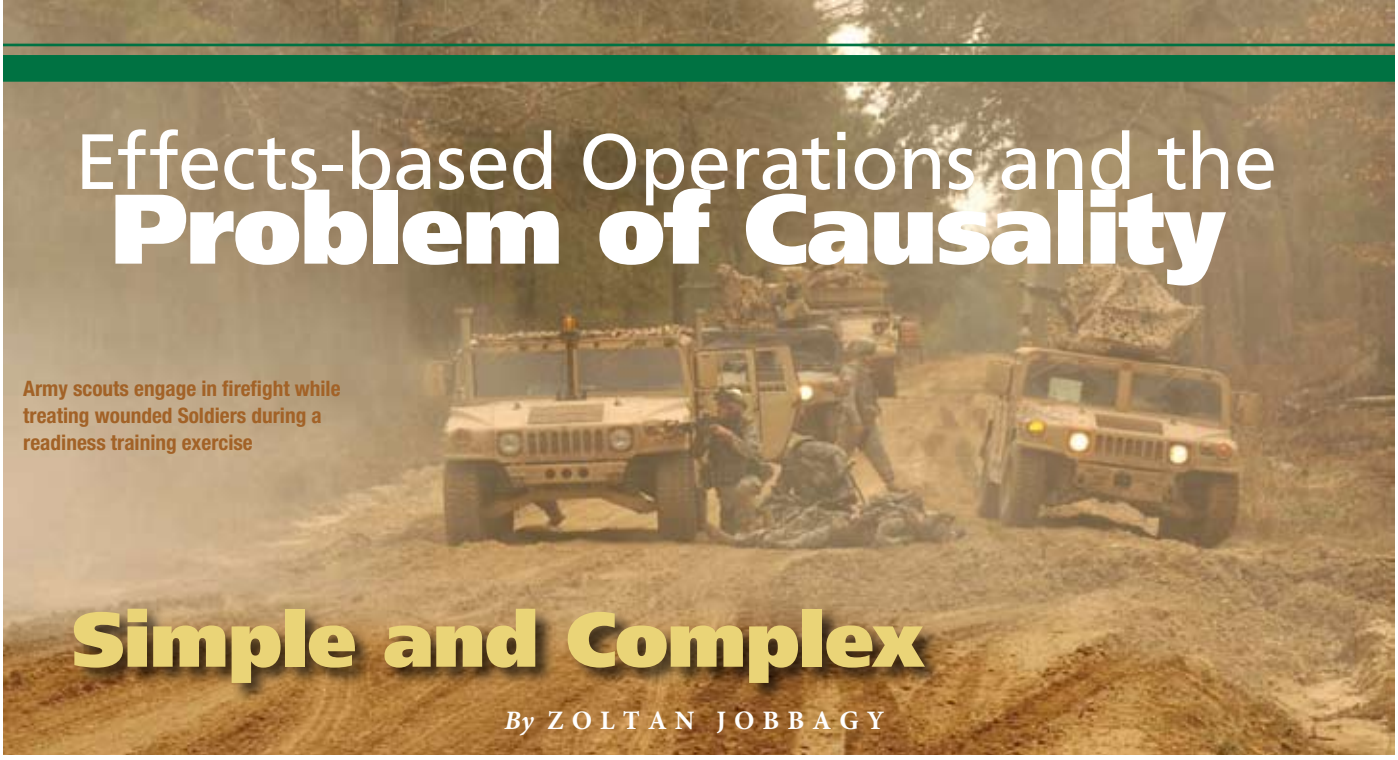
Effects-based Operations and the Problem of Causality



Army scouts engage in firefight while treating wounded Soldiers during a readiness training exercise

U.S. Army (Shawn Cassatt)

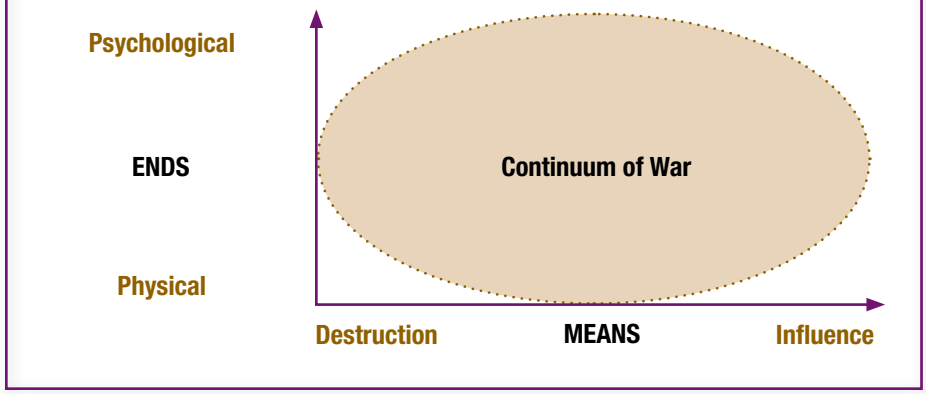
Simple and Complex

By ZOLTAN JOBBAGY

It has become fashionable in most armed forces worldwide to go "effects-based." The *2006 Quadrennial Defense Review Report* emphasizes explicitly the need to make the shift "from massing forces—to massing effects" and "from focusing on inputs (effort) to tracking outputs (results)."[1] In a similar fashion, the North Atlantic Treaty Organization (NATO) is adopting the effects-based approach in order to drive force employment and transformation. The Alliance claims that its interest in effects in military operations represents "a fundamental way of thinking that focuses on the efficient and effective achievement of desired effects in the operational environment, vice a primary focus on the completion of assigned tasks."[2] Armed forces outside NATO are moving in an effects-based direction, too; for example, the Israel Defense Force chief of staff emphasized that force transformation issues must focus less on force and power but more on effect.[3]

It appears that nothing can stand against the power that comes from a causal focus aimed at achieving various sorts of effects on the enemy. However, there are many reasons to be doubtful regarding the practical utility of *effects-based operations* and the *effects-based approach* in general. Thus, the aim of this article is to address some basic assumptions upon which the two neologisms are built and analyze whether those assumptions are valid.

Figure 1. The Continuum of War in Terms of Ends/Means Relationships



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Setting the Scene

To understand war in terms of causality better, we suggest depicting it as a continuum characterized by an ends/means relationship as seen in figure 1. Whereas ends can be placed on the vertical axis, characterized by the combination of physical and psychological effects, the means can be located along the horizontal axis, ranging from destruction to influence.

Thus, effects can occur on a spectrum characterized both by tangible and intangible attributes. In a similar way, Carl von Clausewitz indicated the existence of a material and a nonmaterial domain in war. As he emphasized, war is "a trial of moral and physical forces through the medium of the latter" in which "psychological forces exert a decisive influence on the elements involved."[4] Based on figure 1, the following is proposed in terms of effects:

- The material domain represents categories such as physical strengths and stamina. They describe the space that the military tries to influence through combat and maneuver. In the material domain, we deal with tangible items such as physical platforms and communications networks that the enemy usually needs to wage war. This is the traditional basis for measuring combat power that has to be rendered useless. The material domain can be defined as reality proper or ground truth. Attempts to achieve effects in this domain aim at physical ability and serve the purpose of changing functions.

■ The nonmaterial domain is characterized by psychological factors such as moral strength and stamina. It represents the mind and attributes that generally influence the will in the form of perception, awareness, understanding, belief, and values. Effects in this domain stand for influencing intangibles that the enemy needs to wage war. Consequently, effects in the nonmaterial domain aim at changing behavior.[5]

Despite the difference regarding the two domains, we assume a strong correlation between them as physical and psychological factors form an organic whole. As Clausewitz emphasized, the physical domain is the "wooden hilt," whereas the psychological domain is "the real weapon, the finely honed blade."[6]



F–16C Falcon flies over Nellis Air Force Base

U.S. Air Force (Aaron Allamon)

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Semantic Issues

Before we proceed with our inquiry, it is equally important to understand what the term *effect* stands for. In normal English usage, an effect indicates a result or outcome, something that is produced by an agent or cause. Thus, an effect immediately follows the antecedent as a resultant condition and implies something that necessarily and directly follows a cause. Terms such as *result*, *consequence*, *upshot*, *after-effect*, *aftermath*, *sequel*, *issue*, *outcome*, and *event* are all regarded as synonymous with *effect* and generally signify a condition that is ascribable to a cause or a combination of causes.

A further skim of the dictionary makes clear that *effect* refers to so many meanings that it might not obviously promote precision and clarity of military language. As one observer ironically remarked, if the proponents of the effects-based approach "were aware of the many different meanings and usages of the term *effect* it is doubtful that they would have made it the first choice among the words they wanted to use."[7] The second and probably bigger problem arises from the fact that although an effect follows an antecedent directly, both effects-based operations and the effects-based approach focus on achieving higher order, follow-on effects mostly in the psychological domain. Unfortunately, semantically, any reference to indirect or higher order effects becomes questionable at best and empty at worst. The more we move toward higher order effects, the more we depart from an effects-based approach and arrive at something that would better be named *consequence-based*, *outcome-based*, or *event-based*. Thus, the more we move toward psychological effects aimed at influencing enemy behavior, the more meaningless the two neologisms become. Clausewitz pointed out in *On War* that whatever we do, "consequences of some kind always follow."[8] He indicated that regardless of what we do, we achieve effects anyway. This, however, means that both neologisms might essentially be vacuous, and it can turn out that we refer to something that is scarcely more than a military truism or commonplace.

Dissecting the Mechanism

Even proponents claim that a successful implementation of an effects-based approach is extraordinarily difficult and requires hard thinking. Some acknowledge that any single action can produce more than one effect, which requires that we consider all potential consequences of the actions taken. It is also stated that effects have a "dual nature" as they ripple and cascade through the enemy system. Thus, the effect of a given action may induce further changes with the result that it becomes increasingly difficult to predict higher order effects.[9] This difficulty in both predicting and achieving desired effects, especially in the psychological domain, indicates that the mechanism linking causes with effects can also be regarded as the Achilles' heel and resembles gambling.

As a rule of thumb, the more we move toward higher order psychological effects, the more difficult it becomes to identify causal linkages. Effects appear to be complex phenomena, as cause-and-effect relationships are of intricate nature. To understand the mechanism of causality better, we suggest examining it along two dimensions, such as couplings and interactions. Although these dimensions were originally introduced to study the way accidents happen, they can also explain, in a slightly modified form, the way causal relationships develop. They indicate four rough areas representing different sorts of causality since interactions can be linear or complex, and couplings tight or loose.[10]

The first dimension is interactions. Due to their simplicity and comprehensibility, linear interactions allow for visible and simple relationships between causes and effects. Linearity can be anticipated since the underlying sequence of causality is directly comprehensible. Complex interactions indicate branching paths, feedback loops, and jumps from one sequence to another. Connections can multiply in unexpected ways, often revealing unintended and unfamiliar effects. Causal relationships are outside the normal and assumed sequence of events, as they are either invisible or not immediately comprehensible.[11] Linear interactions can also display invisible cause-and-effect strains, but they occur mostly in a well-defined segment and sequence. Complex interactions do not stand for a well-defined segment or sequence, as causes and effects can be linked differently and may interact in unexpected ways. Causal processes are more indirect and inferential (in the case of complex interactions, for instance, not even the top of an iceberg is visible). We have to expect a wide array of misunderstood

or missed signals and faulty information regarding causes and their likely effects. Whereas linear interactions have minimal feedback loops and are generally clear and concise, complex interactions are more likely to display unanticipated or unintended relationships.[12]

The second dimension is couplings, which refer to slack or buffers in cause-and-effect relationships. Tight couplings do not contain slack or buffers; these refer to direct causality in which an effect is coupled to a cause. Loose couplings can best be characterized by ambiguity and flexibility, since connections can remain unobserved. Whereas loose couplings make it possible to display logic in terms of causality, tight couplings restrict such attitudes. Loose couplings are also more stable since they can accommodate shocks without destabilization. In contrast, tight couplings generally respond in a quicker and more disastrous fashion to perturbations.[13] To sum up the preceding structural analysis, we can state the following:

- Linear interactions indicate spatial segregation and dedicated connections. They refer to attributes such as easy substitution with only a few feedback loops. They also allow for single-purposed and segregated control, as the emphasis is on direct information that makes an extensive understanding possible.
- Complex interactions are based on proximity and common mode connections. They display interconnectedness, which means limited substitution and many feedback loops. They require multiple and interacting control, which stands for indirect information and limited understanding.
- Tight couplings do not make delays possible. Due to the underlying invariance of sequences, there is only a small amount of slack. Should buffers and redundancies exist, they are mostly built-in features that allow only for limited substitution. In tight couplings, there is hardly any spatial and temporal separation between a cause and effect.
- Loose couplings allow for delays due to the changeable order of sequences. The result is extended and often unanticipated sets of alternative methods, slack, and buffers in which substitutions are fortuitously available.

the more we move toward higher order psychological effects, the more difficult it becomes to identify causal linkages

Projecting the Mechanisms

It became clear that linear interactions refer to highly structured, logical, sequential, and predictable cause-and-effect relationships. In contrast, complex interactions offer less predictability due to the presence of unplanned and unforeseen relationships. Tight couplings can be described by high centralization and rigidity, which allow for a close monitoring and a certain tolerance. Loose couplings mean decentralized operations and allow for a wide variety of outcomes in terms of effects.[14]

Based on the four combinations of interactions and couplings, we suggest subdividing the continuum of war, as depicted in figure 2, into four different but interrelated areas such as simple, complicated, complex, and chaotic.[15] The more we move from the first area to the last, from tightly linear to tightly complex, the more the level of causality decreases, and in the case of the latter, it disappears entirely. The figure also shows that even if it is possible to discern causality in terms of physical effects due to the underlying mechanism, it is mostly impossible to see which way a particular effect relates to subsequent and desired psychological consequences.

The growing instability of couplings and interactions points toward an increasing difficulty in decoding causal relationships. Nevertheless, the following listing explains some characteristics of the combinations found in figure 2:

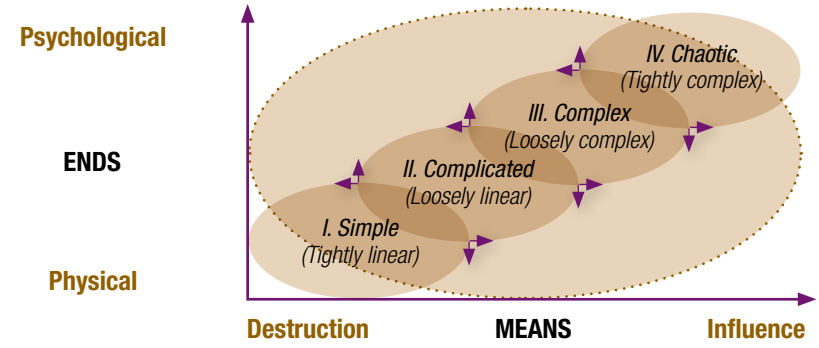
- *Simple*. Area I can be described as tightly linear and stands for linear causality, indicating known causes and effects. We can discern clear and visible cause-and-effect relationships that allow for prediction. Due to their empirical nature, causal relationships are not open to dispute and planning. Consequently, this area can be characterized by the predominance of centralized causes and effects.
- *Complicated*. Area II can be described as loosely linear and refers to knowable causes and effects. Although causal relationships exist, due to spatial and temporal separations, they might not become fully known. The relationship between causes and effects is generally difficult to comprehend, which indicates limitations in terms of prediction. Planning for effects still makes sense, but we must take into



Officer walks through rubble after firefight with insurgents in Salah Ad Din, Iraq

U.S. Army (Russell Klika)

Figure 2. The Flattened Quadrant Projected on the Continuum of War



account that centralized causes increasingly yield decentralized and unexpected effects.

- *Complex*. Area III can be described as loosely complex. Cause-and-effect relationships still exist, but they defy most attempts at categorization or other analytical techniques. Effects can be perceived but not predicted since their relationship is not open to any inspection. Both interactions and couplings indicate that causes and effects are mostly decentralized and appear coherent only retrospectively, but even then, causality is subject to debate.
- *Chaotic*. Area IV can be described as tightly complex. Here, no visible cause-and-effect relationships exist, which indicates that causality is not perceivable. The number of factors together with spatial and temporal separations makes prediction either impossible or confined to very general terms. In this area, it is not possible to plan for effects or to discern causal relationships in a meaningful way.[16]

The two dimensions made it possible to dissect war into four interrelated areas with different characteristics. In colloquial terms, we can say that in tightly linear systems, everyone can detect causality. In loosely linear systems, only experts might detect causality, and in loosely complex systems, causality often becomes clear only retrospectively. In tightly complex systems, there is no discernible causality that can guide our actions.[17] Thus, the more we move toward tightly complex attributes, the more unpredictability takes hold.

Unfortunately, the "high ambition" of the effects-based approach indicates a focus on an area where it is very difficult, if not impossible, to detect and exploit causality. A further problem is that even the area in which we *can* discern clear causality interacts with areas that are rather unpredictable. Consequently, we must expect novelty everywhere and every time in war. In other words, the Clausewitzian assumption that in war, everything is simple but even the simplest thing can become difficult generally takes hold. The four areas also remind us that if we have no firm basis for comprehending the initial state with all the factors that must be considered, we have equally no basis to judge which of the possibilities should be regarded as desired effects. Thus, we claim that even if effects-based operations or the effects-based approach worked, they would offer considerable promise only for physical effects—but in the case of psychological effects, they appear hopeless. In the case of systemic effects, the concept touches the borderline that separates prediction from pure guesswork. So an effects-based approach is generally good for creating desired physical effects and might occasionally be good for generating desired systemic effects. However, in the case of psychological effects, the best we can say is that the concept does not work well.[18]

Continuum as Complexity

Analyzing the continuum of war along the two dimensions makes it possible to see the way structures are produced and dissolved in causal terms. The four areas make clear that war stands for a general unpredictability that has serious consequences for effects-based operations and the effects-based approach. Moving toward the pole characterized by "physical/destruction" indicates direct causality and prediction, but the value of the effects achieved is normally seen as low. Although effects achieved around the "psychological/influence" pole have high values, they increasingly prohibit predictions in causal terms. It is a truism to state that in war all activities take place in an environment in which chaos meets order constantly in a disorderly way. However, the four areas indicate war to be a phenomenon in which pre-order meets order in disorder as occurrences move continuously back and forth in the continuum. This 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 emphasized, the "state of crisis is the real war; the equilibrium is nothing but its reflex."[19]

Due to such attributes, war can best be described by the term *complexity* since it denies the primacy of order and causality and the drive for efficiency and constant affirmation. In general we can say that complexity stands for freedom and openness, which puts an emphasis on action and possibility.[20] It demands that we take the various interdependences better into account. Links between



Tomahawk cruise missile fired from nuclear-powered submarine USS *Florida* during Exercise Giant Shadow

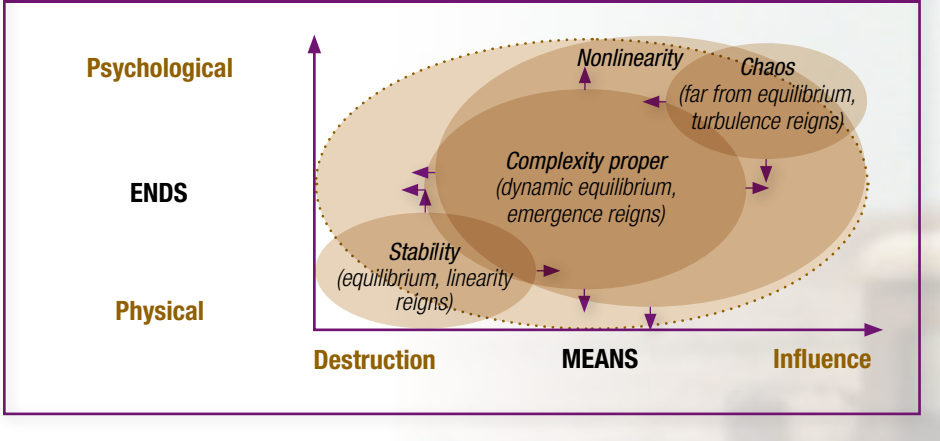
U.S. Navy

causes and effects can become distant in time and space, and in the case we proceed as if "simple linear links exist, even if we do not know what they are, then we are likely to undertake actions that yield unintended and surprising results."[21] Complexity displays a bewildering array of causal relationships that spans several scales in which we have to deal with emergent properties that come from the constant interplay of chaotic and non-chaotic forces. The result is a broad network of various alternatives that cannot be represented based on reasoning and causality.

We made clear that the combination of interactions and couplings can often produce unforeseeable results. However, the four areas also make discernible an explanatory framework that helps us to understand better the consequences of our actions and the spatial and temporal effects generated.[22] The four combinations allow for establishing generalized areas in the continuum of war as depicted in figure 3. In these areas, different characteristics overlap and constantly influence each other, making cause-and-effect relationships difficult to identify. As we can see in war, linearity goes together with nonlinearity and stability always coexists with complexity and chaos. Whereas stability stands for simplicity and linearity reflecting a tight and linear relationship between causes and effects, nonlinearity points toward chaos that can be described by extreme sensitivity to initial conditions.

The biggest area within the continuum of war is complexity proper, which stands for nonlinearity, far-from-equilibrium conditions, and emergence. The figure clearly shows that although war contains linear properties, its mechanisms are mostly defined by nonlinear attributes. Consequently, we must rethink the basic mechanism that drives effects-based operations and the effects-based approach and shift our reasoning away from prediction aimed at identifying desired effects.[23] The generalization also indicates that the continuum of war can reveal both deterministic outcomes and random fluctuations. This constant shuffling between stability and instability explains why war can display "growth and decay, capture and domination, periods of opportunity for alternative developments followed by solidification of the existing domination structures."[24] Put simply, war displays emergent and interactive attributes that come as a result of structured but nonadditive interactions. It is more than the sum of its constituents, and we always face a general unpredictability in relation to the input.

Figure 3. Overlapping Characteristics of War



The belligerents continuously adjust and adapt, providing them with multiple and often unexpected paths, making causal explanations very difficult.[25] Instead of a causal focus, war requires an everything-affects-everything-else model in order to grasp the entire web of various connections. War is a messy phenomenon that cannot be examined through conceptual elegance reflecting rational thinking, deductive logic, and analytical categorization. It contains novelty that often comes from simple properties producing emergent and unpredictable effects. Depending on the level chosen, we always confront structures for which different laws, concepts, and generalizations apply. In contrast to most assumptions that drive effects-based operations and the effects-based approach, war stands for an infinite variety of possibilities and a general unpredictability regarding causes and their likely effects.[26]

complexity stands for freedom and openness, which puts an emphasis on action and possibility

Conclusion

The effects-based approach emphasizes deductive reductionism and causal laws in order to predict desired effects. The supporting assumption is that war displays order and equilibrium, the possibility for rational choice, and the ability to steer and control events. Unfortunately, war stands for variety and novelty in which certain properties remain inherently unknowable to the human mind. This short analysis reveals that although war can be described in general terms using causal relationships, effects that go beyond the immediate spatial and temporal horizon cannot be predicted with any accuracy. Complexity indicates something very different than the fundamental assumption of the two neologisms—namely, that it is possible to comprehend only some things, especially those that are local to us both in space and time.

Everything in war is interrelated, and we can attain nothing more than a temporary and partial interpretation. Complexity also reminds us that we tend to confuse causation with correlation and simulation with prediction. Whereas the former refers to our preference for creating retrospective validation to identify best practices, the latter points to the fact that even if we can simulate something, it does *not* mean that we can equally predict its future.[27] War is a phenomenon full of discontinuities and uncertainty, which indicates a general unpredictability that makes both individuals and organizations disoriented. This uncomfortable feeling explains why focusing on effects appears attractive for so many. The international arena has been a messy place since the demise of the bipolar world order. During turbulent times in which orientation becomes difficult, humans increasingly turn to panaceas for advice. If we do not understand or cannot cope with challenges, we often look for simple or simplistic solutions that promise quick help.[28] The unpredictability of war stands for several possible futures in which there is not always time for mechanical, deductive systemic analyses aimed at detecting causality. The most important message

war is full of discontinuities and uncertainty, which indicates a general unpredictability that makes both individuals and organizations disoriented

of complexity is that instead of focusing on certain desired effects, we should rely on the ability to respond consistently to war's unpredictable nature. War cannot be waged based on single and prescriptive models but requires that we evolve rapidly to handle dynamic and changing situations.[29]

The serious contradiction between the basic assumptions behind the two neologisms and the complex nature of war naturally raises the demand for a better conceptualization. Unpredictability of war indicates that we must be satisfied with understanding certain general features in terms of correlation rather than attempting to discover a mechanism that links causes with effects directly. Consequently, the unpredictable nature of war should be regarded as an opportunity that can explain qualitative behavior instead of inaccurately predicting futures in terms of desired effects.[30] This, however, indicates a low practical ceiling both for effects-based operations and the effects-based approach. **JFQ**

NOTES

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