Game Theory, Predicatibility and Route Selection

CPT BRANDON COLAS

MC2 Robert Whelan, USN

A U.S. Soldier works with Iraqi Army soldiers from the 6th Iraqi Division as they plan a patrol through Abu Ghraib, Iraq.

Although it's not one of the five principles of patrolling, it should be. Learning how to avoid setting patterns is vital for the small unit leader, especially in counterinsurgency (COIN) operations. The concept that "constant and unpredictable activity … over time, deters attacks and creates a more permissive environment" had been discovered by our NCOs and lieutenants long before David Kilcullen's "28 Articles" was first published. But Army doctrine stops at this point. We are told to be unpredictable with the implication that this is easy. Unfortunately, humans are inherently predictable — unless they learn how to make decisions that cannot be patterned.

In this article, I'll discuss how the basic principles of Game Theory can aid in route selection during your mission-planning process. Game Theory is a mathematical method used to determine the various results from competing strategies, but you don't need much math to make it work. Think of Game Theory as a tool, like an S-2 brief, that can help with troop-leading procedures.

After reading this article, you'll know enough to never pattern yourself again, which will disrupt the enemy's planning cycle. Of course, that doesn't mean you won't get attacked. However, when attacks occur, they will be because the enemy got lucky — not because they knew your route based on previous patrols.

The use of game theory and randomness as a security measure is nothing new. Security officials at the Los Angeles International Airport have been using game theory (via a computer program) to generate truly random patrols since 2007, according to the November 2007 *Hypercube* article "Practice Random Acts of Security" by Lauren Cox. COL Kevin Brown, the garrison commander of Fort Riley, Kan., observed that the concept of randomization of activity for installation security measures is well established. If we need random activities to protect our airports and CONUS bases, it is much more vital to do so with our combat patrols.

You're Not as Random as You Think

Humans think and act in habits and patterns. For instance, when asked to think of a random number between one and 10, the majority of people say three or seven. Likewise, marketing campaigns are based on humans acting in a consistent manner. For instance, people spend more money at grocery stores on products placed at eye-level.

In a similar manner, the Army trains Soldiers to fall back on previous patterns, like battle drills, when they are tired and under stress. This isn't always a bad thing, but it's a problem when it comes to route selection.

Not only are you naturally predictable, "the harder you try to be random, the more predictable you become," wrote Mark Burnett and Dave Kleiman in their book *Perfect Passwords: Selection, Protection, and Authentification.* By trying to avoid patterns, you create them. For instance, when people are asked to scatter a handful of pennies randomly, patterns emerge such as all pennies being equally spaced apart. Although the subjects of the test might not realize it, they are far less random than they think, according to Burnett and Kleiman.

Why do humans struggle with being unpredictable? In his book *The Compleat Strategyst: Being a Primer on the Theory of Games of Strategy,* J.D. Williams observed, "Habits, prejudices, orderliness, and so on all militate against … being random."

When humans try to be unpredictable, they aren't. And whether or not you realize it, you are probably fairly predictable in your patrolling.

What Is Game Theory?

As mentioned, Game Theory determines the various results of different strategies. It attempts to predict benefits and costs for competing groups when they make choices.

Game Theory began in the mid-20th century with a mathematician, John von Neumann, who was looking for new ways to model economic behavior. In the *Small Wars Journal* article "Game Theory: Can a Round of Poker Solve Afghanistan's Problems," author Richard Gash wrote that von Neumann discovered three key components to games of strategy, such as poker. He wrote, "First, a player without a strategy was doomed. Second, a player who failed to adapt his strategy to that of the other players was equally doomed. Third, a novice player, without a strategy, although doomed to failure in the long run, could disrupt a seasoned, strategic player."

Why would the novice disrupt the veteran? Because the experienced player is unprepared for the random and sometimes illogical choices made by the newcomer. Let's interpret these components in military terms: First, you need a plan. Second, the enemy gets a vote; we must adapt based on their actions. Third, our enemies — many of whom are experienced fighters — can do a significant amount of damage to us, in part because most U.S. forces do things the same way.

Von Neumann concluded that **seasoned players who *use* randomness in their strategies are generally the most successful**. This is because randomness hides your strategy from your opponents, according to Gash.

How Can I Use Game Theory?

By deliberately inserting randomness into your choices for route selection, you'll negate the insurgents' ability to predict your choices. Let's use the city of Hawijah, Iraq, as an example. Hawijah is divided in half by a canal that runs north to south, and only three bridges cross from the eastern half of the city to the western half: North Bridge, Market Street Bridge, and South Bridge.

Let's say that each of the three bridges offers similar cover and concealment for the insurgents, who can only ambush one bridge at a time. They have no tactical advantage in choosing a particular bridge. Likewise, coalition forces have no defensive advantage in choosing a particular bridge. Finally, let's say you have an escort mission every Monday, Wednesday, and Thursday, and there is no particular intelligence about where the insurgents will ambush — only that they will attempt an attack.

Game Theory can offer an effective way to choose which bridge you cross on the way there, and which way you cross on the way back. However, the math gets quite involved, so we'll simply use the key idea: inserting randomness into your strategy will mask your decision. Since all other factors are equal, **you should choose your route by a random method**, in order to avoid patterning yourself.

Devices of Chance

Here's how it works: you have three choices to cross the city and three choices on the way back. Six choices in total. For this decision, you could use a die. Let 1 be North Bridge, 2 be Market Street Bridge, 3 be South Bridge, 4 be North Bridge, 5 be Market Street Bridge, and 6 be South Bridge. The odds are one in three for any of the bridges. Roll it twice, once for going there and once for your way back. Now you've inserted chance, or randomness, into your strategy. Although headquarters has patterned when you patrol, you can improve your safety by using a device of chance to select your route, thus guaranteeing your unpredictability.

49	62	33	44
40	86	49	48
12	22	15	52
05	26	06	07
33	90	77	03

Figure 1

Another device of chance when you only have two choices (all other factors being equal) is a coin. A deck of cards could be used for four choices.

What if the situation is more complex, and not all of the choices are equal? When this is the case, you should **skew the probabilities depending on the situation**. Higher headquarters instructions, intel reports, previous experiences, the weather, and many other factors will all affect how you "value" each route. For instance, if Market Street Bridge offers the enemy a significant advantage, and North Bridge is better defensively, while South Bridge is neutral, let 1, 4, and 6 represent the choice of North Bridge, 3 and 5 represent South Bridge, and 2 be Market Street Bridge. Now your chances of going on Market Street Bridge have lessened (but in order to be unpredictable, it must stay as an option).

A deck of cards could also be used to skew the odds, by using choices such as face cards and aces versus non-face cards (odds are 4:9) or hearts, spades and diamonds versus clovers (odds are 3:1), depending on how many choices you have.

One other popular device of chance is a table of random numbers. RAND publishes a table of a million random digits that can be used for any sort of problem involving chance.

Suppose that Hawijah had 10 bridges. Here's how you could use this table. Start at the bottom right and work your way left. All other factors being equal, if the digit is 00 to 09, you'll take the first bridge, 10 to 19, the second bridge, 20 to 29, the third, and so on. You could also work your way across diagonally, top to bottom, or bottom to top. Regardless of how you use such a table, your selection will be random.

In summary, **the complexity of your choice affects the device of chance you use and how you skew the probabilities.**

Objections

My company commander/platoon sergeant/Soldiers will panic if they see me flip a coin during my planning process. In other words, it seems that …

Chance is an irresponsible way to select a course of action that has people's lives at stake. In his book, Williams wrote, "there is nothing irresponsible about it: all the cogent reasoning which you feel should go into the decision does go into it."

The Hawijah example is deliberately simple. As mentioned, other factors such as enemy patterns, friendly support, headquarters instructions, and so on will all affect your decision when it comes to weighing the odds of one route against another. However, you still have to choose. And when you have done your planning, collected all of that information, analyzed all your options, and weighed your odds, *only then* do you deliberately add in a device of chance.

The Role of Instinct

Instinct, of course, can't be measured. Don't leave this article thinking that you can't trust yourself — there will be times when you get a bad vibe from South Bridge and suddenly decide to take Market Street Bridge, despite what your deck of cards recommended. It's your decision. Sometimes changing your route based on instinct will be the right choice — but that will be the exception, not the rule.

Chance makes things far tougher for the enemy. Because you're inherently predictable, the use of controlled randomness will make things safer for your Soldiers and yourself.

CPT Brandon Colas is a 2006 graduate of Cedarville University and was commissioned from Central State's ROTC program.