Developing Strategy

On Effects-Based Operations, Complex Adaptive Systems, and the Importance of Biological Connotations

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Introduction

There is a fashionable tendency in recent military writings to use the vocabulary of complexity theory and refer to complex adaptive systems. In fact, there are many good reasons to elaborate further on insights gained from a serious study of complex adaptive systems theory. First, war displays a wide array of multi-layered problems in which an approach that is less rigid and more flexible, less artificial and more organic, less mechanistic and more living appears to be very appropriate.[1]

Second, natural science and its supporting paradigms ignore most human attributes such as apprehensions, sensations, perceptions, impulses, and emotions that constitute a very important part of war. Third, comprehending war as a complex adaptive system can help us think outside the box since it demands creativity. Looking for novel metaphors and methodologies can help us make the shift from mechanics to biology.

An equally fashionable tendency in recent military writings is to refer to 'effects-based operations' or the 'effects-based approach'. The sheer amount of papers written on the subject can easily give us the impression that nothing can stand against the power that comes from a causal focus aimed at achieving desired effects on the enemy.

The aim of this article is twofold as it both attempts to conceptualise war as a complex adaptive system and examine the practical utility of focusing on causal relationships. The argumentation of the article proceeds through five interrelated sections. Section one sets the scene by expanding on Clausewitz's Dynamic Law in War. Section two briefly delineates the traditional top-down approach of the military to strategy development and names some of its obvious shortcomings.

Dodo (Foto collectie NIMH)

Section three details the basic characteristics of a bottom-up strategy development based on insights coming from complexity theory. Section four suggests three possible approaches that help to exploit the combined power that comes from merging the two sorts of strategy development. Section five concludes on the findings and details to what extent the effects-based approach is valid for war when seen from a complexity theory point of view.

From Darwin to Clausewitz

Seeing war as a complex adaptive system has an organic connotation and emphasises dynamics over statics, time-prone over time-free reality, probabilities and chance over determinism, and variation and diversity over uniformity. In order to elaborate

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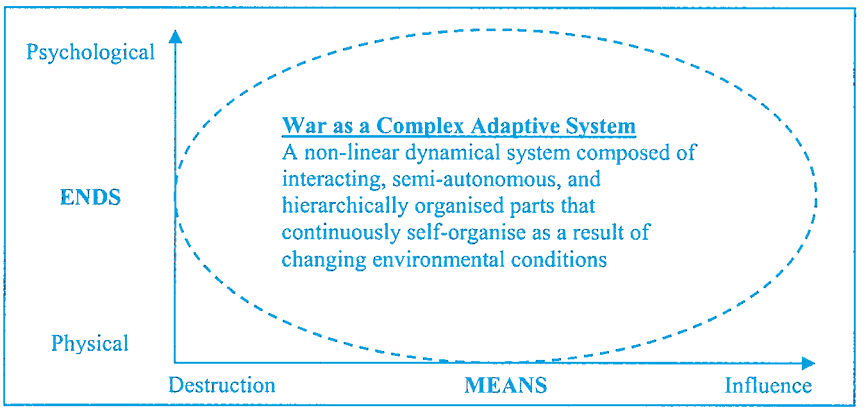
Figure 1: Continuum of war as a complex adaptive system



on this analogy I suggest depicting war as a continuum as shown in figure 1.

Thus I approach war as a phenomenon, which contains a multitude of interrelated phenomena that continuously interact. In this way it becomes possible to see war within an organic framework and look for similarities to biological evolution.[2] The attempt to look for exploitable analogies between war and evolution is not that new.

Darwin in his book *On the Origin of Species* already recognised that genetic usurpation and endemic warfare share similarities as both are important forces in evolution and human history. Consequently, he drew an analogy between war, battle and natural selection and saw evolution as a '*[b]attle within battle [that] must ever be recurring with varying success*'. This analogy made him conclude that '*from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows*'. Thus evolution for him was a '*great and complex battle of life*', which together with the 'Law of Battle' for survival formed a recurrent pattern, also in his second epic work *The Decent of Man*.[3]

War in this framework suggests a phenomenon that seethes and bubbles due to constantly changing disorderly processes. It can be seen as a continuously evolving open system in which assumptions regarding direct causality, linear deduction, and analytical categorisation cannot address the full spectrum of emerging possibilities.[4] War seen within an evolutionary framework indicates a dynamic give-and-take process, which demands continuous adaptation as everything shuffles back and forth from chaos to order.

This approach is also in accordance with Clausewitz's observation regarding the nature of war. His 'Dynamic Law' depicts war as a phenomenon in which '*periods of active warfare [are] always […] interspersed with greater or smaller periods of rest*'. According to him every '*action in war is not continuous but spasmodic. Violent clashes are interrupted by periods of observation, during which both sides are on the defensive*'. As he emphasised the '*state of crisis is the real war; the equilibrium is nothing but its reflex*'.[5]

War seen within the framework of biological evolution helps expanding on Clausewitz's law and indicates that soldiers might share similar problems with ecologists as both try to find a mechanism that matches the crude reality of life. Prominent military thinkers such as John Boyd have also pointed out that evolution by natural selection and the conduct of war might be intimately related. Both reflect conflict, survival, and conquest in a very similar and fundamental way. Thus insights coming from evolutionary biology are very helpful in comprehending causality in war since even a modest pool of effects can show an enormous amount of possible combinations. In a similar fashion Clausewitz also pointed out nearly two centuries ago that '*the vast, the almost infinite distance … between cause and its effect, and the countless ways in which these elements can be combined*' demand things to be seen in a comprehensive way.[6]

Strategy Development as a Top-Down Process

The traditional military approach to strategy development has a mechanical connotation and promotes a rigid model that rests on an ends-means calculation. It is based on the clear definition of ends and the proper organisation of available means for which objectives are set, options narrowed and choices made. Objectives come as a result of a general consensus. They are assumed to be ultimate, identified, well-defined and sufficiently few, which keeps them both manageable and measurable.[7]

Within this framework the military is mostly seen as a self-sufficient system containing the necessary means both to determine and attain objectives. Enemy opposition is often regarded as something that falls outside the system, an environmental peculiarity that can be overcome. In other words, the enemy is simply not allowed to affect the reasoning, drawing up and pursuit of objectives. War is subdivided into various headings such as strategy, operations and tactics, and often competence in one area does not mean competence in the other. Waging war is based on prediction and control in which the military acts as a machine.
A high degree of stability and calm are required in order to provide a basis for the rational patterns of orders for which the total body of avail-

able information is analysed and reduced.

War is seen as a series of discrete actions in which events come in a visible and serial sequence. Strict military discipline has the function to ensure that '*nothing occurring in the course of its execution should in any way affect the determination to carry it out*'.[8] It is not difficult to see that this design resembles a similarity to engineering. Attempts to impose stability presuppose a predictable course of events and an environment that can be stabilised and controlled. The supporting formalised process often detaches thinking from action, strategy from tactics, and formulation from implementation. Strategy development is seen as a sort of scientific activity in which courses of actions are put into dry and crunchable numbers.[9]

This approach attempts to see the end from the beginning and by going into ever finer details it reflects linear causality. The subdivision of war into tactical, operational and strategic levels also suggests a step by step incremental process in which objectives add up and victory can be seen as the sum of the achieved objectives.

However, as depicted in figure 2 such an approach appears to have clear limitations.

In order to support my arguments I detail some of the factors that defy assumptions regarding the practical utility of a mechanical image of strategy development, hence a mechanical image of war:

- Gambling – Despite the neat and clean logic behind them, planned strategies often resemble gambling. Thus there will always be a certain margin of error in the estimation regarding what we know and what we expect;

- Contingency – The inherent contingency of war always limits the ability to control causes sufficiently well in order to produce desired effects. By definition, strategic calculation is vague, which also limits the possibility of causing intended effects;

- Personality – The personal character of decision makers often distorts strategy. Power is as much applied to manifest political purposes as to subliminal personal ones, which can heavily influence the link between military means and political ends;

- Cognition – Strategic decisions always go through non-logical filters such as bias and prejudice. Causal calculations are always non-rational as we tend to see what we expect to see;

- Communication – Strategies, especially coercive ones aimed at influencing will depend mainly on communication. Logical strategic calculations only have reference within their own cultural context;

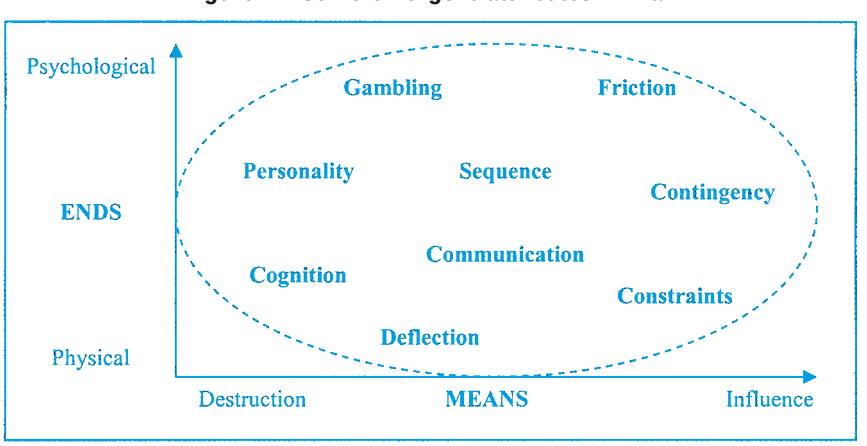
- Friction – Normal operational friction can significantly influence the way plans are executed and decouple assumed causes from expected effects, as coercive signals that depend on coupling often collapse;

- Deflection – Habits and interests always distort the way means are applied, resulting in stated goals and objectives coming closer to parochial priorities that reflect organisational stability rather than larger political aims;

- Sequence – Strategy has the purpose of shaping the courses of action that suit policy. Unfortunately, the proper sequence of causes and

War seen as a complex adaptive system shares a similarity to biological evolution
(Foto L.G. Lucena; collectie NIMH)

Figure 2: Some emergent attributes in war



effects is usually disturbed or reversed and does not unfold according to expectations;

- Constraints – Opposing preferences also constrain options since they require compromise. Unfortunately, political compromises can result in military half-measures that often serve no strategic objectives at all.[10]

Strategy Development as a Bottom-Up Process

Unlike the mechanical metaphor, war seen as a complex adaptive system promotes an organic connotation and shares a similarity to biological evolution. This framework, however, makes it very difficult if not impossible to see the end from the beginning.

The evolutionary analogy indicates dynamic equilibrium, which blurs most temporal and spatial assumptions regarding linear causality. Approaching war in this way requires creativity, constant change, evolving situations and limitations regarding comprehension, prediction and control.

In other words, we have to acknowledge that in war much depends on chance as possibilities always emerge and form a broad spectrum. War indicates an abundance of options in which the emphasis is on emergence and self-organisation.[11] Although the evolutionary analogy does not help to reduce uncertainty, it can be extremely useful in exploiting shifting opportunities.

Clausewitz indicated that war is a dynamic and non-linear phenomenon in which effects do not follow causes directly. Thus we have to deal constantly with internal tensions, inefficiency, various options, possibilities and choices.
A particular input never produces only one particular output and the best we can do is to estimate probabilistic occurrences within the domain of focus.

Consequently, the biological analogy indicates war to be full of corrections since the pursuit of objectives and desired effects on a once-and-for-all basis is mostly impossible and success comes as a result of actions that respond to changing circumstances.[12] Bottom-up strategy development is full of internal conflicts, but the greater the uncertainty the greater its real value. Although it does not allow for the identification of the most or least likely outcome, by evolving over time it can cover a broad array of emerging possibilities. The evolutionary analogy indicates that victory is less the result of a sustained competitive advantage, but more of a continuous development aimed at exploiting temporary advantages. This requires sufficient variation based on innovation and novelty in which we must take into account the fact that significant strategic redirections can often originate from little actions and decisions initiated by '*the foot soldier on the firing line, closest to the action*'.[13]

It is not difficult to see that this new metaphor shows clear similarities to the recent idea of 'network-centric warfare':

- Both are characterised by the refocus from the sum of individual platforms to the network of possibilities they provide for and the gains that can be exploited;

- Both are characterised by the refocus from mostly isolated and homogenous actors to the various interdependencies smaller and more specified players stand for;

- Both are characterised by the refocus from control, analysis and causality to issues such as adaptation, learning and coping under continuously changing conditions.[14]

In other words, the evolutionary analogy indicates that strategy development is no longer the exclusive domain of the strategic level. Those who are in contact with the enemy on the tactical level, develop their own initiatives that can lead to strategy either spontaneously or gradually over time.

Both biological evolution and war stand for dynamic and changing environments in which it is not always possible to predict where strategic directions emerge. They can pop up everywhere as the various patterns proliferate and influence the behaviour at large. Consequently, strategy development should be seen as the result of collective actions that simply spread out. As they evolve through experiments it becomes possible to establish and exploit new directions, which requires a climate within which a wide variety of strategies can grow in order to find a good balance between internal variation and external demand.[15] Strategy development understood this way stands for trial-and-error rather than control, which indicates that it is often more important to learn from failures than from success.

Biological evolution also indicates that it is often better to make a suffi-

The top-down approach: a cerebral and formal process
(Foto D. Tiriba; collectie NIMH)

ciently good decision in time than make an excellent decision later. In a similar fashion most soldiers would agree that it is often better to fire more shots than to start improving one's aim.[16] According to this approach strategy development might on occasion equal the conduct of random experiments in which the emphasis is less on rationality but more on common sense. It requires 'strategic wisdom' that stands for personal knowledge coming from an intimate 'sensing' of the situation. The evolutionary framework indicates war to be a phenomenon that contains surprise and situations of no choice. Therefore, developing strategy this way stands for learning and adaptation in which we link the present with the future through experience rather than link the past with the future through analysis.[17]

Strategy Development in a Complex Adaptive System

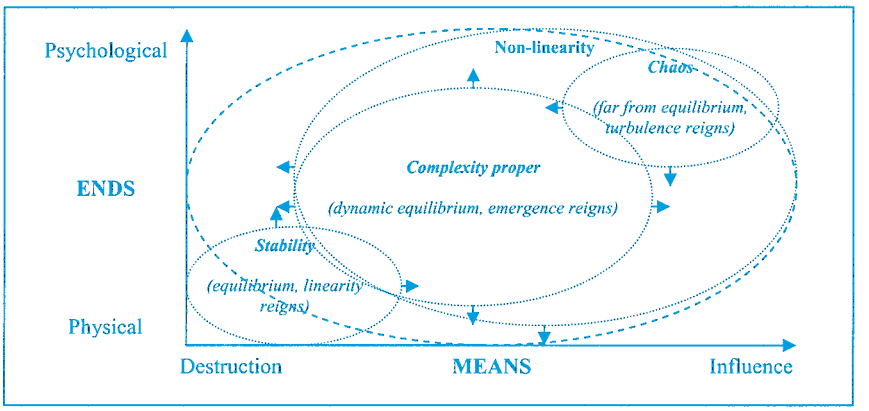
The top-down approach to strategy development points toward a cerebral and formal process decomposed into distinct steps and checklists. It is mostly elitist and harnesses only a small proportion of the organisation's creative potential. The bottom-up approach emphasises learning and adaptation, which require a peripheral vision in order to detect and take advantage of unfolding opportunities.[18]

Seeing the continuum of war as a complex adaptive system indicates that the strategic, operational and tactical levels can often overlap or merge and in the case we want to achieve victory, both approaches must be taken properly into account.

It is a commonplace to state that war in many aspects is non-linear but as depicted in Figure 3 we can also find areas where linearity reigns.

Thus even the engineering approach to strategy development has relevance in war. If we combine the two approaches successfully it becomes possible to harmonise internal diversity and external demand. This way we can both strive toward perfection and find attractive windows of opportunity. The former presupposes unity of perspective and diversity of purpose as the planners are assumed to be at the top of the organisation and the executants down below.

Figure 3: Dissected continuum of war



The latter emphasises diversity of perspective and unity of purpose as it acknowledges that people who influence strategy development by their actions can also be found deep inside the organisation. Seeing strategy development this way indicates that we put more emphasis on the latter and acknowledge that influential and important ideas are distributed widely, reaching even to the peripheries where soldiers have fewer resources and information and are exposed to factors that often defy ideas coming from the top.

Since it is impossible to predict the very places in which useful ideas form, the net must be cast as wide as possible. From a bottom-up perspective war also tends to appear in the form of core competencies rather than a collection of various units and other elements. Integrating the two approaches this way means something like 'planned emergence' or 'emergent planning'.

War as a complex adaptive system requires that strategy development becomes both a bottom-up and a top-down process. Whereas the former enables subordinates to exhibit autonomy and flexibility, the latter secures a certain degree of compliance throughout the organisation in order to avoid fragmentation of resources. In contrast to the traditional exclusive focus, war seen as a complex adaptive system indicates that voices must be heard and options explored since lack of diversity can lead to dogmas requiring little more than compliance.[19]

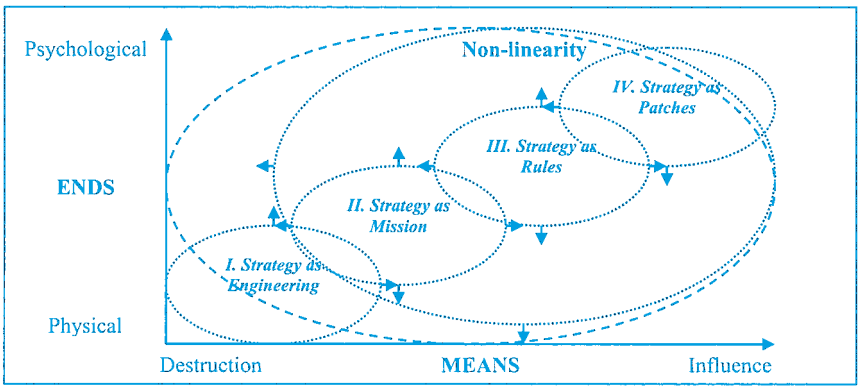
In order to detail the consequences of such a conceptualisation of strategy development I introduce the three approaches 'strategy as mission', 'strategy as rules' and 'strategy as patches'.

The more we venture into the nonlinearity of war, the more we have to expect emergence and self-organisation. Consequently, as depicted in Figure 4 we have to rely increasingly on mechanisms that help us exploit learning and adaptation. In fashionable terms the first approach stands for an attempt to self-synchronise, the second approach for an attempt to desynchronise, and the last attempt for an attempt to a-synchronise.

Strategy as Mission

The simplest way of finding the winning edge means that our strategy combines the higher rhythm generally found at lower levels with the lower rhythm generally found at higher levels, resulting in a vertical and horizontal harmony within the organisation. This self-organisation indicates

Figure 4: The continuum of war and various approaches to strategy development



that general or larger efforts on the highest level become synchronised with particular activities conducted at lower levels.

Empowerment in the form of responsibility and commitment throughout the organisation makes it possible to achieve a rhythm that does not pull the organisation apart resulting in chaos, or turn it into a rigid monolith. Freedom of action and freedom of execution successfully combine subordinate initiative with superior intent. Whereas the superior's intent guides as it describes broadly the 'what', the subordinates' actions are realised as good as possible since they stand for the 'how'.

The German concept of 'Auftragstaktik' is the best example for self-synchronisation. Orders are not orders in a linear, classical and rigid way since the subordinates have the right to question the feasibility of the mission if they feel that the superior's ideas are not in accordance with the existing situation or no adequate resources are available. However, after an agreement is reached on what should be achieved the superior has every right to expect the mission to be carried out. In this way it becomes possible to minimise a loss of cohesion in the overall effort.

Lt.-Col. Lyle Bernard (right) discusses military strategy with Lt.-Gen. George S. Patton on Sicily, 1943
(Foto collectie NIMH)

Coupling bottom-up initiative with top-down intent enables military organisations to adapt to changing circumstances.[20] Strategy as mission reminds us that strategy development also must capitalise both on elements of deliberate planning, and learning and adaptation. Thus success comes as the result of a dialectic process '*generating both disorder and order that emerges as a changing and expanding universe of mental concepts matched to a changing and expanding universe of observed reality*'.[21]

This dialectic process enables us to cope successfully with situations in which we face no clear boundaries, an unpredictable opponent or a future for which we cannot plan properly.

Strategy as Rules

As the situation becomes more non-linear we must further lessen our rigor in terms of ends/means rationality. Only in this way it will become possible to gain an even higher level of flexibility.

Asymmetric warfare is the best example for an abundance of complex and difficult-to-decode challenges. In such warfare the emphasis has traditionally been on simplicity, organisation and proper timing.
Thus nothing is more important than moving quickly, taking advantage of emerging opportunities and rapidly cutting losses.[22]

Asymmetric warfare is extremely fluid and a simple focus aimed at increasing flexibility is more useful than any overly detailed and difficult-to-revise plan. Although the evolutionary analogy indicates lack of prediction, it also means abundance of opportunities that can be captured, exploited, or dropped should they fail to develop accordingly.

Increased flexibility can come from a few critical strategic processes guided by a handful of rules that can define

directions without confining them. In this way we can delineate only a few parameters within which it becomes possible to keep pace with the flow of events. They enable us to screen and exploit opportunities and allocate resources to areas in which they are the richest.[23]

Simple rules can guide military units to follow emerging, colliding, splitting and declining opportunities as displayed by a Chinese folk rhyme drawn up by Mao and Zhu: '*[When the] enemy advances, we withdraw, [When the] enemy rests, we harass, [When the] enemy tires, we attack, [When the] enemy withdraws, we pursue*'.[24]

Rules stand for constantly evolving options that are normally considered unattractive in traditional terms. However, in a dynamic and continuously changing environment a strategy based on simple rules can better seize unanticipated and fleeting opportunities should circumstances change. Those rules help not only to provide for a 'just sufficient' structure but help define processes, boundaries, priorities, timing and an exit should efforts fail to succeed.

Simple rules do not indicate that objectives are useless but in a constantly changing environment learning from experience makes often more sense than pursuing predefined objectives that are either inappropriate or cannot be met. Simple rules can also grow out of experience and mistakes. They might often exist already in some implicit form until they become explicit and extend into stated objectives and desired effects. Although simple rules can provide for flexibility, we should never forget that in a dynamic and constantly changing environment it is impossible to predict how long an advantage lasts.[25]

Military operations are often conducted under circumstances in which the amount of available information can approach zero. However, even in such cases commanders must provide guidance to subordinates. For this reason three rules such as '*capture the high ground, stay in touch and keep moving*' are often proposed.[26] Although such rules may appear very simple, they can contribute to agility in order to harness learning and adaptation.

Strategy as Patches

War is a hard, conflict-laden task in which many factors interact as the result of internal and external constraints. If the amount of constraints is extremely high we often face chaos full of 'unsolvable' problems and 'no-go' situations. Consequently, the match between strategic directions and emerging opportunities constantly falls out of alignment. Finding 'the' optimal solution is very difficult if not impossible since there are many solutions of roughly the same value.

US Army Staff Sgt. Kevin Rettig monitors the radio while his leadership meets with a sheik near Riyadh, Iraq, 2007
(Foto US Air Force, A. Dunaway; collectie NIMH)

However, chaos also indicates the opening-up of new opportunities, which can always converge, occasionally explode or just fade away. Earlier I indicated that biological evolution is the result of many conflicting, distinct and modular strategic directions that can either stand alone or re-map constantly into evolving opportunities. Under such circumstances strategy development comes very close to a trial-and-error game. In other words, strategy development equals an empirical bottom-up process in which we discover a solution that fits our requirement.

Thus we develop our strategy by exploring the various opportunities as good as we can, which resembles finding the right size of the patches in a quilt. Whereas in the traditional top-down approach strategy can be defined by the entire quilt, the bottom-up approach indicates optimisation first within the patches themselves.

Although patches do not overlap, they are coupled to each other across their boundaries. Due to the underlying dynamism any 'selfish' optimisation deforms the characteristics of the adjacent patches. In other words, through their couplings a good solution in one patch might help solve problems in some of the adjacent patches. By means of mutual adjusting, good solutions can overlap and spread through until the patches eventually gain the right size.

The patch analogy also reminds us of the fact that whereas a single-focused and carefully planned top-down strategy can 'freeze' into rigid and poor solutions, an exclusive bottom-up strategy can 'churn' chaotically *ad infinitum*.[27] However, finding the right size indicates that in a chaotic environment despite the errors made during the process of strategy development, the result always comes out of mutual and constant adjustments. This way we can both act under conflicting constraints and track emerging opportunities should the environment change quickly.[28]

Conclusion

The suggested three approaches indicate that victory in war requires a mix of strategies that are rigid enough to organise change but not too rigid to prevent change.
War as a complex adaptive system means that the central challenge in strategy development is managing change. We must always be prepared to accept rapid and unpredictable changes.

The evolutionary analogy indicates that accepting surprise, making moves, observing the results and continuing with the ones that seem to work is an inherent feature of strategy development in war. There is simply too much going on in war and it is not possible to orchestrate every move from the top. Often we have to conduct uncontrolled and parallel actions.

Biological evolution indicates that strategy development must happen both at the top in headquarters and down below at the front lines. According to traditional measures such an approach means short-term inefficiency based on duplication and misfit. However, conceptualising war as a complex adaptive system requires strategies that are not based exclusively on causal assumptions. They must be built as much by top-level competence as by empowered individuals at the bottom of the organisation who rely on expanded access to local information.

The dynamic interaction with the enemy also requires that we eliminate unnecessary constraints. In this way we can better exploit the uncertainty and complexity that are normally associated with war.[29] The most important lesson of recent military operations is that success and failure often rest on the shoulders of junior personnel down to the lowest level. By being closest to the events they often have to make the right decision at the right time without any direct supervision. This requires an atmosphere that promotes agility, information sharing and peer-to-peer relationship in which everyone is empowered to do what makes sense. Consequently, we have to redefine the individual, the relationship between the individual and others, and between the individual and the organisation.

A US Marine Corps drill instructor inspecting recrutes
(Foto US Marine Corps, B. Barr; collectie NIMH)

The particular demand posed by factors such as time, place and the task should define who takes charge. Doing so makes it possible to successfully allocate responsibilities and resources. Although strategy development this way is not optimal for accomplishing pre-defined objectives and desired effects all of the time, it can deliver more innovative solutions to problems at hand at any given time.[30]

Seeing war as a complex adaptive system does not mean that there is no longer a distinction between those who lead and those who are led. Leadership will still play an essential role but '*instead of fusing individuals into a mass through the suppression of their individuality and the contraction of their thought, the lead … only has effect, lightning effect, in proportion to the elevation of individuality and the expansion of thought. For collective action it suffices if the mass can be managed; collective growth is only possible through the freedom and enlargement of individual minds. It is not the man, still less the mass, that count; but the many*'.[31]

War conceptualised as a complex adaptive system requires a fundamental shift in the way we think about strategy development. The problem of unclear causality and lack of prediction cannot be solved by an allegedly better or more superior way expressed in fashionable neologisms. Unpredictability together with variability of performance is both an inherent feature of biological evolution and that of war. It is not a sign of failure that can be eliminated.[32]

Liddel Hart was probably right when he wrote that regarding causality in war '*bad means deform the end, or deflect the course thither*'.
He indicated that the only thing possible for us is to acknowledge that '*if we take care of the means the end will take care of itself*'.[33] In a similar fashion Helmuth von Moltke emphasised that '*[i]n war it is often less important what one does than how one does it*'.[34] However, I do hope that this article will not lead anybody to suggest 'cause-based operations' or the 'cause-based approach to operations'.

Notes

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