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Effects Based Applications/Operations

Effects-based operations: language, meaning and the effects-based approach

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Abstract

The effects-based operations (EBO) concept has been proposed as an approach to maximizing efficiency and minimizing wasted effort in the pursuit of goals, military or otherwise. While not a new idea, it is an attempt to institutionalize the heretofore-intuitive approaches that many military commanders have exercised during periods of war. It has also arisen due to the complex nature of modern conflict, where military forces are operating across the spectrum of conflict, dealing with other forces and non-military organizations and the interactions are many and multifaceted. While there is generally a common understanding of the aspiration of the concept, there is less consensus on the formalisms that can transform it from a concept to a process. One hindrance to this is a lack of a precise common language for discussing and understanding effects and EBO. This paper proposes a set of fundamental concepts that are clear and precise. These are then compared to several different sets of definitions and a simple example is provided that shows the utility of the construct.

Introduction

The effects-based operations (EBO) concept does not embody a new idea. In a sense, EBO is a revisiting of historical wisdom: political science is exactly about influencing the thoughts and beliefs of adversaries in order to gain the upper hand, to secure victory. Such thoughts have been articulated throughout history by such luminaries as Sun Tzu, Clausewitz and Machiavelli, and EBO merely formalizes the idea. However, the re-emergence of effects-based thinking is, perhaps, in response to a number of contemporary issues, including: the failure of the “mass over mind” attrition approach, where physical destruction of the enemy's forces is seen as the end in itself, when it is really only a means to an end (the “subjective” in warfare, as Clausewitz defined it); the development of social global interdependencies, which significantly complicate the assessment of actions and their consequences, so that the motivations of the state are more often as not shaped by business and social transactions that are increasingly transnational in nature as by the security of state borders and the welfare of the internal mechanisms of economy and society.

What is new about the EBO concept, as it is proffered today, is threefold: first, it is an attempt to institutionalize into process the heretofore-intuitive approaches that many military commanders have exercised during periods of war; secondly, it is founded upon a new scientific appreciation of complexity and system-of-systems theory that challenges one to think beyond the linear; and thirdly, it

calls upon (indeed, relies upon) new manifestations of technology that allow one to represent complex causal relationships in a useful way. In other words, EBO is new in its formalisms, but not in its underlying basis in the military art.

The Effects-based approach is also broad in scope. It is applicable to military operations, but it also has implications for operations other than war, and for National and Military strategy. At the strategic level, the effects-based approach is of as much relevance to “winning-the-peace” as it is to winning wars. In fact, the effects-based approach is a concept that may impact on National Security and National Prosperity in profound and challenging ways.

Many conflicts epitomize an effects-based approach, as might be expected given the roots of the fundamental idea. However, as a modern security concept, it has been borne from and matured out of more recent conflicts. In particular, the 1990 Persian Gulf War, the conflicts in Bosnia and Kosovo and the September 11, 2001 terrorist attacks have been posited as significant demonstrations of the maturation of EBO, with the 2003 Persian Gulf War as the most recent example of this approach to conflict. As such, EBO has been proposed as the "new" and proper approach to planning, conducting and analyzing military activities and achieving military (and strategic) outcomes.

Modern History of EBO

Brigadier General Deptula is perhaps one of the modern pioneers of Effects-based Operations (EBO) as well as being one of its strongest advocates. Writing from his experiences during the first Gulf War, he argues that the air campaign "introduced profound changes in the planning and conduct of warfare" [1]. Starting as a relatively narrow concept of Effects-based Targeting (EBT) [2], it has now evolved and expanded into the broader term, Effects-based Operations (EBO), that is now used universally.

While it was already being discussed widely by 2001, it has gained increasing prominence since the U.S. Joint Forces Command (JFCOM) produced its own White Paper on EBO late that year [3]. The different perspectives and the variety of applications presented in EBO publications have resulted in different models, frameworks and interpretations of EBO.

EBO and Effects

Davis observed in 2002 [4] that there was not a definition of EBO that was agreed upon, and a survey of the literature since seems to indicate that this situation does not appear to have changed. Many have adopted or utilized the initial definitions of US JFCOM [3], including the Australian Defence Force (ADF) [5], while other authors have constructed their own variations. While some are more detailed than others, have different emphases and there is no agreed upon definition, there appears to be a degree of common understanding of the aspiration of the concept and they generally appear to have the following properties in common:

- The aims are (1) to produce desirable results at all levels of conflict in the most effective and efficient manner and (2) to facilitate the integration of different military services, coalition forces and non-military agencies in a common operating environment.
- There is a focus upon the ends, not the ways or the means (except insofar that they achieve ends). The intention is to de-emphasize destruction (and more generally, military force) and emphasize impacts, results or outcomes.

- There is a recognition (explicit or implicit) that we are dealing with a complex and interconnected system.

On the other hand, the definition of "effects" is less clear. The term "effects" is often used in a variety of ways. As Smith points out, "The term effect has been routinely used in military writings to imply everything from outcomes or results, to operational objectives, to the blast radius of a weapon's warhead" [6]. Where specific definitions have been provided in the context of EBO, "effects" have been variously described as an "outcome, event or consequence" [3] [7], the "result or impact" [6] or the "cumulative consequence" [8]. The meanings of these are generally understood from the context, possibly descriptions or processes, in which they are applied. For example, the JFCOM definition includes the descriptors "physical, functional or psychological" with the intention of further specifying the domains in which the effects will apply. Smith's broad definition "implies that effects may be either kinetic or non-kinetic, and may equally be either physical or psychological/cognitive in nature." [6].

Effects Taxonomies

In a further attempt to clarify effects, improve understanding and move towards a process of planning and conducting EBO, separate authors have proposed a variety of taxonomies to describe effects. Smith's view [6] is that effects fall into two general areas: physical and psychological. Physical effects can be further described as "Destruction", "Physical attrition", "Chaos/Entropy". Psychological effects can be categorized under "Chaos/Entropy", "Foreclosure" (curtailing options), "Shock", "Psychological attrition". Davis [4] proposes a fairly similar taxonomy: Effects are classified by the nature of the target as physical or behavioural. A second layer further describes the possible types of effects, with physical effects classified as "Damage equipment/systems", "Disrupt processes", "Kill people" and behavioural effects are typed as "Demoralize", "Paralyze/Slow", "Divert/Confuse" and "Influence". Mann, Endersby and Searle [9] don't start the categorization with the physical and mental domains but with the position in a chain of effects, classifying effects as direct (1st order) and indirect (2nd/3rd order). They then further describe the outcomes possible under these groupings, where direct effects can have physical, psychological, functional or collateral outcomes and indirect effects can additionally have systemic, cumulative and cascading outcomes. Williams [10] very simply categorizes all effects in two dimensions: predicted/unpredicted and desirable/undesirable. The United Kingdom Joint Doctrine and Concepts Centre (UK JDCC) [8] rephrase and expand slightly on this, identifying properties such as Intended/Unintended; desired/un-desired, expected/un-expected, +ve/-ve. Both UK JDCC and ADF [5] [8] also divide effects into two types: decisive and enabling. Although the definition is slightly different in each case, the former is essentially concerned with effects that contribute significantly to desired end states, and the latter are those that support decisive effects.

All of these classifications are reasonable and certainly not incorrect. They represent different authors' approaches to understanding and clarifying effects and formulating an EBO process. However, these different starting points influence the subsequent framework and methodology of an EBO process, resulting in a number of different EBO structures that can be difficult to compare or bring together. We believe a more basic and precise manner of defining effects can assist in developing a process of planning and conducting EBO. The aim of this paper is to develop a basis set of EBO terms and definitions to provide a foundation upon which an EBO language can be constructed. Starting from this basis set, it will be shown that one can incorporate many of the concepts of other EBO proponents,

including higher-level concepts. A simple example of the usage of these terms will then be provided to show the potential of this approach.

Establishing an Effects-based lexicon

In proposing a lexicon that starts from a set of fundamental statements, it is believed that these statements should have the following properties: This set should be

- clear and precise (ambiguity should be removed or at least minimized)
- self-consistent and comprehensive (they should be able to span all of "effects conceptual space" in a coherent manner)
- useable at different scales (tactical to strategic) i.e. fractal or scale-invariant to allow it to be applied at all levels of command
- universally applicable (they should be able to describe all types of conceivable situations, phases of conflict and other conceptual frameworks)

A straw man set of five axioms have been proposed:

- Axiom 1: *States* are descriptions of the value of an *entity* at a given moment in time
    - Corollary 1.1: An *entity* is an object that can be described as existing in a defined *state*
- Axiom 2: A *delta* is the difference between two states of an *entity*.
- Axiom 3: An *action* produces an *effect* that moves an *entity* from one *state* to another *state*.
- Axiom 4: A *system* is defined as two or more *entities* that interact with one another.
- Axiom 5: An *effect* is any change in the state of an *entity* caused by an *action* on the *system* of which the *entity* is a part.
    - Corollary 5.1 An *effect* removes a *delta*.

A number of properties can be ascribed to these terms:

- *States* have the properties of being desirable or undesirable.
- *Effects* have the properties of being intended or unintended.
- *Actions* have the properties of being direct or indirect.
- *States*, *effects* and *actions* may all be expected or unexpected.

Thus an effect becomes specifically a *change of state* of an entity. This narrows the definition of what is meant by outcome, event, consequence or result when these are used to describe an effect. These definitions offer the potential of being applicable at all scales. States, effects and actions, in principle, can be aggregated into larger units or disaggregated into smaller units that allow one to describe all levels of command.

It can be seen that this construct essentially utilizes the properties described already by the UK JDCC and Williams [8] [10]. However, by explicitly defining states, effects and actions, it further refines the properties, ascribing them specifically to one or more of these terms.

Using this construct, the descriptions of Davis and Smith [4] [6] are seen to be higher-level effects concepts. They in fact are more complex and richer descriptions of effects that can be distilled using this framework. The basic categorizations of physical and psychological/behavioural effects would be rephrased as the *change of state of an entity*, whether it is physical or mental. For example, the concept of "Foreclosure" could be viewed as the inability for certain psychological states of entities being able

to be realized (implying that certain effects cannot occur). Or the concept of "Disrupt Processes" can be viewed as the state of entities (as a collective system) not physically functioning at capacity.

Mann, Endersby and Searle's concept [9] of direct effects would be instead described as actions that directly produce a change of state, i.e. an action produces an immediately consequential effect; while an indirect effect would be a change of state that occurs elsewhere in the system that can be traced back to the original action and effect.

Application of the Effects lexicon

In order to explore the utility of this construct, a simple example is presented. It should be noted that this example is intended to be only indicative and is not comprehensive.

Example Scenario:

> There are three nations: Blue, Red and Green. Prior to the current situation, Green had suffered a natural disaster and Red had responded, providing humanitarian aid. However, they had also used the opportunity to build up a military presence in the north of the country. With the humanitarian crisis subsiding, the Green government has requested that Red withdraw its military forces but this has not occurred. The Green government does not have the capacity to force Red to comply and the international community has ruled that Red's occupation is now illegal. The Green government has made a request to the Blue government for assistance. It is known that Red's economy is currently unusually weak.

Step 1

The initial step is to identify the main entities (or state variables) that are of interest to Blue. Note that we are currently operating at the national strategic levels.

The main entity is readily apparent:

- a) Status of the Red control over Green territory and compliance with International Law

Other entities are concerned with the situation within Green territory:

- b) Status of Blue nationals and Authorized Foreign Nationals (AFN)
- c) Status of Green Government
- d) Status of Green Security Apparatus
- e) Status of Green Populace
- f) Status of Green relationship with Blue

One other entity is apparent as it can directly influence the main entity

- g) Status of Red Economy

Clearly we could develop this model at this strategic level in much greater detail, but for the sake of clarity the current discussion will be limited to these entities.

Step 2

The second step is to develop an influence diagram that describes the how these main entities (state variables) are directly connected. This requires expert analysts that can comprehend and interpret the situation. This is similar in concept to Operational Net Assessment (ONA) and such a process could easily feed into this framework. In this case, the result is shown in Figure 1.

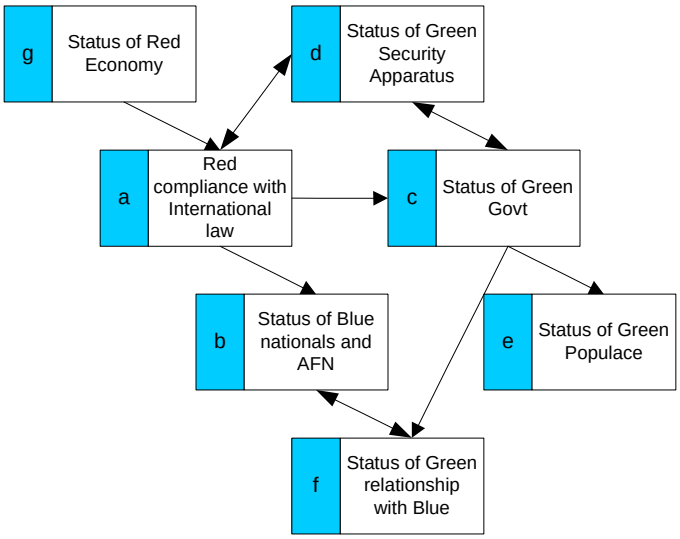

Figure 1. An influence diagram showing the main entities of interest and the direct connections between them. An arrow indicates one entity has a direct influence on another entity.

Step 3

The next step is to record the current status of these entities and the desirable future status of the entities.[1] In the case of some entities, we may not be interested in their future status. These are the influence nets shown at the top of Figure 2. The value of an entity is indicated by the colour: red for undesirable, green for desirable and blue for neither (i.e. we don't care). The difference between these two states is the *delta* that currently exists.

The current and future status of each of these entities are linked via an effect. In Figure 2, this is shown for one of the entities and is represented by the curved arrows connecting states d0 and d1 via a box that describes the effect required to move between these two states. When this is done for all entities, the required high-level effects become immediately apparent. The primary effects are those where a change of state is required (orange). The secondary effects are related to those states that need to be maintained i.e. the net effect is zero (yellow). The remaining effects are those that are of no concern to us since we don't care how that entity changes (white).

[1] It could be said that these desirable states become our *objectives*.

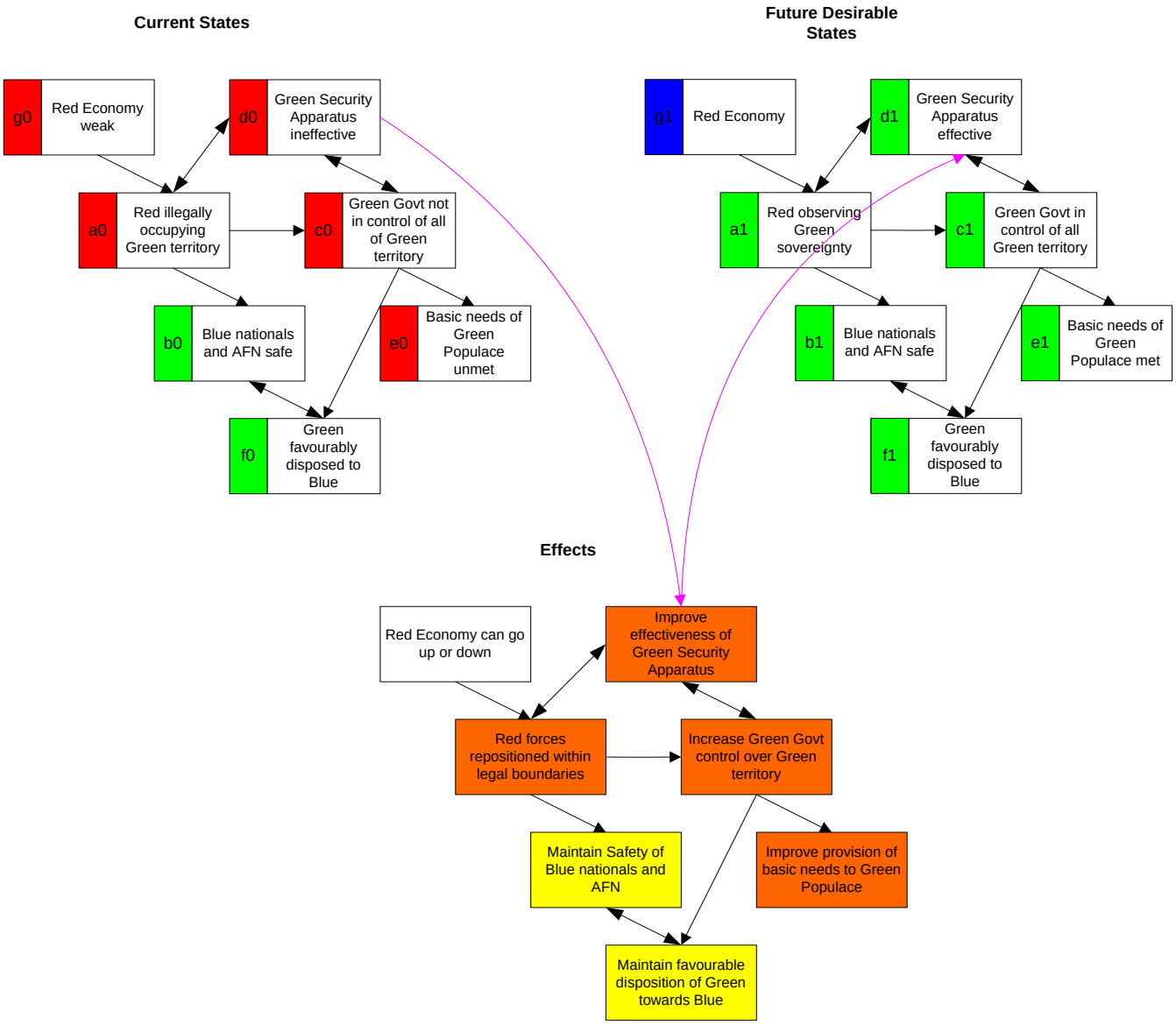

Figure 2. The present and desired future status of each of the entities, indicated by the numbers 0 and 1 respectively. The value of the entity is indicated by the colour: red for undesirable, green for desirable and blue for neither (i.e. we don't care). The effects that are required link the current and future states of the entities. The category of the effect is indicated by the colour: orange for a change of state, yellow for a maintenance of state and white for unimportant effects.

The influence diagram of effects should look exactly the same as the influence diagram of the entities themselves. This allows the decision-makers to focus upon the key effects and how they may relate to each other. This approach to constructing effects ensures consistency of the concept since all the effects articulated are changes of state.

Step 4

The final step is the exploration of possible direct actions that one might produce on any of these effects. These direct actions must also be examined for their possible indirect consequences on other effects, firstly (and most obviously) via the connections in the influence diagram, and secondly, via other paths not yet considered. The existence of any of the latter type may indicate flaws in the current influence diagram.

In this example, the obvious effect to examine first is the one of most concern, the repositioning of Red forces. Possible actions include:

- The application of military force to directly move the Red forces.
- The application of psychological force to directly move the Red forces.
- The application of economic force can be employed on the Red economy to indirectly affect the Red force.
- Improvements to the Green security force could cause the Red to reconsider its deployment.

One would then step through all of the other effects, identifying possible actions for each of them, considering how these actions might positively or negatively impact other effects (directly or indirectly). Ultimately, a table of actions against effects would be constructed that would assist in choosing the appropriate actions. An overall strategy of coordinated actions would then be decided upon.

Final comments

Once the planning stages are completed and an operation is commenced, these influence diagrams and tables would be continually updated, helping to keep track of events and highlighting any errors or misjudgments.

If an undesirable state or unintended effect occurs, this is an indication that our understanding is incomplete or erroneous and would indicate that our influence diagram required reevaluation. Similarly, anything unexpected, whether it is states, effects or actions, would force a re-examination of our understanding.

The process has the potential to be developed hierarchically in a scale invariant way i.e. it allows aggregating and disaggregating down to any level and following the same procedure.[2] This process can be extended to effects or actions if desired.

Conclusions

Much has been written of EBO, with the discussions invariably consisting of a variety of descriptions and definitions of the concept. While sharing commonalities, they tend to focus on a particular perspective of effects, applying emphasis to those aspects that the writer/s consider most important or most tractable to articulate in detail. While not absolutely fatal, these small differences can lead to confusion, misunderstanding and a lack of transparency, all of which contributes to undermine the utility of the concept.

[2] One possible drawback is the possibility of stove-piping by the entity you have chosen to examine ... however, if the main connections have been correctly identified at the higher level, this should minimize any possible negative consequences.

This paper has presented a basis for a lexicon that helps refine some of the terminology currently used. This starting lexicon is not revolutionary, but a reworking of common ideas arising from within the EBO community. It shows how the underlying ideas can be organized into a fundamental set of statements that simply, precisely and comprehensively describes the nature of effects and can be foundational to understanding more sophisticated EBO concepts.

This basic lexicon has then been applied to an example of a high-level EBO process. The process is not dissimilar from that espoused by the UK JDCC [8]. What it mainly attempts to add is a refinement of terminology that may improve the development of such approaches. This lexicon needs to be tested with much more rigour than has been applied so far to examine if it is robust and indeed beneficial.

References

[1] Deptula, Brigadier General David (2001), “Effects-Based Operations: Changes in the Nature of Warfare”, Aerospace Education Foundation, Arlington, VA.

[2] Deptula, D.A. (1995), “Firing for Effect: Change in the Nature of Warfare”, Defense and Airpower Series, 1995.

[3] US Joint Forces Command J-9 (2001), “A Concept Framework for Effects Based Operations”, White Paper Version 1.0, 18 October, 2001.

[4] Davis, P. K. (2001), “Effects-Based Operations (EBO): A Grand Challenge for the Analytical Community”, RAND, 2001.

[5] Australian Defence Force Directorate of Future Warfighting Concepts (2003), “Effects Based Operations Discussion Paper”, 25 November 2003.

[6] Smith, E. A. (2002), “Effects Based Operations, Applying Network Centric Warfare in Peace, Crisis, and War”. Center for Advance Concepts and Technology, DOD Command and Control Research Program, November 2002.

[7] Mann III, E.C. (USAF, Retired), G. Endersby (USAF, Retired) and T.R. Searle (2001), "Dominant Effects: Effects-Based Joint Operations", Aerospace Power Journal, **15** 92-100 (2001)

[8] United Kingdom Joint Doctrine and Concepts Centre (2003), "A Multi-National Concept For The Planning, Execution & Assessment Of Future Military Effects Based Operations" Discussion Paper, 4 August 2003.

[9] Mann III, E.C. (USAF, Retired), G. Endersby (USAF, Retired) and T.R. Searle (2002), "Thinking Effects: Effects-Based Methodology for Joint Operations", College Of Aerospace Doctrine, Research And Education Paper No. 15, Air University October 2002.

[10] Williams, B.T. (2002), "Effects-Based Operations: Theory, Application and the Role of Airpower". Carlisle Barracks, Army War College, Pennsylvania 2002. 31p.