

Predicting insurgent attacks with a mathematical model

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When bombs and bullets left 37 dead during Friday prayers at a mosque in Pakistan, earlier this month, the insurgency was using the element of surprise. Unpredictability is the hallmark of modern insurgent attacks such as this one. However, the likelihood of such events, their timing and strength can now be estimated and managed before occurring, according to a new study by researchers at the University of Miami. The study entitled "Common Ecology Quantifies Human Insurgency" is featured as the cover of the December 17, 2009 issue of the scientific journal *Nature*.

The University of Miami (UM) researchers and their collaborators analyzed the size and timing of 54,679 violent events reported in Afghanistan, Colombia, Indonesia, Iraq, Israel, Northern Ireland, Peru, Senegal and Sierra Leone. The findings show that there is a generic way in which humans carry out insurgency and terrorism when faced by a large powerful state force, and this is irrespective of background history, motivation, ideology, politics and location, explains Neil Johnson, principal investigator of the study and professor of Physics at the UM College of Arts and Sciences.

"We have found a unified model of modern insurgent wars that shows a fundamental pattern in the apparent chaos of wars," says Johnson. "In practical terms, our analysis can be used to create and explore scenarios, make predictions and assess risks, for present and future wars."

The study finds a common statistical distribution for insurgency attacks that is significantly different to the distribution of attacks in traditional wars. This finding supports the belief that insurgent wars represent "fourth generation warfare" with different dynamics from conventional wars.

"Despite the many different discussions of various wars, different historical features, tribes, geography and cause, we find that the way humans fight modern (present and probably future) wars is the

same," he says. "Just like traffic patterns in Tokyo, London and Miami are pretty much the same."

The unified model of human insurgency establishes a quantitative connection between insurgency, global terrorism and ecology, and this model demonstrates that insurgency behaves like a "soup-of-groups, with no permanent network or leaders, but with common decision-making processes," says Johnson. This "mathematical law of [war](#)" challenges traditional ideas of insurgency based on rigid hierarchies and networks, explains Johnson.

Interestingly, this model of human insurgency bears a "striking similarity" to models of crowd behavior of financial markets. Therefore, in addition to its academic and practical contribution to understanding and managing human conflict, "it also suggests a possible link between collective human dynamics in violent and non-violent settings," says Johnson.

In the future, Johnson and his collaborators plan to explore what would happen if a third population is added to the analysis, such as a peacekeeping mission; how should they be deployed in order to minimize casualties? They also hope to apply this understanding of conflict to other areas. For example, in the medical field, a virus might be represented by an insurgency, while the state army is the immune system and a blocking drug may be the peacekeepers. "We are starting to explore its applications in other 'wars', such as the personal battle of a patient with cancer," Johnson says.

Provided by University of Miami

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