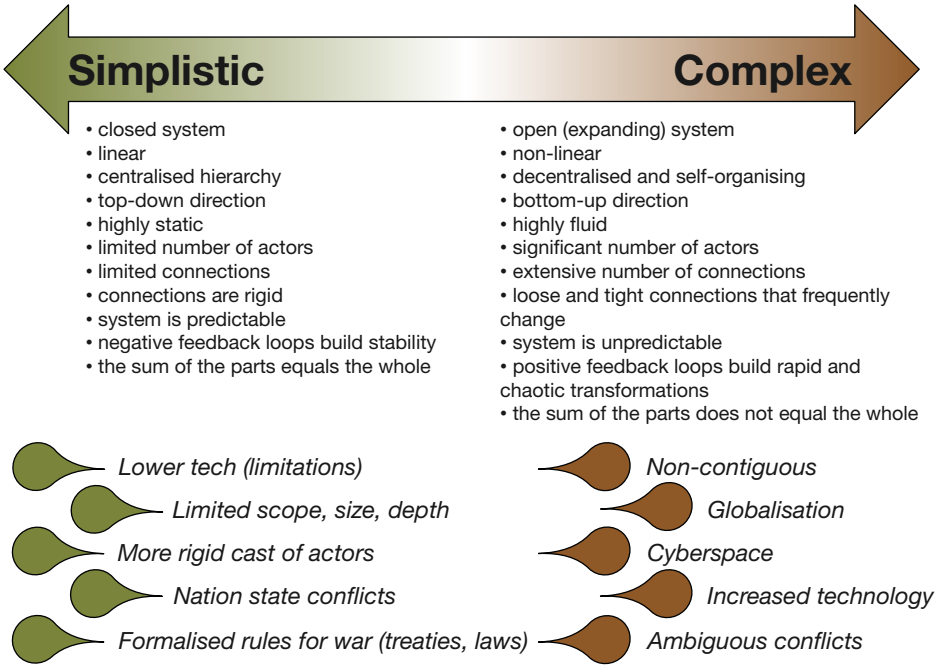

Figure 2: Spectrum and characteristics of simple to the complex

Figure 2 lists multiple characteristics along the spectrum of simplistic to complex, and offers various examples to indicate that we might consider some traditional fielded armies in the pitched battles of earlier periods closer to 'simplistic' or, at the least, further from 'complex' than other recent conflicts where the scale, adaptation and technology have muddied the waters. Clausewitz imagined centres of gravity in the early nineteenth century when conflict still teetered between the classical warfare of the Middle Ages and the 'total war' of the twentieth century.[24] His metaphors, language and concepts support an early scientific appreciation of the way the world appears to function.

Again, this does not mean that all conflict prior to the twenty-first century must have been simplistic and all modern conflict can only be complex. Technological innovation and developments such as global trade, cyberspace and the internet do not alone make warfare 'more complex', although they do add to the possibilities. Instead, we should combine both the evolution in technology and a greater understanding of how and why these changes impact on sense-making. We need to consider the organisational elements of how complexity and socially constructed (subjective) interpretations of reality do not bend to exact analytical solutions.[25]

How we think, and think about our thinking …

Philosophy and organisation theory (within sociology) provide some useful though fundamentally dissimilar constructs to apply to our effort to 'think about our thinking'.[26] They assist us to appreciate not only the context of Clausewitz's original theory in the nineteenth century, but how over time our own military institutionalisms have interpreted, modified and at times corrupted elements of *On War*. A nineteenth-century reader does not equal a twenty-first century reader of Clausewitz's work, and a twenty-first century reader reflecting on what a nineteenth-century writer wrote will potentially make just as many errors in interpreting the past to apply to the present.[27] To build this case, we need to deconstruct what we know, and reflect on *how we know what we know about knowing*.

While many military historians focus their analysis of the centre of gravity concept on the Battle of Waterloo, this paper will not. Instead, it will consider only the date that the battle occurred. It was Sunday, 18 June 1815. One might say it was '18 June, 1815', or even '06/18/1815' among several other methods for discussing dates. These are nuances in the *methodology* of chronology — the way linear time, symbols and processes are used to integrate information into historical discipline. But how does one 'know' that Sunday follows Saturday (of the last week) and is followed by Monday after exactly 24 hours have passed? How do we know that 60 minutes are in an hour, and that our planet revolves around the sun approximately 365 days over the course of a year? How do we know that 1701 starts the eighteenth century, and 1800 ends it? *How do we know how to think about time?*

While different ways to display the date are methods within a methodology for tracking time and dates, the second set of questions on 'how do we know how

to …' is not about methodologies. Instead, these questions address how we know about our knowledge, and how those deeper processes occur, often implicitly. This level is called 'epistemological' and is worthy of further exploration. Outside the 'how do we know there are 365 days in a year' there operates an even deeper, more abstract level of knowledge production.

How do we know that the Battle of Waterloo occurred in 1815? Is it because, at an ideological and historic level, we agree that exactly 1815 years prior, Jesus of Nazareth was born? Yet other non-Western societies disregard this perspective on time and substitute alternative dates that still relate chronologically to the same day of the Battle of Waterloo.[28] By the Hebrew calendar, Waterloo occurred in 10 Silvan, 5575, and in the Persian calendar, in 27 Khordad, 1194. The Mayan calendar would depict it as the 12th Baktun, 9th Katun, 19th Tun, 11th Uinal, and 0 Kin.[29] Even for Russia, which had participated in several of the Napoleonic wars, the date of Waterloo was different to that of the French because Russia used the Julian rather than the Gregorian calendar.[30]

These different ways of considering when the Battle of Waterloo occurred represent *ontological* decisions on which societies agree and implicitly accept. Figure 3 offers an illustration on stacking these three concepts for consideration and interplay and employs the Waterloo date metaphor to introduce these concepts.

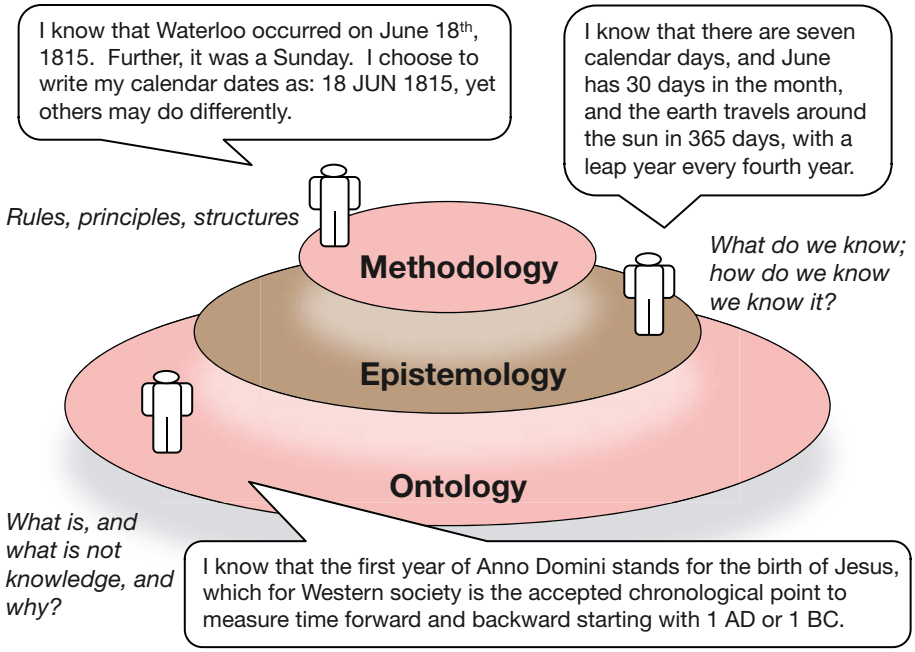

Figure 3: Ontology, epistemology, and methodology 101: When did Waterloo occur?

Methods to madness: exploring methodology, epistemology, ontology

What is meant specifically by the term 'methodology?' Quite simply, it encompasses rules and methods, guided by societal and organisational values that drive patterns and structured actions. For example, the methodologies of the German and American ground forces in the Second World War were very similar in that proximities in technology, weapons, personnel, tactics and logistics in a broad sense were similar.[31] When attempting to enter and clear a building in an urban environment, both armies approached with similar methodologies. Neither a German nor American infantry platoon would have conducted land navigation using animal spirits, tea leaves, conducting a vision quest in a sweat lodge, or tasting the ground soil to assist them. Thus, while some Native American scouts and trackers could conduct land navigation equally as well as Second World War-era infantry units, they employed *different and often incompatible methodologies*.

Returning to centre of gravity as a construct, the vast majority of academic discussion revolves entirely around methodological disagreements. Some centre of gravity methodologies employ an 'ends–ways–means' construct, others apply the 'critical requirements, capabilities, vulnerabilities' construct. Some view 'non-physical centres of gravity' as irrelevant or non-existent, while others embrace them.[32] While the base layer of 'methodology' is important for understanding subsequent philosophical concepts, this article will not retread familiar centre of gravity arguments that are limited to the methodological level. If we employ one methodology yet reject another, we must ask the deeper question of *why this is*. This leads us to a higher level of abstraction.

'Epistemology' helps address the question of 'why this organisation or society values this methodology over another'.[33] Epistemologically, why might one military

choose to value a centre of gravity and another ignore it? Even within the US military there are epistemological conflicts over centre of gravity constructs. The US Army applies centres of gravity only to the strategic and operational levels of war, while the US Marine Corps includes tactical centres of gravity. Epistemological queries help us rise above the methodological arguments and reflect on deeper institutionalisms, to include why we prefer to interpret the world in certain ways, but not others. While methodologies deal with 'we know how to …', epistemologies focus on 'we know that …' and why this is.[34]

The third philosophical construct necessary for this inquiry into centre of gravity applications is termed 'ontology' and reflects at perhaps the most abstract and fundamental levels what constitutes a rule, value or knowledge. Ontological queries interact and influence (and are influenced by) epistemological ones, and challenge us to explain what constitutes knowledge, and why this is. Aaron Jackson argues that 'ontology is the study of the nature of reality and the relationships between objects within it and epistemology is the theory of knowledge acquisition'.[35] Complex social systems are dominated by these epistemological and ontological processes, yet they are usually implicit, unexamined or even denied.[36] We tend to cling to methodological debates and accuse anything beyond this of being rather pointless navel gazing. Yet methodological processes spring from the illusive epistemological and ontological choices of a given paradigm. Epistemology does not work above or below ontology, as they mutually influence how we construct knowledge in an iterative, collaborative manner.

Preventing ontological and epistemological fratricide

We must refrain from relying on methodological answers for epistemological questions, or epistemological answers for ontological questions, and so on. While they are not hierarchical and each level influences another, we must remain aware of when we are thinking of one and not another. To put it another way, consider the M.C. Escher artwork-inspired Figure 4. In this mind-bending representation

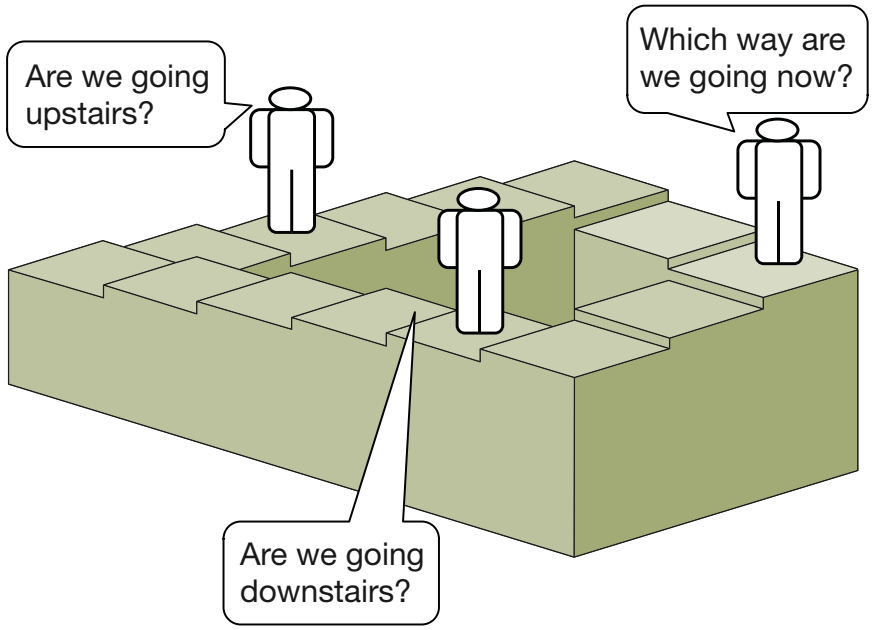

Figure 4: Interplay of ontology, epistemology, and methodology

of ascending and descanting stairs, is the person walking downstairs or upstairs? This presents a mental paradox in which, if you follow the image, your mind needs to 'jump' from visualising 'upstairs' to 'downstairs'; an upstairs-moving question cannot be met with a downstairs-moving answer![37] We must remain aware of this, as many faulty arguments stem from mixing ontological, epistemological and methodological linkages in order to justify one paradigm's insistence on explaining reality.

This flawed logical loop tends to dismantle several arguments about centres of gravity, such as when an author argues about the proper translation of *Schwerpunkt* as an answer to the implied epistemological question of 'why should the US military continue to apply centres of gravity to campaign planning?[38] For example, Joseph Strange and Richard Iron, in 'Center of Gravity: What Clausewitz Really Meant', make epistemological choices where a centre of gravity is adversarial and warfare must have balance between opponents; yet the authors apply methodological answers which focus on language meaning and translation issues to support this.[39] They argue that the confusing centre of gravity definition is the 'root of disagreement', yet they never address the linked epistemological question of 'why do we disagree on language meanings, signs, symbols and metaphors?' Many academics offer strategic leaders such as George W. Bush, Osama bin Laden, Winston Churchill and Saddam Hussein as various methodological examples without addressing the epistemological query of 'how do we know the strategic level features a primary component of physical or moral strength?'[40] Again there is an imbalance between epistemological and methodological beliefs which promotes confusion in both how we solve problems and how we explore our own problem-solving approaches.[41] Michael Reed expresses this most succinctly, writing that 'epistemology [rather than ontology] acts as both gatekeeper and bouncer for methodology in that it determines and regulates what is to be known and how it can be known'.[42] This becomes essential when we consider academic, organisational, cultural and other pressures for embracing the centre of gravity construct. If a war theory discussion occurs without acknowledging the ontological and epistemological choices, we are potentially limiting our understanding while digging in our fighting positions to confront other perspectives.

Figure 5 illustrates yet another more detailed way of depicting the interplay between ontological, epistemological and methodological queries concerning centres of gravity.[43] Note that most centre of gravity discussions are grounded entirely in 'methodology' considerations.

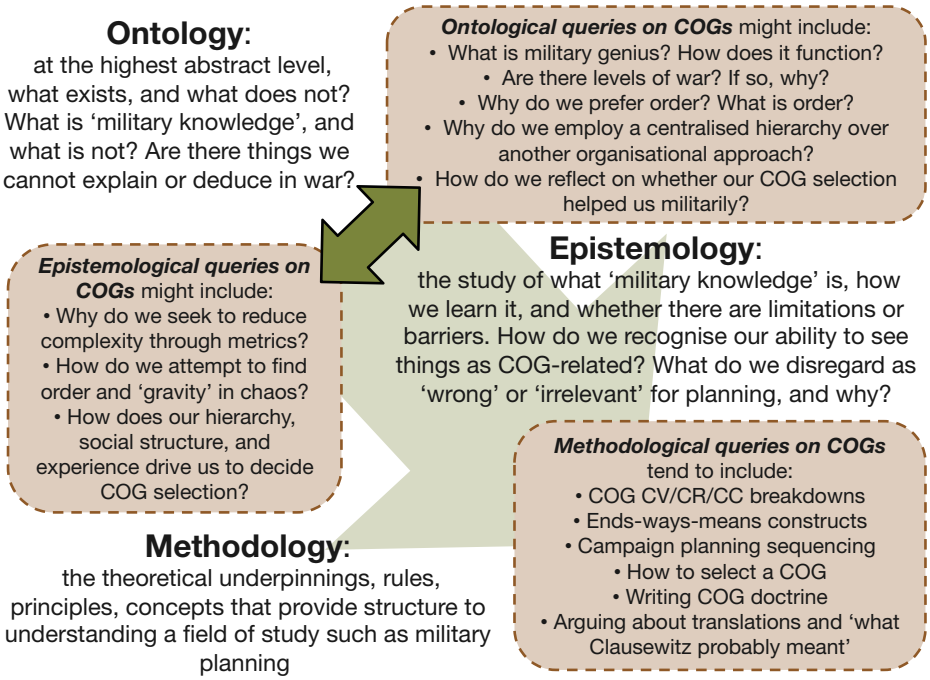

Figure 5: Thinking about how we construct knowledge to think about thinking of COGs

While many academics and doctrine writers may argue extensively over whether to employ 'ends-ways-means' or in what order one might consider critical vulnerabilities, capabilities and requirements, these arguments fail to reach deeper institutional issues because they tend to orbit the methodological level exclusively. Again, we cannot attempt to answer questions on whether centres of gravity work, or why our organisations are so confused over how to decipher centres of gravity, if we cannot examine our entire institution and thereby include fundamental and often invisible ontological and epistemological processes.

Bottom up versus top-down: Wikipedia versus Encyclopedia Britannica

One important reason centres of gravity resonate so strongly in military organisations (but not anywhere else) is that the military organisation is an extreme example of a centralised hierarchy. Ori Brafman and Rod Beckstrom in *The Starfish and the Spider* argued so persuasively on the distinctions between centralised and decentralised organisations that the US Army Training and Doctrine Command (TRADOC) directed a study and experimental leadership course to explore the concepts.[44] The US military most resembles the spider metaphor, in which the head controls all the actions of the legs, and damaging the head kills the entire organisation (top-down organisation). The starfish, which can be cut into pieces that all form new starfish, possesses strengths where centralised organisations have weaknesses, and can quickly adapt through local and self-organising processes (bottom-up organisation).[45]

Brafman and Beckstrom's work drew significantly on organisational theory, swarm theory and complexity theory, which all function through deliberately different ontological and epistemological processes. The centralised military hierarchy may not work as the dominant lens when facing non-linear situations that are dominant in complex environments. In fact, it may hurt it in many applications. Through examining the military's preferred structure as well as the paradigms chosen to make sense of warfare, we might understand why centres of gravity as a concept remain so very seductive for centralised thinking, yet so ultimately counterproductive.

When people within an organisation or institution choose a paradigm for making sense of the world, they make many implicit decisions about knowledge at the

ontological, epistemological and methodological levels that subsequently interact and create paradox or tension with one another and reality.[46] Things become precisely what we *say they are*, events occur precisely as we *explain why they do*, and nothing could ever be anything but what we *know it to be* (within a chosen paradigm).[47] Centres of gravity, as understood within our preferred paradigm, must function just as we say they do, and we interpret events to reinforce their relevance.

Figure 6 depicts a traditional 'command and control' mapping of the centralised military hierarchy in which decisions move from the top down and information moves from the bottom up.[48] Like structured religious organisations and many businesses that imitate organisational aspects of the military, strong military hierarchy features numerous strengths as well as weaknesses.[49]

Epistemologically and methodologically, the top-down hierarchy benefits from clear relationship structures and often has redundancies to ensure wide dissemination of guidance and decisions. Each subordinate level of control directs decisions downwards, but requires extensive information (often in the form of analysis) from lower levels to form future decisions. Departments form within departments, with each sub-section of the hierarchy just as focused on its own continued self-relevance

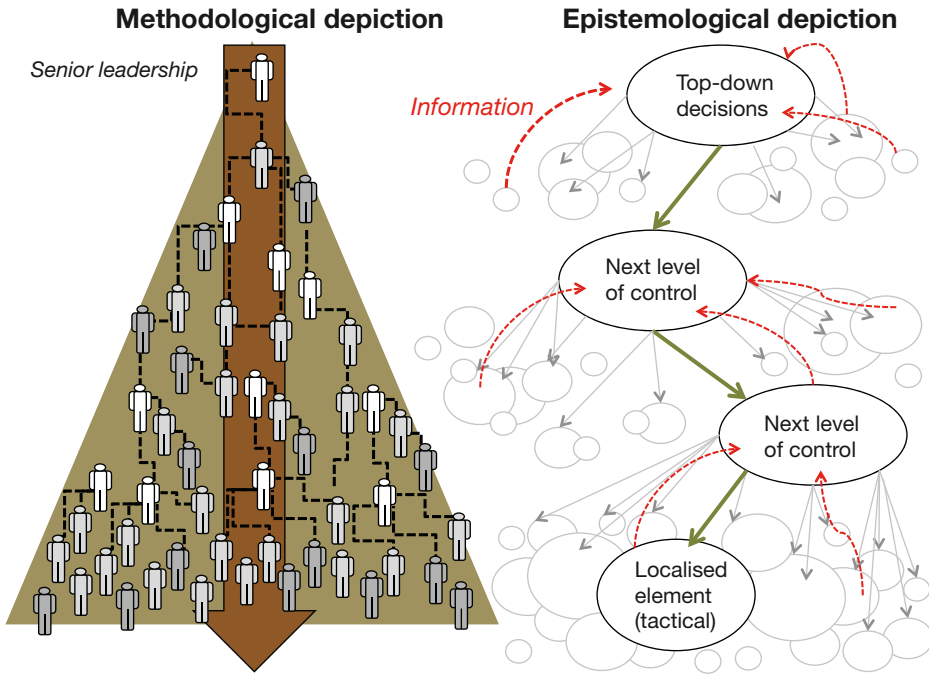

Figure 6: Centralised organisations and flow of decisions/information

as any directions coming from above.[50] Clearly, the hierarchical organisation has a strong and proven track record in human history up to modern times. Yet being the dominant form does not excuse anything from critical inquiry. Consider the following.

The process in which a printed encyclopedia company produces a yearly volume of books is a useful metaphor for exploring organisational differences. The senior leadership directs the actions of subordinate levels (budget, salaries, writers, editors, bookbinding, distribution) while subordinate levels contribute to complete the encyclopedia. Once approved and with resources committed, the end result is a set of books in which no content has been entered without the hierarchy commanding and controlling the inclusion. While this does not mean that the senior CEO for *Encyclopedia Britannica* has read every page of the company's product, collectively a group of editors and senior managers did so following his guidance and decisions. Once published, the books are static in that they cannot change until the entire process repeats and a new version is printed. The world is frozen in time within the publication until a new snapshot is put to ink, under absolute centralised control. While New York's Twin Towers were destroyed in September 2001, the entries in printed encyclopedias remained incorrect on that topic until the centralised organisation directed a new publishing with updates.

The centre of gravity as a construct integrates favourably into a centralised hierarchy. At the epistemological level, the military seeks to find order in chaos, and embraces the scientific approach to making sense of military problems.[51] Organisational theory offers the term 'technical rationalism' to specify a driven belief that complex systems can be both understood and even controlled through a regimented scientific approach, reductionism and quantified measurements.[52] Technical rationalists seek to break unwieldy problems into smaller ones, and attempt to reassemble 'solved' smaller problems expecting the larger solution. Technical rationalists are drawn to details, data, metrics and modelling that swap complexity for smoothed-out, closed systems.[53] Universal laws are sought, with the promise that technology coupled with scientific approaches might untangle any complex system and provide deeper explanation.[54]

For an organisation comprised largely of technical rationalists who organise into a centralised hierarchy with top-down decision-making, the centre of gravity concept resonates on multiple levels.[55] The top-down directives, reductionist approach, and linear perspective of 'targeting this vulnerability causes this effect' is well suited to integration to hierarchical world views. Figure 7 illustrates how friendly (blue) and enemy (red) centres of gravity at each level of warfare share similar structure

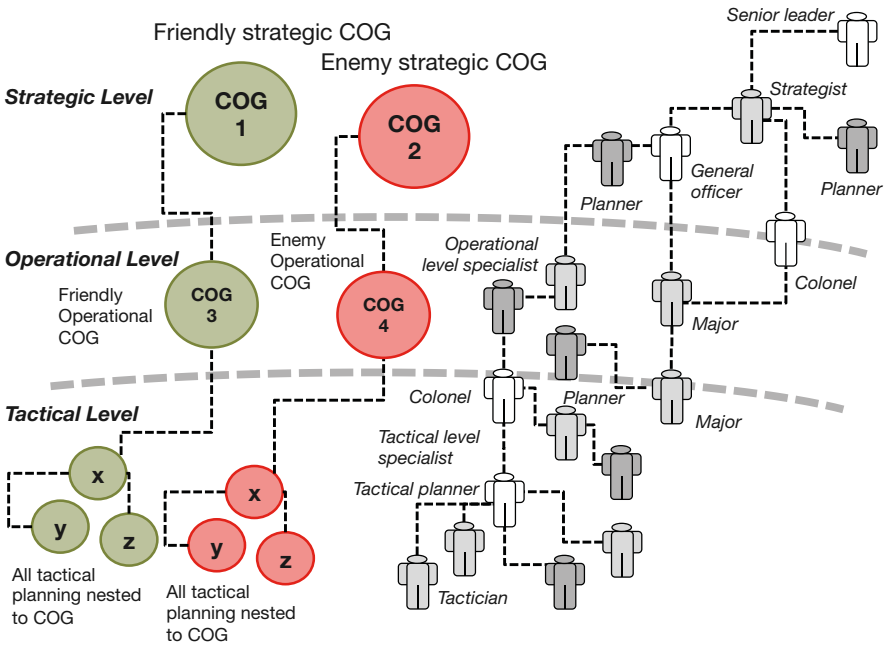

Figure 7: How centralised hierarchies and COGs reinforce similar structures

to centralised hierarchical structures. Thus, they appeal to most Western military organisations by embedding at epistemological and ontological levels. In addition, we cannot ignore the fact that centralised hierarchies are the most powerful and successful organisational constructs in human history. They dominate and can wield enormous power in highly productive ways. Yet there are many lessons to learn from hierarchies that suffered defeats against decentralised rivals, whether we consider military situations (Vietnam, Iraq, Somalia) or capitalistic ones (entertainment industry and piracy/social file-sharing).

Technical rationalism encourages the reduction of complexity to smaller measurable parts.[56] Adherence to a top-down hierarchy encourages the tight couplings (strong relationship bonds) where targeting an essential node might topple or severely disable the system. This lays the groundwork for the entire 'critical vulnerability, critical requirement' analysis espoused by Strange, Eikmeier, Rueschhoff, Dunne, Reilly and other noted military academics.[57] Technical rationalism seeks universal, scientific principles and laws of organisation and management, illustrated by the dominance in military doctrine of Jominian principles of warfare and select Clausewitzian constructs such as centres of gravity.[58]

Finally, technical rationalism desires prediction and the ability to control, which plays ontologically and epistemologically into how we construct, select and subsequently measure centre of gravity success through targeting and coordinated 'lines of effort' in campaign plans.[59] We construct through reverse engineering, where we establish a desired future state, build linear timelines within our 'lines of effort' and tightly coupled decision points, decisive points, and other metrics associated with centre of gravity critical vulnerabilities, critical requirements and critical capabilities or the 'ends–ways–means' constructs.[60] We take selected aspects (often key points that relate to identities, self-relevance and institutional biases) of a complex system and cast these into the future. We shackle this watered-down but organisationally attractive misrepresentation to our planned goals and end-states, and subsequently build a bridge of phases, decisive points, and metrics along lines of effort backwards to the present. Figure 8 provides an example of the reverse engineering espoused by planning doctrine in joint and Army applications.

By planning in this manner, the technical rationalist accepts ontological suppositions that a complex system is measurable, 'mapable', comprehensible

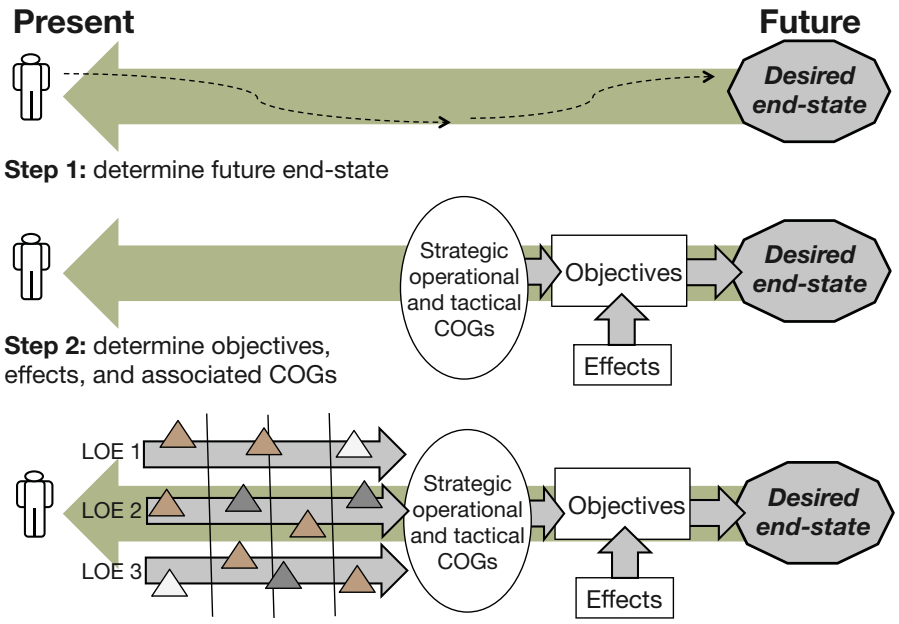

Figure 8: Technical rationalism and 'reverse-engineered planning'

and, most importantly, controllable from our present state out into the future.[61] Yet, by definition, complex systems are impossible to map, and transform far too rapidly and in directions that are too novel for any person or organisation to anticipate accurately.[62] Figure 9 provides an illustration of how, as complexity increases, the ability to identify any possible centre of gravity relationship reduces commensurately. While leaders in centralised hierarchies will undoubtedly select something in the decision-making process, the odds that they select anything remotely useful decreases once we enter more complex environments where systems are open, emergent, non-linear and adaptable.[63]

Figure 9 illustrates the relationship between simplicity and centre of gravity selection options. In simpler, static systems, it becomes possible to identify patterns and processes that relate to a 'centre', yet as change and options increase exponentially, it becomes rather futile. Even if, for one instant, we might link three 'centres of gravity' under complex conditions, they would all transform within the emergence of the next moment (which includes our own engagement in

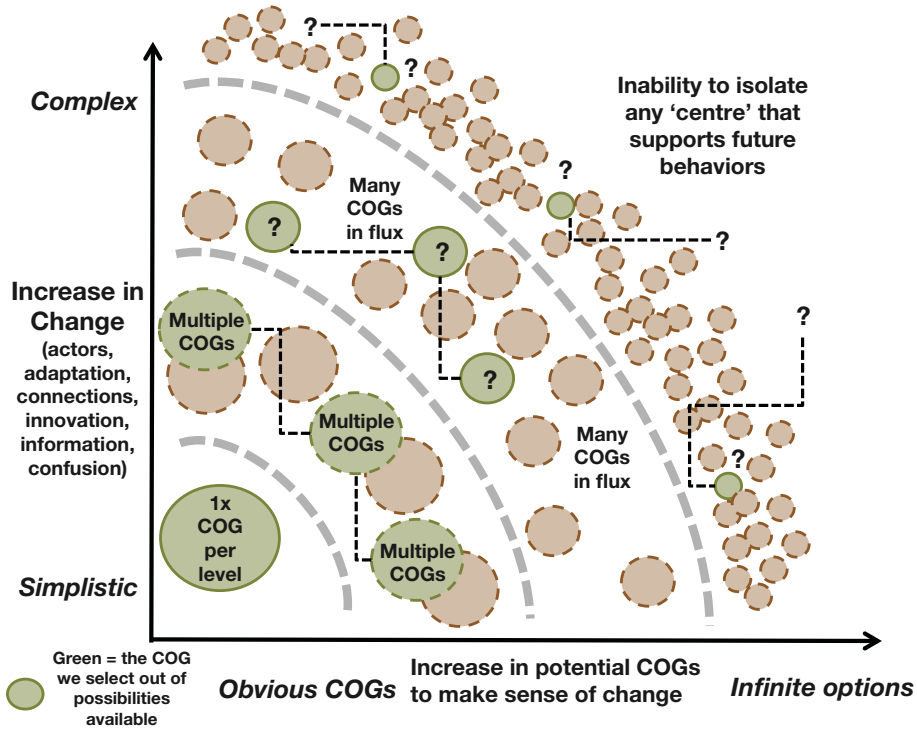

Figure 9: COG feasibility with respect to simple and complex environments

attempting to measure the system). For every proposed centre of gravity in modern conflict environments such as Syria, Ukraine, Iraq, Afghanistan, Nigeria or Somalia, military professionals might easily offer five different centres of gravity for debate. Ultimately, the centralised hierarchical structure for the military ends this debate through the deliberate decision of a senior leader (centre of gravity selection). Yet complexity does not yield to 'classic, equilibrium-based mathematical approaches that rely on linearity … fixed points … and the like', nor do complex systems obey top-down decisions in a linear, predictable sequence.[64] To understand why the centre of gravity construct fails repeatedly in modern military applications, it helps to consider other organisational forms beyond the traditional hierarchy. We must dismantle the hierarchy, as well as the ontological, epistemological and methodological structures working against our efforts to make sense of complexity in warfare.

How a starfish ignores gravity while the spider is trapped

Applying complexity theory, Russ Marion and Mary Uhl-Bien argue that, over the past two decades, al Qaeda has functioned as a decentralised organisation, based on overlapping common goals, steered by indirect leadership, distributed intelligence, and multiple conflicting feedback loops where bottom-up actions direct most outputs.[65] Returning to the metaphor of the encyclopedia company, a decentralised organisation such as al Qaeda also describes how the socially collaborative Wikipedia functions in many (but not all) ways.

There are no formal writers or editors such as in the centralised hierarchy example, and almost all the Wikipedia content enters the system and is refined by largely self-organising anonymous contributors through local conditions. Rules continue to change, as do the actors, connections and structures — this causes an 'evolving structure' that never quite reaches what might be considered an 'end state'.[66] There are leaders in Wikipedia who steer the enterprise indirectly, and there are those who structure the framework such as web designers, code writers, editors, advertisers, managers of human resources, finance and hardware maintenance for servers, and even janitors for the headquarters. These various actors work in a combination of strong and weak relationships to support the complex actions of the larger element of contributing volunteers.

In most ways, a decentralised organisation at the epistemological and methodological level operates distinctly from traditional hierarchies. Unlike static printed encyclopedias, a wiki system is fluid and constantly changing, with edits and new additions occurring in a decentralised, local fashion. Although opponents argue that socially constructed systems such as Wikipedia are 'less accurate', it

can at least be argued that decentralised approaches such as that of Wikipedia make up for inaccuracy with speed, scope and adaptation.[67] Further, the localised processes of peer review and shared rights provide a self-correcting process in the event that a contributor places incorrect, controversial or nefarious content on a page. Figure 10 illustrates a reversal of Figure 6's top-down structure to depict a bottom-up organisation as a snapshot in time. The differences between 'leader' and 'subordinate' change drastically and, at times, reverse positions.

Entirely dissimilar to the traditional hierarchy, a decentralised organisation model features the cumulative local inputs of many self-organised actors. Those who choose to contribute to Wikipedia may contribute on any topic for as long or as little as they wish without any form of direction. Others will interact and edit this work, but these interactions represent 'loose coupling' relationships common to social media such as Twitter, Facebook and other internet structures. The interactions and connections, through which information exchanges occur across the organisation, can be loose (temporary, informal, weak) or they can be tight (formal, permanent, strong) couplings.

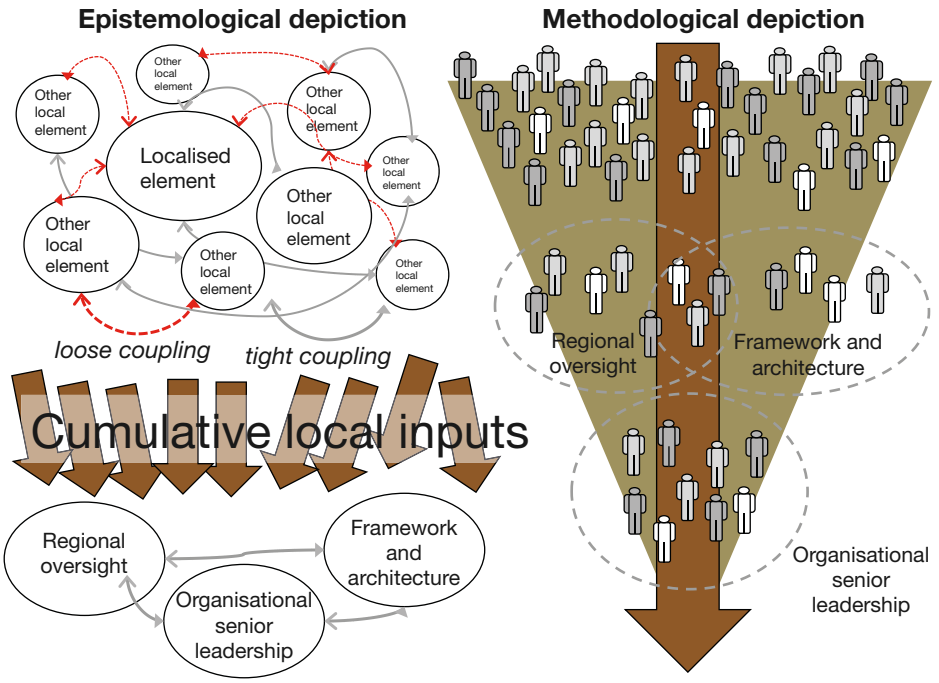

Figure 10: Decentralised organisation information and decision flow

Marion and Uhl-Bien and other researchers find that decentralised, indirect leadership processes function in a plural and bottom-up fashion where emergence plays a critical role.[68] While centralised hierarchies remain susceptible to randomness and change, decentralised organisations tend to thrive in dynamic environments.[69] Dynamic environments involve a high degree of uncertainty, change, and complexity. Brafman and Beckstrom describe the decentralised successes of social networks and file-sharing exchanges (Napster, Kazaa, eDonkey, eMule), social service organisations such as Alcoholics Anonymous, and military engagements in which the decentralised organisation outperforms centralised organisations (seventeenth-century Apaches against the Spanish Army, al Qaeda in Africa).[70]

The centre of gravity functions as a strong ontological choice by centralised hierarchies to impose their view of the way the world works on everything, including warfare.[71] Hierarchies do not deserve too much criticism as they remain by far the most successful organisations on this planet in almost all political, economic and military conditions. Yet the formalised process of reverse engineering, centre of gravity selection by the senior leader (ultimately) and linear outlook on a predictive, static system is ontologically and epistemologically incompatible with complexity.[72] Record companies may plan marketing scenarios against 'peer-to-peer' enterprises just as the Spanish Army planned to wipe the Apache off the map. Reality, however, may reject these planned efforts to command and control the future. The sudden rise of the Islamic State in Syria and the Levant (ISIL) in 2014 featured elements of centralised as well as decentralised organisation; should we target it militarily as one or the other? Do we pursue centre of gravity analysis on ISIL in order to dissect it and tease out vulnerabilities? If so, does the military take the role of the record company attacking the latest version of Napster?

The often quoted metaphor of 'a butterfly flapping its wings today in Hong Kong causes a hurricane next month in Miami' represents the non-linearity of 'emergence'. While a linear structure links actions together with proportionate outputs (placing five apples in a basket on a scale increases the weight of the basket equal to each apple added), non-linear actions produce other effects. In a recent non-lethal action (June 2014) in the Ukraine, where rebels attempted a linear 'give the local children candy, win the popular support' action typical of centre of gravity methodological applications, the action backfired spectacularly.[73] While the candy was given to the crowd in an effort to reinforce rebel narratives, the rebels failed to realise that the candy, apparently plundered, was made by the very political leader (and chocolate distributor) against whom they were demonstrating

— Ukrainian President-Elect Poroshenko. A riot quickly erupted as the candy outraged many attending the gathering. The rebels watched their entire event fall apart. 'We wanted to give candy to children! That's all! What difference does it make where it came from?' one exasperated fighter shouted.[74] This is an example of non-linearity in action, and the emergence of a now frustrated rebel element that will carefully consider the labels on its candy in the future.

Non-linearity, when used metaphorically in this ocntext of candy and warfare, offers us a telling example of linear planning gone wrong. We want A to lead to B so that we can comfortably predict C. While today the environment is receptive to a candy propaganda effort, emergence and non-linearity makes tomorrow a different environment where the candy takes on different meanings. Emergence, as defined in complexity theory, requires the future state of a system to be an unexpected development from the current state where it unfolds in a non-linear path. We are unable to even describe or explain emergent states prior to them occuring, and their non-linear movements carry additional paradoxical factors where the future state is dependent as well as autonomous from the prior state. Returning to the Poroshenko candy example, one spectator rmarked: 'We smoked German cigarettes during the Second World War. What's the difference?'[75] Yet, the unexpected candy riot occurred where the emergent protesting was dependent upon plundered candy originating from a Ukrainian rival.

The emergent riots were autonomous from pior systems such as in the Second World War where plundered goods were readily enjoyed by rebels. Non-linearity makes for significant turmoil when we desire to explain the world in linear and sequenced constructs.

Signs and symbols: how meanings and institutional values transform over time

Previous points focused on philosophical constructs such as ontology and epistemology concerning the irrelevance of centre of gravity in military applications. This last point employs the study of signs or semiology (also known as semiotics). Signs constitute our languages, but go well beyond written and verbal cues into non-verbal and implied relationships; making sense of signs requires making sense of meanings. Signs function all around us, and some semiological proponents argue that the entire human experience functions wholly through sign interpretation.[76] Language becomes part of a 'system of signs' that philosopher Paul Ricoeur explains as, 'language is oriented beyond itself. It says something *about* something'.[77] As centre of gravity constitutes a metaphor employed by Clausewitz, there are multiple signs at play with a variety of subjective interactions. Semiology offers yet another way to examine the centre of gravity problem for the military.

Many other military theorists have laboured over the translation of *Schwerpunkt*, with some making great efforts to modernise select interpretations of what Clausewitz may have intended.[78] When languages (comprising signs) translate ideas across one another, relationships form between different signs so that the information crosses into a different language. With the signs come associations, concepts (gravity, physics and uniformed rules) coupled with the idea in transition. This creates a binary and unavoidable relationship between concepts and the very artefacts or things they string together.[79]

Societies, through assumptions and values, tend to take certain sign relationships and elevate them to 'symbols' that carry stronger influences over the way societies (and organisations and institutions) understand reality.[80] For example, the Statue

of Liberty, as an object (or artefact), is encoded with signs and various concepts such as statue, gift from the French nation, political freedom and democracy, size and so on. American society and many others connect the Statue of Liberty with opportunity, immigration and many other associations. Even the mere sign of the statue's profile relates to notions of America itself. Yet, as sociologist Mary Jo Hatch explains, societies cycle through a dynamic process of symbolisation and de-symbolisation as their values and assumptions transform over time.[81] Before returning this discussion to Clausewitz's centre of gravity, we will first consider something a little unusual.

The Flintstones was one of the first animated cartoons to dominate prime-time airways in America in the 1960s; its popularity provides insight into signs and symbols during that period of time. Generations of viewers can easily recall the theme song, the last chorus line of which is: 'we'll have a gay old time'. The vast majority of viewers during that period associated the sign 'gay' exclusively with 'a carefree, happy pursuit'. As *The Flintstones* was a comedy despite carrying social, political and ideological commentaries, viewers expected to laugh and enjoy the experience. Yet as the twentieth century progressed, social transformation and the sign of 'gay' gained a new symbolism of homosexuality, often with derogatory overtones. Today, the older meaning of 'carefree and happy' is a far weaker association.

Children who watch old re-runs of the show today may ask about the use of the word 'gay' in the song. The response of parents helps illustrate the notion of 'secondary referentiality'. 'Secondary referentiality' is an important element applied by semiologists in which signs offer an 'indirect reference to the structure of temporality' that reflects how the sign and associated concept relate to the passage of time.[82] Back in the 1960s, the signs and symbol relationships had the exclusive 'gay means carefree and happy' structure, whereas society has transformed and a new symbolism emerged and now dominates the sign for 'gay'.[83] The 'secondary referentiality' means that there is an awareness of the passage of time, and that over time signs gain multiple complex relationships with multiple other signs and symbols. One must 'decode' the often tangled web of signs and symbols through the twists and turns of dynamic societies, language, and information.[84] To negotiate these concepts requires awareness of the signs, symbols, relationships and passage of time. Figure 11 (below) illustrates using *The Flintstones* metaphor for the sign 'gay'.

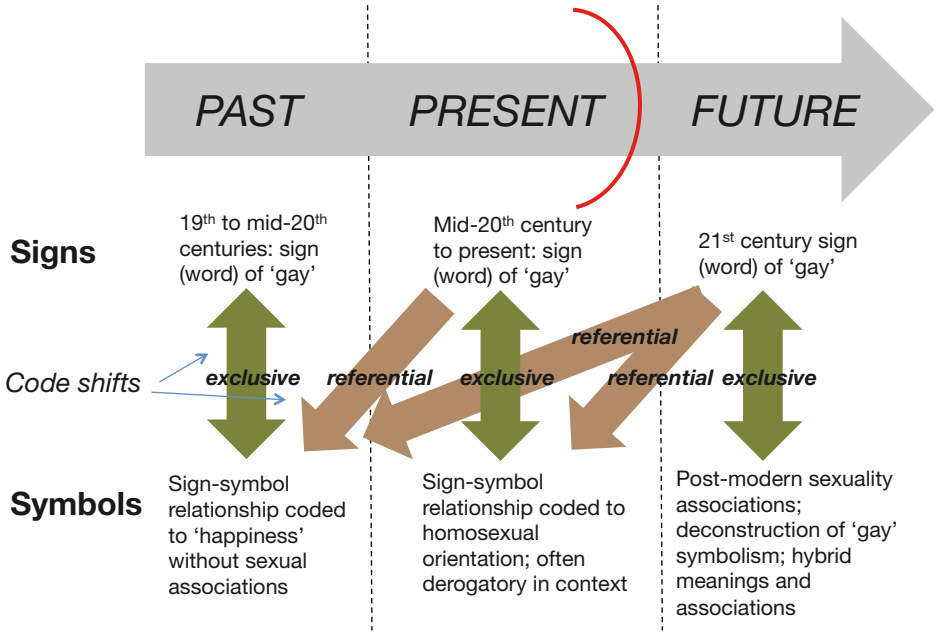

Figure 11: Signs, symbols, code shifts, and secondary referentiality

Figure 11 offers an anticipated future in which the word 'gay' may undergo further transformation, with emergent code shifts to different meanings. Here, art tends to be quite influential in driving societal adaptation. Mainstream artists continue to challenge notions of human sexuality, assisting in the emergence of new sign-symbol relationships. Performing artists such as Marilyn Manson, donning his genderless spandex suit, and popular television shows such as *Modern Family* and *Glee* influence new and positive views of homosexuality, and even the US military recently acknowledged that transgendered soldiers require new acknowledgements of rights and roles.[85] Potentially, the sign 'gay' may gain new symbolism. Future parents may need to perform multiple code shifts when their children encounter multiple generations of televisions programming: old Flintstones cartoons, 1980s television shows where 'gay' is used as a slur, ironic references like *Seinfeld*'s 'not that there's anything wrong with that', all potentially conflicting with a future generation's exclusive association of 'gay' with another future symbolisation or even a shift to an entirely different word.

Fred Flintstone's signature yell 'yabba dabba doo' and a dated cartoon theme song can act as a metaphor for appreciating why centres of gravity are irrelevant in military affairs. Few would agree with a historian who suggested that the original

Flintstones cartoon supported alternative lifestyles by employing 'gay old time' in any sign–symbol–code other than what it meant for the 1960 society that generated it. Yet military historians today continue to tinker with Clausewitz's sign–symbol–code relationship for centre of gravity in much the same way. Strange and Iron commit this semiological error by suggesting that 'Clausewitz would recognize the evolving concept of effects-based operations' as they attempt to force the short-lived 'effects based operations' methodology from joint doctrine into the original Clausewitz sign–symbol relationship.[86] Some centre of gravity proponents even openly admit that they reject Clausewitz's original text and request readers to substitute a new meaning to 'modernise' the concept.[87] This is akin to suggesting that the Flintstones were pioneers of gay rights, and illustrates some significant flaws in the way we understand the signs and symbols of Clausewitz's work. Introducing semiological inquiry into the centre of gravity discussion helps frame these sign–symbol patterns and avoid pitfalls in applying logic.

To modify Figure 11 from Flintstones to centre of gravity, the original and exclusive sign–symbol relationship established centre of gravity within the German term *Schwerpunkt* and associated it with a nineteenth-century symbolisation in which natural laws and rules linked everything together in intricate yet definite ways. Over the passage of time from the publication of Clausewitz's work, the centre of gravity has gained many new symbol code shifts as various militaries and schools of thought established new relationships and applications. The signs can continue to evolve with the future ushering novel and unexpected code shifts, but we cannot flip code shifts backwards to where signs and symbols operated in a previous time under an exclusive relationship. Ultimately, centre of gravity enthusiasts who continue to re-interpret 'what Clausewitz meant to say' or 'had Clausewitz known about quantum physics, he would have explained it this way' continue to dismantle established sign–symbol relationships and ignore the importance of secondary referentiality. Although often persuasive, these efforts miss the larger ontological and epistemological processes they are implicitly following to hold on to flawed positions.

Further, the alternative argument that centres of gravity must have some intrinsic value because militaries have been applying the concept in various ways through many conflicts also ignores the distinction between code shifts and secondary referentiality. Many suggest that the centre of gravity is 'the best of a field of inferior options' in this manner. One should not argue that we must ignore using the word 'gay' for anything but the original term of happiness simply because the *The Flintstones* has been in syndication for over five decades. *The Flintstones* advertised cigarettes

(their sponsors at times) with the main characters lighting up; however most modern viewers understand that, during the 1960s, cigarette advertising occupied a vastly different social context. Sign and symbol relationships change, often radically, and each exclusive relationship and subsequent code shifts requires an awareness of the ontological transformations in a given society.

Sometimes an idea or concept falls out of fashion, and at other times it was never a good idea. Recognising irrelevant concepts such as the centre of gravity in modern military applications requires a semiological awareness to break the veil usually obscured by the muddy waters where military signs, symbols and code shifts dynamically transform over time.

Thus far, this paper has discussed the importance of understanding how we think at an ontological, epistemological and methodological level, as well as how centralised and decentralised organisations function differently. It has looked at various types of problems from the simple to the complex. It has examined the centre of gravity and seen how it is well received in certain situations by particular organisational structures, and poorly in most others. Finally, it has considered the semiological aspects of how the centre of gravity functioned as a sign and symbol during Clausewitz's time of writing, and modern reinterpretations. The centre of gravity has been twisted, hammered, polished and fashioned into so many interpretations that almost every proponent has a variety of institutional, social or philosophical motives to preach his/her version. This makes for rather ineffective military planning and sense-making. Were the centre of gravity to be eliminated from military planning approaches, doctrine and methodologies, what might happen?

Conclusions: are centres of gravity a 'black hole' concept we can no longer escape?

Challenging the centre of gravity represents a major challenge to the entire knowledge system our military has created and maintained.[88] Technical rationalism, in practice, embraces the centralised hierarchy structure that empowers doctrine and hard-science models to become misapplied to complex social environments. There are strong self-interests associated with reinforcing a singular paradigm for approaching all military problems, where one must only apply a new model or formula to unlock secret centres of gravity, exploit them and mass produce them for the entire audience to apply in practice. As has been discussed in detail, complexity rejects these linear and static approaches.

Ultimately, is casting Clausewitz's centre of gravity construct aside and ridding decision-making and doctrine of this tortured and misunderstood concept any different to eventual rejection of other military concepts? The once-popular 'morale bombing' of Second World War aviation strategy, the ill-fated 'effects based operations' centred on uni-minded systems theory, and the tactical nuclear construct of the 1950s Army 'Pentomic Divisions' were all discarded once they were deemed flawed or inadequate. Yet many concepts are debated only methodologically, while remaining entrenched in deeper epistemological and ontological processes that make them highly resistant to change. Are centres of gravity something that, despite being an irrelevant and incompatible concept for complexity, cannot be abandoned?[89]

Clausewitz cannot be blamed for placing the centre of gravity on a pedestal. Rather, the designs of multiple generations of military theorists and doctrine writers and the almost absolute obedience to technical rationalism and positivism have made the centre of gravity the 'centre of gravity' of our own military decision-making and campaign design. Removing the centre of gravity may enhance other elements within *On War* that seem to embrace non-linear, complex aspects of warfare.[90] At ontological and epistemological levels, both joint and service-specific planning doctrine have made the centre of gravity a central pillar for campaigns and major planning activities.[91]

The abandonment of the centre of gravity concept remains a bold proposal when our military institution generally remains a large, overly bureaucratic organisation shackled to technical rationalism. Yet complexity disavows all efforts to simplify through reductionism, and reverse-engineering the planning process creates bigger problems. Our rigid hierarchy and centralised control subsequently delays critical reflection of the centre of gravity process and increases the expenditure of resources, time and lives towards potentially irrelevant or misunderstood objectives. The centre of gravity cannot be removed from our strategy and planning processes only to be replaced by a 'centre of gravity-like' replacement that reinforces the rest of the centre of gravity-centric system. This paper is not just an attack on the centre of gravity — it opens the door to challenging the entire preferred paradigm employed by most military forces.

To liberate cognitive approaches to military sense-making, the centre of gravity must be removed from its artificial cornerstone position in doctrine and practices so that we might move on to more pressing concerns. We could next consider that there are no levels of war, and our efforts to enforce these constructs cause even greater damage than centres of gravity do in sense-making within conflicts …

Endnotes

1 Carl von Clausewitz, *Two Letters on Strategy*, Peter Paret and Daniel Moran (ed, trans), Fort Leavenworth, Kansas: Combat Studies Institute Press, 1984, p. 38, http://usacac.army.mil/cac2/cgsc/carl/download/csipubs/carlvonc.pdf.

2 John Holland, 'Complex Adaptive Systems', *Daedalus*, 121: 1, Winter 1992, p. 17.

3 Christopher Paparone and William Davis, Jr., 'Exploring Outside the Tropics of Clausewitz: Our Slavish Anchoring to an Archaic Metaphor', Select Faculty of the US Military Command and Staff College, *Addressing the Fog of COG, Perspectives in Addressing the Center of Gravity in US Military Doctrine*, Celestino Perez Jr. (ed), Fort Leavenworth, Kansas: Combat Studies Institute Press, 2012, pp. 66–69. The US Army Command and General Staff College found the centre of gravity debate so worthy of focus that, in 2012, it commissioned multiple faculty members and experts in military theory to argue the merits of centre of gravity applications in doctrine, theory, practice and history.

4 George Rizer, *Sociology: A Multiple Paradigm Science* (revised edn), Boston: Allyn and Bacon, 1980, p. 7. See also Thomas Kuhn, *The Structure of Scientific Revolutions* (3rd edn), Chicago: University of Chicago, 1996, pp. 5–15.

5 Select Faculty of the US Military Command and Staff College, *Addressing the Fog of COG*.

6 US Department of the Army, *FM 3-0, Operations*, Washington DC, 2011, p. 7-6. See also US Department of the Army, *ADP 3-0, Unified Land Operations*, Washington DC, 2011, p. 9–11; US Department of Defense, *Joint Publication 5-0, Joint Operation Planning*, Washington DC, 2011, p. A-3.

7 Stephen Melton, 'Center of Gravity Analysis — the Black Hole of Army Doctrine' in *Addressing the Fog of COG*, pp. 81–84.

8 Phillip Pattee, 'Center of Gravity: Right Idea, Wrong Direction', in *Addressing the Fog of COG*, pp. 124–25.

9 *Joint Operations Planning*, p. IV-2. See also US Department of the Navy, *MCWP 5-1, The Marine Corps Planning Process*, Washington DC, 24 August 2010, p. 2–5. Marines employ a tactical centre of gravity while the Army does not. Joint and service-specific centre of gravity definitions also differ.

10 Michael Cohen, James March and Johan Olsen, 'A Garbage Can Model of Organizational Choice', *Administrative Science Quarterly*, 17: 1, March 1972, p. 2. The authors describe decision-making stimuli in organisations, referring to an organisation as 'a collection of choices looking for problems'. Thus, the way an organisation self-identifies often determines what problems it seeks and how it prefers to solve them. See also Werner Stark, *The Sociology of Knowledge*, London: Routledge & Kegan Paul, 1968, p. 16.

11 Joseph Strange and Richard Iron, 'Center of Gravity: What Clausewitz Really Meant', *Joint Forces Quarterly*, 35, 2004, pp. 24–25. The authors offer a number of historical and retrospective examples to illustrate valid centre of gravity in historical conflicts, adding the qualifier 'with the gift of hindsight'.

12 Subsequent sections of this paper will explain the differences between highly centralised 'top-down' organisations and those that are decentralised. Future adversaries that maintain a largely centralised structure may be susceptible to 'centre of gravity'-like concepts in some situations.

13 Kurt VanderSteen, 'Center of Gravity: A Quest for Certainty or Tilting at Windmills', *Addressing the Fog of COG*, p. 49. See also Christopher Paparone and William Davis Jr., 'Exploring Outside the Tropics of Clausewitz: Our Slavish Anchoring to an Archaic Metaphor' in *Addressing the Fog of COG*, p. 66; Antoine Bousquet, *The Scientific Way of Warfare; Order and Chaos on the Battlefields of Modernity*, New York: Columbia University Press, 2009, pp. 46–54.

14 Carl von Clausewitz, *On War*, Michael Howard and Peter Paret (eds and trans), New Jersey: Princeton University Press, 1984, p. 119.

15 Stark, *The Sociology of Knowledge*, p. 15.

16 Antoine Bousquet and Simon Curtis 'Beyond Models and Metaphors: Complexity Theory, Systems Thinking and International Relations', *Cambridge Review of International Affairs*, 24: 1, 2011, p. 55.

17 Clausewitz, *On War*, p. 75.

18 Dale Eikmeier, 'Modernizing the Center of Gravity Concept — So it Works', *Addressing the Fog of COG*, p. 135.

19 Pattee, 'Center of Gravity: Right Idea, Wrong Direction', p. 125. Pattee summarises the centre of gravity work of Eikmeier, Strange, Iron, Kem, Rueschhoff, and Dunne among others. 'They all propose the remedy in fixing the doctrinal definition of center of gravity …' See also VanderSteen, 'Center of Gravity: A Quest for Certainty or Tilting at Windmills', p. 39. VanderSteen explains Dr Strange's 'reductionist and dualistic method' for centre of gravity formations as driven by the need to 'explain complex theoretical concepts to future practitioners', yet 'students often demand clear concepts that have direct application to problems they face in the operational environment'. See also Strange and Iron, 'Center of Gravity: What Clausewitz Really Meant', p. 24. The authors isolate the root problem as the centre of gravity's confusing definition in doctrine and attempt to provide a suitable replacement so that 'hours wasted in fruitless argument could be better spent on planning'.

20 Pattee, 'Center of Gravity: Right Idea, Wrong Direction', p. 116. 'What [Dr] Strange and [Dr] Iron propose is a model of nested centres of gravity, something like a zipper. Once you grasp the pull and tug, it comes apart'. Pattee further cites Dr Eikmeier's centre of gravity work commenting, 'what this method provides is a simple and clear process for the identification and selection of a center of gravity' (p. 121). Eikmeier and others offer the promise of universal keys for unlocking centres of gravity in virtually all future military scenarios, provided their methodology is employed correctly.

21 Antoine Bousquet, 'Chaoplexic Warfare or the Future of Military Organization', *International Affairs*, 84: 5, 2008. See also Draper Kauffman Jr., Systems 1, *An Introduction to Systems Thinking*, The Future Systems series, T. Lance Holthusen (ed), 1980; Bousquet, *The Scientific Way of Warfare*; Gerald M. Weinberg, *An Introduction to General Systems Thinking*, New York: John Wiley and Sons, 1975; Jamshid Gharajedaghi, *Systems Thinking: Managing Chaos and Complexity* (2nd edn), Butterworth-Heinemann, Elsevier, 2006; Ludwig von Bertalanffy, *General System Theory*, New York: George Braziller, 1968.

22 Bousquet and Curtis, 'Beyond Models and Metaphors', p. 46. See also Russ Marion and Mary Uhl-Bien, 'Complexity Theory and Al-Qaeda: Examining Complex Leadership', *Emergence*, 5: 1, 2003, pp. 56–57; Justin Kelly and Michael Brennan, 'The Leavenworth Heresy and the Perversion of Operational Art', *Joint Forces Quarterly*, 56, 2010, p. 110.

23 Alan Beyerchen, 'Clausewitz, Nonlinearity, and the Unpredictability of War', *International Security*, 17: 3, Winter 1992/93, p. 62. Beyerchen explains linear systems as having a central concept 'that the whole is equal to the sum of its parts', which allows a problem to be broken into smaller elements, solved, and then reassembled to obtain the overarching solution.

24 John L. Romjue, *American Army Doctrine for the Post-Cold War*, Military History Office, Fort Monroe: US Army Training and Doctrine Command, 1997, p. 11. Modern army principles of war in US doctrine are copied directly from Jomini's principles of war. See also Francois Jullien, *A Treatise on Efficacy Between Western and Chinese Thinking* (trans Janet Lloyd), Honolulu: University of Hawai'i Press, 1996, p. 11. For a Chinese perspective, see Qiao Liang and Wang Xiangsui, *Unrestricted Warfare*, Beijing: People's Liberation Army Literature and Arts Publishing House, 1999, p. 19. For a Russian (post-Soviet) perspective, see Vladimir Slipchenko, 'For What Kind of War Must Russia Be Prepared?', *Future War Lecture Series*, Polit.ru Public Lecture Series, Transcript C47, 11 November 2004, pp. 20–21.

25 Beyerchen, 'Clausewitz, Nonlinearity, and the Unpredictability of War', p. 60. The author suggests that Clausewitz recognised that his contemporaries interpreted war as something they could control with purely linear analytical solutions. Beyerchen attempts to demonstrate that Clausewitz understood complexity and embraced non-linearity, although not in modern terms.

26 Karl Weick, 'Rethinking Organizational Design', *Managing as Designing*, Richard Boland Jr. and Fred Collopy (eds), California: Stanford University Press, 2004, p. 42. Weick argues that highly coordinated groups are 'the last groups to discover that their labels entrap them in outdated practices'. For the military, attachment to centre of gravity constructs may be a valid example of this.

27 Hayden White, *The Content of the Form: Narrative Discourse and Historical Representation*, Baltimore: John Hopkins University Press, 1990, pp. 40–43. White casts narratives as preconfigured discourse that reflects values, themes and 'codes' that every culture and society weaves into narratives.

28 Ibid., p. 42.

29 Fourmilab's calendar converter at: http://www.math.harvard.edu/computing/javascript/Calendar/ Entering the date of the Battle of Waterloo produces all manifestations of that date computed within various other calendar systems.

30 An interesting aside: during the War of the Third Coalition (1803–06), this difference in dates may have contributed to the failure of Austrian war planners to correctly anticipate the date on which they were expecting to rendezvous with their Russian allies. This failure in turn led to them confronting Napoleon with inferior numbers, itself a contributing factor in their defeat at Ulm in October 1805. See Owen Connelly, *Blundering to Glory: Napoleon's Military Campaigns*, (3rd edn), Lanham: Rowman & Littlefield Publishers, 2006, pp. 76–78.

31 While some historians might take issue with this, it serves as a metaphor to illustrate a key point. The Germans wore uniforms, fired projectile weapons, moved in similar formations, used aviation, artillery and armour in generally similar ways to the Allies.

32 Pattee, 'Center of Gravity: Right Idea, Wrong Direction', p. 124. See also VanderSteen, 'Center of Gravity: A Quest for Certainty or Tilting at Windmills', p. 41; Jeffrey Reilly, *Operational Design: Shaping Decision Analysis through Cognitive Vision*, Maxwell Air Force Base: Department of Joint Warfare Studies, 2009, pp. 22–29; Jack Kem, *Campaign Planning: Tools of the Trade*, Fort Leavenworth, Kansas: Department of Joint, Interagency, and Multinational Operations, 2009, pp. 25–31.

33 Stark, *The Sociology of Knowledge*, p. 13. Epistemology is 'concerned with the relationship between the knowing or perceiving subject on the one hand, and the world of objects which he sets out to perceive and know on the other'.

34 Wm. J. Olson, 'The Continuing Irrelevance of Clausewitz', *Small Wars Journal*, July 2013, http://smallwarsjournal.com/jrnl/art/the-continuing-irrelevance-of-clausewitz. Olson summarises 'epistemology' as 'how we know what we know; or how can we reliably know what we know; or can we reliably know what we know; or we cannot reliably know'.

35 Aaron Jackson, *The Roots of Military Doctrine: Change and Continuity in Understanding the Practice of Warfare*, Fort Leavenworth, Kansas: Combat Studies Institute Press, 2013, p. 3.

36 Bousquet and Curtis, 'Beyond Models and Metaphors', p. 56.

37 Douglas Hofstradter, *Godel, Escher, Bach: an Eternal Golden Braid*, New York: Basic Books, 1979, pp. 275–84. Hofstradter offers a vignette featuring a crab, a tortoise and man named Achilles that discusses the M.C. Escher lithograph titled 'Cube with Buttons'. The crab exclaims, 'There's no way to see them simultaneously as concave AND convex — somehow one's brain doesn't allow that'. This notion of paradox and complexity is a strong theme in Hofstradter's book.

38 Eikmeier, 'Modernizing the Center of Gravity Concept — So it Works', pp. 136–37.

39 Strange and Iron, 'Center of Gravity: What Clausewitz Really Meant', p. 25. The authors cite numerous translation errors in Howard and Paret's English version of *On War* while presenting epistemological-level problems.

40 Kem, *Campaign Planning: Tools of the Trade*, pp. 25–28. See also John Leskovich, 'An Operational Center of Gravity Analysis of Operation Iraqi Freedom' (unpublished), US Naval War College, 13 February 2006; Jay Aldea, 'The Effect of bin Laden's Death and Arab Spring on Al Qaeda's Operational Center of Gravity' (unpublished), US Naval War College, 4 May 2012; Strange and Iron, *Center of Gravity: What Clausewitz Really Meant*, pp. 20–27.

41 Catherine Hardy and Denise Tolhurst, *Epistemological Beliefs and Cultural Diversity Matters in Management Education and Learning: A Critical Review and Future Directions*, Academy of Management Learning & Education, 13: 2, 2014, p. 268.

42 Michael Reed, 'Reflections on the "Realist Turn"', *Journal of Management Studies,* 42: 8, December 2005, p. 1623.

43 Figure 5 includes reference to CV/CR/CC for centres of gravity. This is the abbreviation for a method espoused by Strange, Kem, Reilly and others who employ an analytic tool to reduce a centre of gravity. Critical capabilities (CC) are the enablers that provide critical functionality — they define the centre of gravity. Critical requirements (CR) are the essential means, actors and items for a critical capability to function. The critical vulnerabilities (CV) are elements of the critical requirements for a centre of gravity and are vulnerable to direct or indirect attack. Damaging a centre of gravity must be achieved through focusing on the enemy's CVs while protecting one's own CVs. See Reilly, *Operational Design: Shaping Decision Analysis through Cognitive Vision*, pp. 25–26; Kem, *Campaign Planning: Tools of the Trade*, pp. 88–89.

44 Ori Brafman and Rod Beckstrom, *The Starfish and the Spider*, New York: The Penguin Group, 2006. For details of the TRADOC leadership program see William Colbert, 'Improvisational Leadership: Setting the Stage for Future Army Leader Development', *Army Magazine*, December 2010, http://www.ausa.org/publications/armymagazine/archive/2010/12/Documents/Colbert_1210.pdf.

45 Brafman and Beckstrom, *The Starfish and the Spider*, p. 39.

46 White, *The Content of the Form*, p. 36.

47 Peter Berger and Thomas Luckmann, *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*, New York: Anchor Books, 1967, p. 59.

48 Marion and Uhl-Bien, 'Complexity Theory and Al-Qaeda', p. 55; see also Jeff Conklin, 'Wicked Problems and Social Complexity', *CogNexus Institute*, 2008, p. 4, http://www.cognexus.org.

49 Marion and Uhl-Bien, 'Complexity Theory and Al-Qaeda', p. 55; Conklin, 'Wicked Problems and Social Complexity', p. 4.

50 Carl H. Builder, *The Masks of War; American Military Styles in Strategy and Analysis*, Baltimore: John Hopkins University Press, 1989, pp. 11–17. See also Stark, The Sociology of Knowledge, p. 23.

51 Bousquet, *The Scientific Way of Warfare*, pp. 46–56.

52 Valerie Ahl and T.F.H. Allen, *Hierarchy Theory: A Vision, Vocabulary, and Epistemology*, New York: Columbia University Press, 1996, p. 1. See also Fritjof Capra, *The Web of Life*, New York: Anchor Books, 1996, p. 29; Nassim Nicholas Taleb, *The Black Swan*, New York: Random House, 2007, p. 16.

53 Shirley-Ann Hazlett, Rodney McAdam and Seamus Gallagher, 'Theory Building in Knowledge Management: In Search of Paradigms', *The Journal of Management Inquiry*, 14: 1, March 2005, p. 36. See also Sinisa Malesevic, *The Sociology of War and Violence*, Cambridge: Cambridge University Press, 2010, p. 334.

54 Horst Rittel and Melvin Webber, 'Dilemmas in a General Theory of Planning', *Policy Sciences*, 4, 1973, p. 162. See also Weick, 'Rethinking Organizational Design', p. 42.

55 Shimon Naveh, Jim Schneider and Timothy Challans, *The Structure of Operational Revolution; A Prolegomena*, Hamilton: Booz, Allen, 2009, p. 88. The authors criticise the military's repetitive 'tacticisation' where military institutions 'are inclined to apply knowledge they have acquired from their tactical experiences to their operational functioning sphere. In such cases, they either reduce the operational inquiry of potential opposition into a mechanical discussion or completely reject the need for a distinct learning operation'.

56 Bousquet and Curtis, 'Beyond Models and Metaphors', p. 45. See also Capra, *The Web of Life*, p. 29.

57 VanderSteen, 'Center of Gravity: A Quest for Certainty or Tilting at Windmills', pp. 40–41. See also Pattee, 'Center of Gravity: Right Idea, Wrong Direction', p. 122; Kem, *Campaign Planning: Tools of the Trade*, pp. 15–24; Reilly, *Operational Design*, pp. 14–23.

58 Romjue, *American Army Doctrine for the Post-Cold War*, p. 11. See also Jullien, *A Treatise on Efficacy Between Western and Chinese Thinking*, p. 11; Beyerchen, 'Clausewitz, Nonlinearity, and the Unpredictability of War', pp. 78–79. Beyerchen goes to great lengths to argue that Clausewitz appreciated key aspects of non-linearity and chaos, but at times dismantles his argument. He cites Clausewitz's metaphor in which 'war is a game of cards'. This unintentionally aligns Clausewitz with Jomini where a successful strategist is closer to a card shark or pool hustler, one who masterfully plays on human mannerisms, hunches and chance. He further damages his position by acknowledging that *On War* provides no definition of 'chance', yet attempts to transform Clausewitz into a futurist who anticipated chaos theory and advanced mathematics such as Pointcare's later work on chance and uncertainty.

59 Bousquet, *The Scientific Way of Warfare*, pp. 128–29. Bousquet discusses the evolution of military concepts from 'command' to 'command and control' where this suggests a process in which the controller might capture all information from the environment, process it, and transmit it back in a 'feedback loop' that promises total control of a battlefield with predictability and precision. For a discussion of the way this has been applied within military doctrine see Jackson, *The Roots of Military Doctrine*, pp. 52–53.

60 Kem, *Campaign Planning: Tools of the Trade*, pp. 15–24. Kem's methodology for operational design demonstrates the 'reverse engineering' aspect of military planning. See also Conklin, 'Wicked Problems and Social Complexity', pp. 4–5; Reilly, *Operational Design*, pp. 14–23. Reilly's 'cognitive map' methodology, like Dr Kem's approach, illustrates a reverse-engineered campaign plan which begins with the desired end-state and military termination criteria.

61 Jackson, *The Roots of Military Doctrine*, pp. 65–68.

62 Gerald M. Weinberg, *Rethinking Systems Analysis and Design*, Boston: Little, Brown and Company, 1982, p. 12.

63 Bousquet, 'Chaoplexic Warfare or the Future of Military Organization', p. 925. See also Miguel Pina e Cunha, Joao Vieira da Cunha and Ken Kamoche, 'The Age of Emergence: Toward a New Organizational Mindset', *SAM Advanced Management Journal*, Summer 2001.

64 Holland, 'Complex Adaptive Systems', p. 29.

65 Marion and Uhl-Bien, 'Complexity Theory and Al-Qaeda: Examining Complex Leadership'.

66 Wikipedia does feature a hierarchy of sorts, with corporate owners and leadership as well as administrative, legal and physical structures. Wikipedia relies entirely on a decentralised bottom-up process for content production (what the organisation makes).

67 Jim Giles, 'Internet Encyclopedias Go Head to Head', *Nature*, 438, 15 December 2005, pp. 900–01. Nature later addressed several critical refutes by Britannica in follow-ups to this article. See also Maria Bustillos, 'Wikipedia and the Death of the Expert', *The Awl.com*, 17 May 2011, http://www.theawl.com/2011/05/wikipedia-and-the-death-of-the-expert. While critics of Wikipedia point to hackers, misinformed contributors and pranksters for errors, the decentralised policing of the site still corrects most problems soon after they are discovered. No printed set of volumes can ever approach the scope or depth of what Wikipedia and other social knowledge constructions now produce.

68 John Molineux and Tim Haslett, 'The Use of Soft Systems Methodology to Enhance Group Creativity', *Systemic Practice and Action Research*, 20: 6, December 2007, pp. 477–96. Molineux and Haslett cite numerous studies on creativity and group dynamics to argue that democratic (plural, not hierarchical) and collaborative leadership fosters increased creativity.

69 Holland, 'Complex Adaptive Systems', p. 17.

70 Brafman and Beckstrom, *The Starfish and the Spider*, pp. 15–21, 36–41, 140–43. For al Qaeda see Marion and Uhl-Bien, 'Complexity Theory and Al-Qaeda'.

71 Gareth Morgan, *Images of Organization*, SAGE Publications, 2006, p. 229. See also Valerie Ahl and T.F.H. Allen, *Hierarchy Theory: A Vision, Vocabulary, and Epistemology*, p. 1.

72 Bousquet, *The Scientific Way of Warfare*, p. 56.

73 Griff Witte, 'Rebels in Ukraine Tried to Distribute Candy to Kids. But the Plan Went Spectacularly Wrong', *The Washington Post*, 2 June 2014, https://www.washingtonpost.com/news/worldviews/wp/2014/06/01/%E2%80%8Brebels-in-ukraine-tried-to-distribute-candy-to-kids-but-the-plan-went-spectacularly-wrong/

74 Ibid.

75 Ibid.

76 White, *The Content of the Form*, pp. 31, 191–92. See also Michel Foucault, *The Order of Things*, New York: Vintage Books, 1994, pp. 46–50.

77 Paul Ricoeur, *Time and Narrative*, (trans. Kathleen Blamey and David Pellauer), Chicago: University of Chicago Press, 1985, p. 78.

78 Eikmeier, 'Modernizing the Center of Gravity Concept — So it Works', p. 145.

79 Foucault, *The Order of Things*, pp. 26–27.

80 Mary Jo Hatch and Ann Cunliffe, *Organization Theory* (2nd edn), New York: Oxford University Press, 2006, pp. 208–15. Hatch adapts her model from Pasquale Gagliardi and uses a cycle of assumptions, values, artefacts and symbols representing the way a society rotates through each of the processes and eventually changes them.

81 Ibid., pp. 210–11.

82 White, *The Content of the Form*, p. 172.

83 There are, of course, other associations with the sign 'gay' such as when something is 'stupid' or 'un-cool' as well as counter-masculine meanings. However, the current predominant symbol association with 'gay' in Western culture is homosexual.

84 White, *The Content of the Form*, pp. 193–98.

85 Will Dunham, 'Hagel backs review of U.S. military ban on transgender troops', *Reuters*, 11 May 2014, http://www.reuters.com/article/2014/05/11/us-usa-military-transgender-idUSBREA4A09A20140511.

86 Strange and Iron, 'Center of Gravity: What Clausewitz Really Meant', p. 25. Effects-based operations were popularised in joint doctrine in the 1990s and were based on a uni-minded system approach (branching from General Systems Theory) in which attacking a key node could collapse an entire system.

87 Dale Eikmeier, 'Redefining the Center of Gravity', *Joint Forces Quarterly*, 59, 2010, p. 156. Eikmeier argued that, 'It does not matter what Carl von Clausewitz said about the center of gravity (COG) in the 19th century. What matters is how we want to use the COG concept in the 21st century'.

88 Karl Weick, 'Drop Your Tools: An Allegory for Organizational Studies', *Administrative Science Quarterly*, 41, 1996, p. 307. Weick uses the image of firemen 'dropping their tools' as a metaphor for the adaptation of organisations. On failure, he writes, 'to drop one's tools may be to admit failure. To retain one's tools is to postpone this admission and to feel that one is still in it and still winning'.

89 This is not the only example of such phenomena found in military doctrine. Jackson, in *The Roots of Military Doctrine* (p. 52) for example, observes that 'mechanistic ideas, such as the 'linear battlefield,' continued to exist alongside other (newer and hence more prominent) ideas belonging to more recent scientific regimes, long after the mechanistic sciences had ceased to constitute the dominant regime'.

90 Beyerchen, 'Clausewitz, Nonlinearity, and the Unpredictability of War', pp. 66–72. Beyerchen argues that, although Clausewitz did not use directly related language or concepts of non-linearity and complexity, his work contains an appreciation of these concepts and used, for his time, many advanced ideas and language to try to convey this.

91 Weick, 'Drop Your Tools', p. 312.