



# SMALL WARS JOURNAL

## Complex IPB

By Tom Pike and Eddie Brown

Journal Article | Mar 24 2016 - 4:23pm

### Complex IPB

Tom Pike and Eddie Brown

*The right perspective makes hard problems easy while the wrong perspective makes easy problems hard.*

-- Scott Page

The last 15 years of conflict have shown the difficulty in understanding the internal dynamics of a foreign population. Understanding these internal dynamics, however, is essential to implementing policies and taking action to influence the foreign population's behavior in pursuit of U.S. goals. The U.S. Government must improve its capability to rapidly analyze foreign populations and the need for this capability will only increase as megacities, with their incredibly complex population systems become more numerous. Unfortunately, the challenge is not only finding effective approaches to understand foreign populations but also finding approaches that can integrate assessments from a Battalion Intelligence Officer all the way to a strategic level agency. This integration is necessary to synchronize the efforts of the large and likewise complex U.S. Government. Acknowledging these daunting challenges demands the U.S., and in particular Army intelligence, work to find and apply improved analytic frameworks for foreign population analysis.

Intelligence Preparation of the Battlefield (IPB) provides a strong nucleus to develop new frameworks, but must evolve past its force on force focus to an approach that analyzes multiple groups competing within a population. The integration of new concepts from complex adaptive system theory provides rigorously tested concepts many of which have already been incorporated into common analytic software—such as Analyst Notebook, Palantir, and others—to cope with the problems of Yemen, Somalia, Iraq, Syria, and elsewhere. Complexity based approaches have also been the core of strategic assessments which have influenced the highest levels of government. The challenge is to operationalize these approaches so intelligence analysts, at all levels, can gain an understanding that leads to synergistic policy and action. A critical capability to support this evolution of IPB is the development and integration of Agent Based Models. Agent based Models, a proven tool of complex adaptive systems, can provide staffs and decision makers an option exploration tool to help them visualize possible effects of their policies and actions. Using IPB as the nucleus and integrating concepts from complex adaptive systems theory generates Complex IPB. Complex IPB is the next generation of IPB and has the potential to dramatically improve foreign population analysis as well as improve U.S. ability to influence foreign populations.

### **IPB**

Define the Area of Operations

Describe environmental effects

Evaluate the threat

Evaluate threat courses of action

### **Complex IPB**

Define the Area of Operations

Describe fitness landscape effects

Evaluate the major groups

Evaluate major groups' courses of action

Asses the groups interaction

Evaluate population behavior

The strength of IPB is its underlying logic. A reasonable prediction of threat behavior can be made by analyzing the situation combined with an assessment of the threat's capability. This logic is evident by reviewing the four steps of IPB. Step one is to define the operational environment. This is a description of the area of operations' significant characteristics that can influence friendly or threat courses of action. Step two is to describe the environmental effects on operations, for example a densely forested swamp would be severely restricted or no-go terrain. Together, these two steps are the constants, which the threat has little ability to change. Step three is evaluate the threat.<sup>[1]</sup> This is the threat's capability, through the context of the terrain and weather effect. What is the range of the threat's weapons and what is the threat's vehicles ability to negotiate the terrain accounting for the weather? What knowledge does the threat have in constructing IEDs? How easily is the threat able to move through the population without interdiction by local authorities? The conventional threat must choose different courses of action in a desert than in a jungle, while the insurgent threat must alter how it plants IEDs based on how freely it can move and its capacity to construct them. This is the simple elegance of IPB. The given situation and the threat's capability limits what they can and cannot do. This situation leads to the fourth step, evaluate threat courses of action, a reasonable prediction of what actions the threat can take reduced by the environmental and capability constraints.<sup>[2]</sup> These courses of action or hypotheses are then confirmed or denied through the implementation of a collection plan. The predictions of threat behavior allows friendly forces to maximize the limited capability of their limited collection assets to determine what course of action the threat adopted and how they are adapting. This logic can be applied not only to threat forces but also to groups in foreign populations. To understand how to do this it is useful to first examine the decision making of an individual.

The choices of an individual sitting within a population socio-cultural-political-ecosystem (fitness landscape for short) are constrained by the same general logic which IPB uses to analyze a threat force.

When a person wakes up they will make decisions to generally maximize their situation. This individual confronts a fitness landscape which has an impact on what action the individual may take. This is similar to the terrain analysis and effects in IPB but with the added layers- politics, economics, social, information, infrastructure, environment and possibly more. The individual also has a capability (or fitness function) such as a profession, education, ethnic group, savings or family connections. A person survives or thrives based on their fitness function and its ability to extract resources from the fitness landscape. This simple dynamic is prevalent across time and space. In the 1980s, while the country faced a horrific insurgency from the Shining Path, a group from the Institute of Liberty and Democracy wanted to see how long it would take a person to set up a two-person sewing machine shop in a shanty town of Lima, Peru. It took more than 1800 hours, which when accounting for access to the government offices was more than 300 days and cost 32 times the monthly minimum wage.[3] When similar studies were done in Peru on everything from marriage licenses to property transfers the results were the same staggering obstacles.[4] The implications were clear, Peruvians in Lima's shanty towns were not joining the legal economy because the bureaucracy was such a daunting obstacle, severe no-go terrain, that it was impossible for them to do so. The government began to reform this situation and these reforms were seen as a crucial in defeating the Shining Path insurgency. In a lecture at the National Defense University, Dr. David Kilcullen described the choice for many Afghans working to find resolution to a dispute. If they went to the local Afghan Government official they would be beaten up and no action would be taken. If they went to the Taliban they could expect at least some sort of predictable, albeit harsh justice.[5] Many individuals therefore choose to ask the Taliban for justice, since at least there was a chance of resolution of their issue. The dynamic is the same as a threat commander making decisions in IPB, an individual has a capability to face the situation and from this develops courses of action.

The challenge then becomes analyzing hundreds to millions of people and their decisions instead of one threat unit. At first glance, this challenge seems overwhelming. Fortunately, complex adaptive systems have a property called emergence. Just as a threat unit is made up of a number of individuals but can be viewed as a single entity due to the military structure, emergence has a similar effect without the requirement of a centralized command structure.[6] Large groups of people will make the same decision without a centralized decision making process. This phenomenon is evident in the recent conflicts, where different tribes, ethnic groups and individuals decided to support either the insurgency or the government. Although each group or individual may have had different motives for their decision when these micro-decisions aggregated together the result was either the strengthening or weakening of the insurgency. Thanks to the property of emergence analysts, can look at groups of people and view them as a cohesive whole. Analysts do not need to understand each person, instead they can identify the key groups within a population and use the same IPB logic to try and predict these groups' courses of action by analyzing their situation and capability. Unlike IPB where the terrain is a constant, however, groups can actively shape the fitness landscape they are negotiating.

Arguably, the reason a fitness landscape of cultural, economic, social and other dynamics even exists is because it is the result of the interaction of lots of individuals and groups, who are negotiating it each day. The idea that each group contributes to the shape of the fitness landscape means different groups may be able to radically alter it. This is a significant difference from IPB as the threat, cannot turn a desert into a jungle, turn a machine gun into a tank, or make a secure radio suddenly compatible with a newly arrived foreign partner. Coalition actions in Iraq clearly demonstrate how a group can significantly change the fitness landscape of a population. Prior to the Iraqi invasion of 2003, being a Ba'athist in the Iraqi fitness landscape provided an avenue of approach to jobs and security. After the invasion the coalition made contentious decisions to bar Ba'athist members[7] which immediately and dramatically altered this terrain. Instead of having an avenue of approach, Ba'athist's now faced no-go terrain when trying to get

government jobs or security. Unfortunately, these same individuals, were the people in the country who had many critical capabilities from technical knowledge of the infrastructure to organizational understanding of the government. This decision had cascading effects throughout the rest of the coalition's time in theater, with many arguing this decision drove key Iraqi leaders to the insurgency.[8] The Coalition dramatically reshaped the fitness landscape, but at the same time they had to negotiate the new landscape they created. Groups within a population have the ability to influence the fitness landscape which shapes the situation of the population every day and subsequently influences decisions. Evaluating group courses of action uses the same reasoning underlying IPB, however, the groups being analyzed have greater ability to shape the situation.

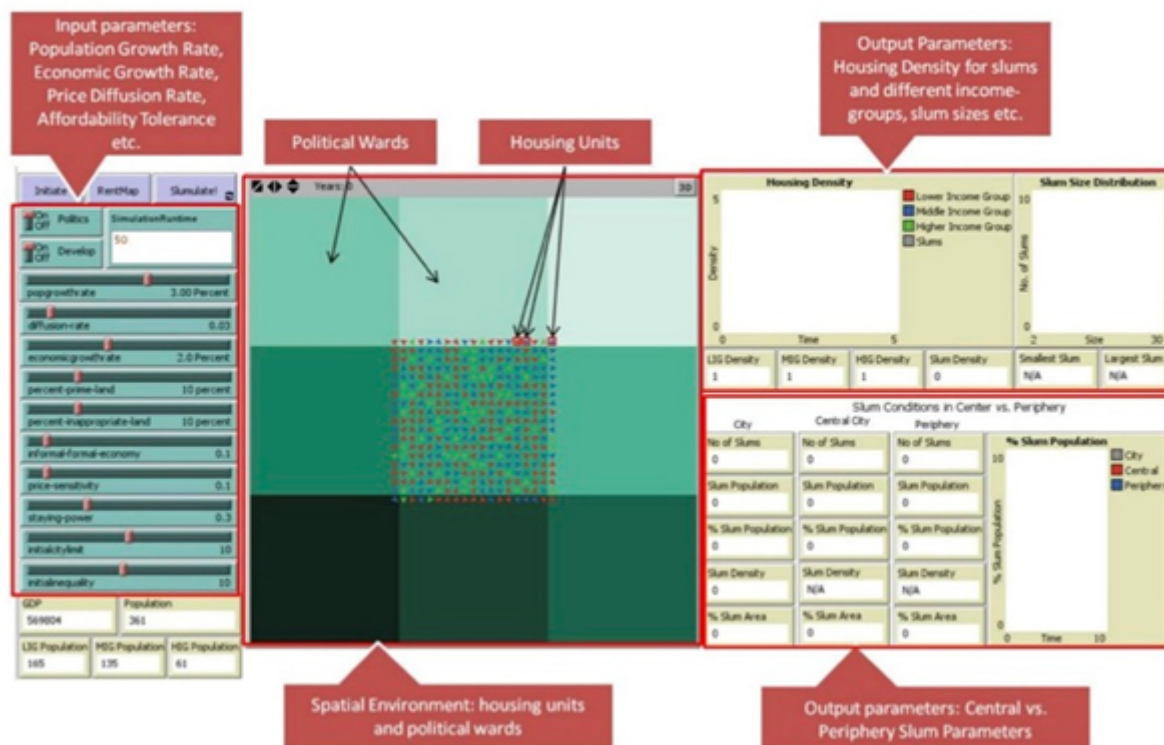
Evaluating group courses of action then leads to the next step of Complex IPB, assessing the groups' interaction. This step is effectively wargaming from the Military Decision Making Process (MDMP). Each group will be making decisions to maximize their situation and outcompete any perceived rivals. They will adjust their courses of action based on what their rivals are doing. Having multiple groups increases the complexity of what one is analyzing. For example, if there is an insurgency, with a government group, an insurgent group, and three more major groups (a total of five groups) in the population each with the three possible courses of action, there are 125 possible combinations. This challenge can be simplified as the possible behavior of concern will likely only have a few categories. Despite this large number of different combinations the effect of these combinations will still fall into four broad categories. The insurgency may be (1) expanding and gaining legitimacy (groups supporting the insurgents), (2) contracting and losing legitimacy (groups supporting the government), (3) is in a stalemate with neither the government nor insurgency gaining ground, or (4) an alternate group is rising up to take power from the government and insurgency. In addition, most of the combinations may fall into only one or two categories. This allows analysts to generalize the combinations and focus on those combinations leading to or away from US objectives.

The interaction of the groups and the courses of action they pursue leads to the population's behavior. This statement is significant because it fundamentally defies the Westphalian tradition, and the default view, of viewing foreign states as a single entity. Instead, foreign populations are more like ecosystems, where the various groups are in a delicate equilibrium and the government is only one part, albeit an important part, of the functioning of that ecosystem. Evaluating the population behavior is an assessment of the interaction of major groups within that population as they pursue courses of action. These interactions may result in an unstable state, a dictatorial regime, or an emerging democracy. Critically, this dynamic is scalable, whether the population is a village, a province, a nation, or a region of the world.

Allowing analysts at all levels to use a common approach to understand the population of concern. The behavior of the population is a result of the interactions of the groups within it at all levels. This assessment of the population's behavior is also the culmination of Complex IPB. Applying the Complex IPB framework will provide decisions makers a better understanding of the internal dynamics which are driving the populations' behavior; this understanding should allow leaders to take more effective action and better synergize the instruments of power to achieve U.S. Objectives.

Applying the Complex IPB framework to population analysis will improve the situational understanding of any population in any environment, this understanding can be further enhanced through the development and integration of Agent Based Modeling tools into the analytic and decision making processes. The primary tool to model complex adaptive systems is Agent Based Models (ABM) As Agent Based Models are unfamiliar to many readers please see the embedded graphic or if you would prefer a video [please follow this link](#). The model the graphic below portrays is very relevant to Dense Urban Areas as it is a model of slum formation. On the left of the picture are the input parameters, which allows users to manipulate variables and see the impact of adjusting these variables. The output parameters are

different ways of measuring the models behavior to provide insight into what is happening.



Graphic One: “Slums provide shelter for nearly one third of the world’s urban population, most of them in the developing world. Slumulation represents an agent-based model which explores questions such as i) how slums come into existence, expand or disappear ii) where and when they emerge in a city and iii) which processes may improve housing conditions for urban poor.”<sup>[9]</sup>

ABMs have already proven effective in analyzing and informing policy on everything from foreign population behavior to the US electric grid to leadership in organizations.<sup>[10]</sup> ABMs are proven tools which takes the perspective of the agents. An agent is a discrete entity with its own behavior and own goals. In the context of the Complex IPB framework, agents would represent the major groups and their internal variations. These agents then interact with each other. The fitness landscape is the terrain in which they interact. These interactions then produce a possible emergent behavior of the population. This emergent behavior is the U.S. objective. Are the groups supporting the insurgency or the government? Does the fitness function of one group allow it to gain dominance over the system undermining the democratic institutions? ABMs allow for the adjustment of variables within a group’s fitness function or a manipulation of the fitness landscape. In the application, the action of the analyst may be to adjust the size of the money variable for a group’s fitness function or adjust a variable of the fitness landscape to represent a change in the government process which may result in restrictive terrain becoming an avenue of approach for a previously excluded group. As the adjustments are made the analysts, staffs and decision makers would be able to see how multiple changes at different points in the system may affect the interaction of the groups and the subsequent behavior of the population. From this course of action development they then may adjust how money is dispersed to influence the power of competing fitness functions, help pass new laws to provide access to previously excluded groups, and/or focus on attacking a different part of the insurgent network. A Complex IPB agent based model application will provide analysts, staffs and decision makers an option exploration tools that gives them insights into how the different groups may react to U.S. policy and actions.



ABM and its integration into decision making processes does face hurdles for implementation. The first hurdle is “can a generic model be created that any analyst can set specifically enough to analyze the local problem set or will an Army element need to be created to build models specific to a Brigade Combat Team (BCT) and their particular problem?” In other words, can a universal application be created that is both effective and user-friendly enough that analysts can apply it to their local situation whether in humanitarian missions in Africa or active insurgencies in South Asia. Or, will a group of experts need to do the coding and formulas necessary for a realistic model to be created that analysts can further adjust to the specific situation of the local area. If a group of experts is needed to support ABM model, it cannot be experts working in isolation instead it must be a symbiotic relationship with the BCT forward, where the entities are working as a team to further refine and update the model so staffs can employ it to achieve their objectives. The second hurdle is these models will only ever give a probabilistic outcome and will have to be run multiple times to see what behavior has the highest probability. This is a reflection of reality and it often creates some computing challenges. The nature of the model, its complexity and the austerity of the environment will determine what is feasible. Even if Complex IPB must be completed in analog, it will still provide an improved understanding of the situation. ABMs enhance the approach they do not replace it. The third hurdle is the need to federate production when conducting a campaign. The analysis of a village will have an impact on the analysis of a region, which will have an impact on the analysis of the country. From step one, any plan to integrate ABM into decision making must look at how to link these ABMs together. National action has a local impact and local events can have a national impact. ABM can and must serve as a catalyst to help synchronize whole of government efforts when influencing the behavior of a foreign population. ABM is a powerful tool which must accompany Complex IPB and be integrated into decision making processes whether MDMP for a BCT or discussions by the National Security Council.

The foundation of IPB is a strong and powerful logic. Understanding a threat’s situation and its capability within the given situation allows for a reasonable prediction of that threat’s behavior. This same logic can be applied to most people who are fighting each day to maximize their situation. The property of emergence allows analysts to focus on the main groups of the population instead of trying to understand the millions of people who may be in the area of operations. Complex IPB then follows the same initial steps as IPB, but with a focus on groups and an incorporation of the more dynamic fitness landscape (the cultural, social, economic, information, government terrain): (1) Define the Area of Operations, (2) Describe the Fitness Landscape effects, (3) Evaluate the major groups (4) Evaluate major group courses of actions. Complex IPB must then add an additional two steps. (5) Assess the groups interaction and (6) Evaluate population behavior. These two steps follow logically from the base of IPB. Complex IPB can then be enhanced through development and application of a Complex IPB Agent Based Model application. Although its development and implementation faces some hurdles, ABMs are a proven tool, which can provide analysts, staffs and decision makers the ability to explore numerous options and combinations of options and visually see the possible effects. Complex IPB is the natural evolution of IPB and has the potential to improve analysis and influence of foreign populations.

## **End Notes**

[1] Headquarters, Department of the Army, Army Techniques Publication 2-01.3, *Intelligence Preparation of the Battlefield*, (November 2014), 1-1-1-4

[2] Ibid, 1-1-1-4

[3] Hernando De Soto, *The Other Path: The Economic Answer to Terrorism*, (New York: Basic Books, 1989), xxi-xxxiv

[4] Ibid

[5] David Kilcullen, "Counterinsurgency," (lecture, Afghanistan-Pakistan Foundation Course, National Defense University, October 6, 2009)

[6] *Understanding Complexity*, taught by Scott E. Page, Lecture 6

[7] *FRONTLINE: The Lost Year in Iraq*, (October 17, 2006)

<http://www.pbs.org/wgbh/pages/frontline/yeariniraq/> (accessed May 26th, 2014)

[8] Ibid

[9] Patel, A., Crooks, A.T. and Koizumi, N., "Slumulation: an Agent-based Modeling Approach to Slum Formation", (2012), [http://www.css.gmu.edu/Slums/PatelCrooksKoizumi\\_Slumulation.pdf](http://www.css.gmu.edu/Slums/PatelCrooksKoizumi_Slumulation.pdf), (accessed 27 February 2016).

[10] Joshua Epstein, *Generative Social Science: Studies in Agent-Based Computational Modeling*, (Princeton University Press, 2007)

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## Links:

{1} <http://smallwarsjournal.com/author/tom-pike>

{2} <http://smallwarsjournal.com/author/eddie-brown>

{3} <https://www.youtube.com/watch?v=FTBUIJwIVBg>

- {4} <http://www.pbs.org/wgbh/pages/frontline/yeariniraq/>
- {5} [http://www.css.gmu.edu/Slums/PatelCrooksKoizumi\\_Slumulation.pdf](http://www.css.gmu.edu/Slums/PatelCrooksKoizumi_Slumulation.pdf)
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