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Carl von Clausewitz, Meet Albert Einstein and Max Planck

Replacing the Center of Gravity Concept with a Quantum Mechanics Military Theory and Its Implications

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For a while now we have been telling ourselves that Counterinsurgency (COIN) and Irregular Warfare (IW) are "different", "more complex", and even the "graduate level of warfare". Although I disagree with the latter two terms, I do think COIN and IW are different than traditional (or conventional) warfare (though I think in reality warfare is much more fluid than we give it credit for). As such, we should be using different tools to conduct these types of operations. Instead we have prescribed "more of the same". We use the same unit structures, personnel system, concepts, and planning tools that we use for more conventional operations. One of these is the "Center of Gravity" (CoG) concept. Instead of using a notion taken from 19th Century physics and fused with an industrial-era reductionist's analytical tool, we should turn to the latest physical science theories to help make sense of operations that are not conventional. Carl von Clausewitz's concept needs updating from the likes of Albert Einstein and Max Planck instead of continuing to rely on Isaac Newton.

CoG Concept History

It should be no surprise that **Carl von Clausewitz first heard the term of "Center of Gravity" at a physics conference in 19th Century Germany** (pg 110) The physics at the time, Newtonian Physics, did well to explain most observable phenomena then in existence. Newton's take on gravity was tied to a mass's body*: that physical point within an object at which the gravitational attraction to other bodies is exactly equal in every direction*. Clausewitz, it is postulated, heard the concept and immediately imagined a wrestler losing his balance due to his opponent finding a center of gravity and exerting a force against it. He further imagined this concept being used in the military context: as a general would find that point at which to concentrate effects so that the opposing army would likewise lose balance and "fall". Of course, Newtonian physics suffered from a few issues, the main ones being that it is only accurate as long as one is dealing with sufficiently large objects and relatively low speeds. As one approaches the speed of light, for instance, Newtonian, or "classical" physics does not explain observable phenomena very well at all. The military, of course, taking its cues from Clausewitz's metaphor, have a very distinct take on the military "Center of Gravity".

Military Take on CoG

The U.S. military, taking many of its cues from Clausewitz, incorporated his Center of Gravity concept into its doctrine, even updating it into an intricate analytical tool with which to assist in targeting enemy capabilities. According to U.S. doctrine, an enemy's Center of Gravity is the source of its strength. Broken

down further, one does a Center of Gravity (CoG) analysis by first identifying critical capabilities (CCs)- those capabilities which enable a CoG. Next, one further breaks down a CoG by identifying those critical requirements (CRs) necessary for those capabilities. Lastly, the requirements are analyzed in order to find those requirements that are vulnerable to action- thus "critical vulnerabilities" (CVs). Once one theoretically has identified an enemy's vulnerabilities, one can concentrate action (force) on the vulnerabilities and thus ultimately influence one's enemy's CoG- thus rendering them defeated, or at least in theory.

What this is, of course, is a targeting methodology for breaking something seemingly complex down to manageable parts. As **COL Dale Eikmeier notes in his JUL '04 article in Military Review** on CoG (pg 5), "*So, as with attacking any complex problem, we can break strategic centers of gravity down into more manageable pieces*." Complexity theorists, of course, would have a problem with COL Eikmeier's description as they most likely would with the U.S. military's use of a reductionist tool to approach complex subjects. Simply stated, one cannot break down a complex problem, study its pieces/parts, and then come to a deeper understanding of the complex problem as a whole. The nature of complexity renders this notion- that one can understand a complex system -very illusory and dangerous. But, COL Eikmeier goes further with his reductionism. He explains that strategic CoGs are very difficult to influence therefore one must identify COGs at the operational levels and then, through the combined action of many operational-level units attacking their respective CoGs, the aggregated result will be that the strategic CoG is defeated. Unfortunately for the U.S. military, the concept of gravity as a physical phenomenon has changed since the 19th Century and complexity theory has gone a long way towards describing the fallacies in reductive analysis of complex phenomena.

Updates to Physics since Newton: Center of Gravity

A lot has changed in science since Sir Isaac Newton got hit on the head with that apple. For starters, Einstein's Theory of General Relativity has updated the concepts of gravity and "centers" of gravity. In physics the center of gravity concept is used to determine the average location of all the mass in a body or group of bodies. Of course this is used to measure distances and locate celestial bodies among other things. In so-called "uniform fields" (a field in which the gravitational forces upon an object are the same no matter the position of the object), this isn't that much of a problem, but in "non-uniform" fields, gravitation's effects cannot be calculated using the center of mass alone. The center of gravity of an object within a non-uniform field may not even exist (or, if it exists, it may not be "unique", i.e., there may be other centers)! In fact, the concept is rarely used in application today, since the center of gravity depends on the external field within which an entity exists. In layman's terms, the center of gravity says more about the *context* of an object than of the object itself. Applied to the military, if one has to, one might say: "*the center of gravity of the Taliban insurgency, even if we could identify one, would say less about the Taliban insurgency than it would about the regional political struggle going on in that part of Asia*."

The description here (**http://www.grc.nasa.gov/WWW/K-12/airplane/cg.html**) is a very good example of how physics uses the CoG concept: it assumes a body at one position or activity, freezes that position/action and then makes measurements of its weight, position, momentum, etc.- to arrive at a pretty close approximation (depending on the use of the information) as to the "center" of the object's mass (or gravity). For uniformly distributed objects, it is fairly simple. For objects that are not uniformly distributed- more complex forms of calculus are required to determine the CoG. If I had to make an argument one way or another, I'd submit that a "small war" would be more like a non-uniform field…

Quantum Mechanics

Complex systems arguably have a lot in common with Quantum Mechanics (QM). Both are very difficult

concepts--not intuitive to humans. Both are not observable phenomena--at least not by the average human and many times only indirectly by others. Quantum Mechanics gets into concepts at the very small levels of our universe, and comes to the surprising and non-intuitive conclusion that at the root of our existence, life is very relativistic. The issue with relativity, of course, is that it is impossible to predict things that are relative to the observer, due to the observer being a part of the equation. For instance, one cannot measure the exact movement and position of entities at the quantum level, because the very act of measuring influences the object being measured. Likewise, one might imagine that the very act of targeting a vulnerability would actually change the CoG of a complex system. Complexity, by its very nature, resists attempts to bring about rapid and objective change. Another issue identified within Quantum Mechanics is a curious lack of deterministic causality. This, if applied to the military, could be maddening since it basically holds that we would be chasing our tails if we attempted any kind of causal analysis of complex entities. In other words, our entire assessments epistemology and infrastructure would have to be scrapped.

CoG updated

To update the CoG concept I propose using the theory of General Relativity to guide our way towards something useful: it might be helpful for most interactions at the "cognitively clear causality level" (where linear thinking is effective, or, one might simplistically say the "tactical level"). In other words, since the physics take today on CoG is that it is largely irrelevant to objects and that it says more about the external field an object exists in rather than the body itself, let's throw the concept out as far as planning goes! If we want to keep something in our doctrine about a capabilities-requirements-vulnerabilities reductionist analytical tool, then by all means do so, but let's be clear in our doctrine where it came from, the weakness of it, and the questionable use of it above the "ground user" level. In fact, it might be more useful as a targeting tool. But to imply any higher benefit from an analytical tool, even to its use during conventional on conventional warfare (if there is such a thing), I submit is oversimplification. Unless one is willing to admit that as soon as one targets something that borders on the abstract ("will of the people", for instance) that one has analyzed it will change and it is very dubious whether it will have any kind of decisive effect, then the use of the C-R-V analytics tool would be dangerously illusory as would any implication of decisive action when dealing with complex phenomena.

A Quantum Mechanics Military Theory

I advocate instead for a Quantum Mechanics (QM) military theory as a more useful metaphor to replace the current one based in 19th century physics. In the latter model of how warfare goes, linear causality is assumed, actors are rational, and the complex can be understood with the right amount of analysis. At the "linear level" (where causality is easier to determine) there are millions of random activities going on--micromanagement and top-down rational analysis of those activities actually would tend to make things worse as for every action there is an uncertain reaction and micromanagement and top-down analysis simply adds to the already existing mix of actions (just to discourage obsessive officers from further attempting to control things below them). At levels further away from direct "ground" level things would seem to "even out" and thus trends can sometimes be determined; this is the real value of headquarters in complex environments: being able to make assumptions about "the aggregate", change priorities, gauge feedback, and revisit assumptions. Because averages are important according to Quantum Mechanics and not a lot of randomness in the aggregate, this is where our analytical efforts should be concentrated, not to lead our action but to confirm our assumptions and help make intelligent decisions on priorities and how best to meet policy objectives through the use of our actions.

To be more effective within a "QM" world we must imagine that it is entirely possible that we have to look at the world in a different way. Not different for everyone: most at the pointy end of the spear would be able to continue seeing things in a Newtonian (or General Relativity) manner. Things are logical there,

there is causality (or the appearance of causality), and one can use reduction to understand greater concepts (one can take an M-16 apart and understand how it works, an ambush can be broken down into its components and lessons can be gained from that analysis, people may protest and burn our President in effigy because they are paid to do so, etc.). As one gets into the aggregate of those "micro-level" activities we have to realize that things are different. Things seem illogical and causality is difficult, if not impossible, to trace. But, because one is attempting to look at an average of "lower-level" actions in the aggregate at higher levels, things don't have to seem random if we don't attempt to force linear causality (simple explanations for things) onto everything. We can aggregate data and make assertions about trends, shift things a little and note the changes, never forgetting that the act of "shifting" itself changes the environment we were observing. At this level it is even more difficult, but not impossible, to affect positive change. Again, it will take a recognition that things are not the same at the aggregate level as it is at the "linear" level. One cannot get too bogged down in the data, the narratives, and the "tactical" to "miss the forest". And one has to at least have an appreciation, if not an intimate comfort level, with complexity theory, systems thinking, emergence, biological evolutionary change mechanisms, quantum mechanics, and other disciplines that study some of the same types of phenomena that one studies in the preparation for warfare.

Afghanistan as an Example of Applying QM Military Theory

One possible description of how this would look in the real world is to imagine Afghanistan as it is now and how it could be under a QM military theory construct. Today we develop campaign plans in the upper levels of our headquarters that in turn influence (in theory) subordinate units all the way down to the battalion and lower levels. Starting at battalion level we manage the current operations through what is termed as an "operations center" or OPCEN. Unit locations are tracked in real-time, message traffic is collated and abbreviated for power point briefing updates, video feeds from drones give a false sense of situational awareness of specific areas and allow those almost wholly divorced from the operational area to feel as if they are there, and resources are pushed down to units who might not necessarily want or require them. Mission concepts are forwarded to these centers and the smallest details are approved of from on-high, what kind of body armor to wear, for instance. Headquarters have even been known to require units to patrol on a certain time schedule or frequency with little thought to the implications of that action in each unique area.

Under the QM Military theory construct there would be no campaign plans, only a list (and most likely a classified and constantly shifting list) of political and strategic objectives that are tied to some very clearly defined assumptions as well as the logic behind why the objectives would further U.S. political interests. Below that political-military nexus, preferably kept at the embassy level, would be a series of resource hubs that would assist the political objective "definers" in prioritizing resources, and the issuance of guidance, guidance updates, and lower-level objectives, to include the logic and assumptions reference those objectives. In other words, the headquarters would exercise true "mission command", or almost "hyper mission command": issuing intent and allowing lower-level units the sufficient freedom to execute within that intent.

Two key missing pieces within mission command, however, would need to be added: *requiring* lower-level units to inform the higher headquarters on issues with their logic and assumptions and the development of concepts from the ground up instead of waiting on higher headquarters to issue plans and orders. The higher-level headquarters would mainly coordinate and prioritize resources, define objectives and describe their logic behind those objectives- identifying assumptions along the way- and monitoring the feedback from the field in order to invalidate improper assumptions and re-work the logic and possibly the objectives as well. It would take trust in subordinate units, some career risk for commanders, and the

acceptance that control (outside of guidance) would not only be very loose, but even detrimental to the accomplishment of objectives if it stifles “emergent” solutions (Marine Corps Doctrinal Publication 6, published in 1996, basically describes this the best in my opinion, although it only applied to command and control and only in a context that fit the USMC’s view of warfare and thus did not go far enough for what I advocate here.) QM military theory rests upon an assertion that emergent phenomena represent one of the best, if not the best way to affect change in a complex environment as opposed to top-down-driven efforts and analysis.

Conclusion

It can be argued that one of the reasons, if not THE reason, that we have struggled to accomplish our objectives in Afghanistan is that we have applied a more industrial-era approach to the way we conceptualize planning for and the execution of operations. Our tools, such as the Center of Gravity concept, have made us think there is a secret formula for success in a not-so-conventional environment and that if we just analyze the situation enough, we can discover that formula. Instead, complexity may by definition and nature resist this kind of approach, and as we get further into the “irregular” (and thus complex) we must turn away from our conventional wisdom and approaches. Instead we may need to rely less on centralized and top-down planning methodologies and analysis and allow subordinate units the most freedom possible to accomplish objectives within the higher’s tied-to-political-objectives guidance. We should do this all the while re-looking our assumptions based on the feedback from below and then re-tooling our logic and the objectives we have identified from that logic.

Headquarters must be adept at trusting subordinates, listening to them, changing logics and assumptions, and noticing trends in data that can allow for exploitation by shifting priorities and resources. What we are adept today in, arguably, is the generation of information, an absolute faith in conventional assumptions, and risk averseness, all due to emergent political and cultural forces perhaps beyond our ability to change without external impetuses. If those traits are self-defeating in a complex environment and cutting-edge physics and science tells us theoretically why, then we have three choices: wait until an external force pushes us to change (a strategic “loss”, for instance), pray for Congress to mandate change, or attempt the very difficult change that internal transformation implies.

To be absolutely clear, the internal transformation I describe here required to tackle complex situations would have to allow for a unique approach to each situation: a unique structure, personnel incentives, planning constructs, assessments methodology, and theory of warfare. This recommendation would most likely redefine what being a member of “the military” means and how it acts. Transformation like this would bring a new definition of pain to the entrenched bureaucracy that struggles today with even simple and meaningful change. The question is not whether we should do this, but whether we should wait until we can no longer afford the current construct, which is arguably at odds with being able to be effective in complex situations.

About the Author

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