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Beautiful Science: Getting the Math Right May Help Thwart Terrorism

If you didn't feel giddy when Russell Crowe (as mathematician John Nash) scribbled his breakthrough equation on the windowpane in "A Beautiful Mind," you weren't alone. But to a select few mathematicians, the moment was as meaningful as the most soulful gaze by Jennifer Connelly. The Nash Equilibrium he discovered in 1950 became the pivotal concept in the branch of mathematics called Game Theory -- and now is informing analyses of terrorism and antiterrorism.

Game theory analyzes outcomes when two thinking, rational agents make choices. Take, for example, two burglary suspects. Cops throw them into separate cells, incommunicado, and offer each a deal. The first one who confesses to the heist and implicates his accomplice will receive a reduced sentence. If only one prisoner rats out the other, then the squealer fares best, since he will get, for instance, one year for possession of stolen property while his partner gets 12 for burglary.

If neither prisoner accepts the offer, authorities won't have sufficient proof to convict them of the more serious charge. Each will be convicted only of possession and receive a two-year sentence. If both prisoners confess, they each get seven years.

Enter the prisoner's dilemma. If Joe figures that Sam will squeal, then to avoid a 12-year-sentence he should likewise spill all. If Sam has the same suspicion, he should squeal, too. Result: each gets seven years behind bars.

Even if Joe figures Sam will keep quiet, he has a big incentive to talk (since there is no honor among thieves): If he does, he'll get a one-year sentence while Sam gets 12. If Sam figures Joe will stay quiet, he has an identical incentive: Start singing.

In every case, the best individual strategy -- and thus the Nash Equilibrium -- is to confess. But if both suspects "irrationally" had decided to keep mum, they would have achieved the best joint outcome, a two-year-sentence for each.

Game theory has become a popular analytic tool in both economics and political science, says economist Walter Enders of the University of Alabama, Tuscaloosa. That reflects a certain mathematics infatuation afoot in academia. But when he and Todd Sandler of the University of Southern California proposed applying game theory to terrorism, "people thought it was bizarre," says Prof. Enders. "We were proposing applying to terrorists an analysis -- Game Theory -- that assumes rational behavior, and terrorists are supposed to be crazy."

If only they were. Instead, their cold rationalism accounts for much of their horrific successes. (See related column[1])

Terrorists make rational decisions about the kind and timing of attacks, employing a substitution strategy. When U.S. airports installed metal detectors in 1973, for example, skyjackings fell to 16 a year from 70. But hostage-taking surged to 48 a year from 20, and assassinations to 36 a year from 20. Similarly, after U.S. embassies were fortified in 1976, attacks on American diplomatic targets fell to 20 a year from 28. But assassinations of diplomats and soldiers outside secured compounds rose to 53 a year from 20. Squeeze here, and terrorism bulges out there.

"When one kind of attack becomes more difficult or expensive, terrorists substitute other, cheaper kinds," says Prof. Sandler.

Because terrorists allocate resources to maximize their return -- media coverage, political instability, a climate of fear -- they have multiple ways to achieve the same end. "Terrorists will always identify a weakest link and send out the team most likely to succeed," he adds.

The best move is not to protect targets. If you secure Disneyland, terrorists may go after Sea World. The effective strategy is to reduce terrorists' resources: Go after training camps and arms caches, choke off financing, infiltrate networks.

Game theory points out another trap for antiterrorism. If country A is at high risk of terrorism, it may tighten border controls and protect more targets. But because terrorism planned for country A might now be diverted to country B, B starts spending more on antiterrorism, too.

We now have a situation analogous to the Prisoner's Dilemma. If A thinks B is increasing deterrence, it must do so, too, or it will be the victim of terrorists diverting operations to A. If A thinks B is going easy on antiterrorism, it has even more reason to crack down: the more secure A is compared with B, the more likely that terrorists will target B and leave A alone. B, of course, makes the same rational calculation. As in the Prisoner's Dilemma, each country has an incentive not to get left behind.

"Countries spend more and more, but don't necessarily become more secure," says Prof. Sandler.

Game Theory also shows that acting rationally can give countries not in terrorists' sights an incentive to take a free ride on the coattails of those actively fighting terrorism. "This is a real concern for the U.S., which has deflected almost all attacks on its interests to foreign soil, where it has little influence," says Prof. Sandler. Witness Monday's bombing in Riyadh.

The Nash Equilibrium shows the most rational move isn't necessarily the one with the highest joint payoff. Applied to terrorism, the results of acting selfishly, albeit rationally, can be tragic.

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