Rethinking Risk Analysis: Outsmarting Adaptive Attackers

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To be most effective against intelligent attackers, risk-informed decision-making requires more than information about current threats, vulnerabilities, and probable consequences of attacks on valued targets. It also requires anticipating how attackers will adapt their strategies as their information, experience, and capabilities change. Future changes in attacker strategies may greatly change the joint probability distributions of threats, vulnerabilities, and consequences for different targets, and effective defense strategies must anticipate and plan for these possible future changes.

This tutorial applies basic ideas and insights from artificial intelligence, optimization, and risk analysis to explore how intelligent attackers might plan and re-plan their attack strategies, dynamically shifting their limited resources and changing their commitment dates to exploit changing opportunities and paths of least resistance, as defensive countermeasures are implemented and as new intelligence information is gained. We consider how to help defenders anticipate and outsmart such intelligent attackers, taking into account the possibility that attack strategies will be adapted to work around defenses. We contrast such risk analysis of adaptive attack plans with more traditional defensive risk analyses based on target attributes. Simple examples show that, in at least some cases, novel risk analyses focused on outsmarting attackers can give different – and more effective – risk management recommendations than more traditional terrorism risk assessments that focus on allocating resources to the most "at-risk" targets.

Biographical Information

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Tony Cox is President of Cox Associates (www.cox-associates.com), a Denver-based applied research company specializing in risk analysis and operations research modeling. He is an Edelman Laureate of INFORMS (2006), a Fellow of the Society for Risk Analysis (SRA), Area Editor for Mathematical Modeling for *Risk Analysis: An International Journal*, Area Editor for Real-World Applications for the *Journal of Heuristics*, and author of over 150 articles, and of books on *Risk Analysis of Complex and Uncertain Systems* (Springer, 2009), *Quantitative Health Risk Analysis Methods* (Springer, 2006) and *Risk Analysis: Foundations, Models and Methods* (Springer, 2001). Tony is Honorary Full Professor of Mathematics and Clinical Professor of Preventive Medicine and Biometrics at the University of Colorado. He holds a Ph.D. in Risk Analysis (1986) and an S.M. in Operations Research (1985) from M.I.T.'s Department of Electrical Engineering and Computer Science. He received the Society for Risk Analysis Outstanding Risk Practitioner Award in 2007.