To bluff, or not to bluff? That is the question

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Economist Christopher Cotton from the University of Miami (UM), uses game theory to explore two of the most famous military bluffs in history. The findings are published in the current issue of the *Journal of Peace Research*.

The study is one of the first to use game theory to assess the Chinese military legends of Li Guang and his 100 horsemen (144 BC), and Zhuge Liang and the Empty City (228 AD). The stories appear in modern day translations of Sun Tzu's fundamental book on military strategy "The Art of War" to explain what is meant by deception.

Both legends involve a military that faces a much stronger opposing force. Instead of retreating, the commander of the weaker army orders his men to act as if they were preparing to bait the enemy into an ambush. The stronger army unsure of whether they are facing a weak army or an ambush decides to retreat and evade combat. In other words, the stronger opponent falls for the bluff.

The legends have been used for the past two-thousand years to illustrate military deception. What is new about this study is that it explains why their strategies were successful, says Christopher Cotton assistant professor in the Department of Economics at the UM School of Business Administration, and principal investigator of the study.

"With this study we gain insight about these legends that nobody had before. For example, bluffing doesn't work because it convinces an opponent that you are strong. It works because your opponent can't tell

whether you are really strong, or whether you are only acting strong. This uncertainty is all that's needed," says Cotton. "The generals chose strategies that left their opponents uncertain, and this uncertainty was enough to avoid confrontation."

Game theory is a field of mathematics that started to gain ground in the 1940's. It provides a way to model strategic situations, in which the success of an individual's choices depends on the choices of his opponent(s), explains Cotton. "The theory basically says that what I want to do depends on what you do, and what you want to do depends on what I'm doing. We ask what strategy people should follow in such situations."

Cotton modeled the military legends as signaling games, where one player has all the information about the situation and the other does not. Equilibrium is achieved when the participants or "players" adopt strategies or "actions" that bring about the best outcome, or "payoff." These optimal strategies can be described as a situation where "what I'm doing should be consistent with what you have chosen to do, and given what you have chosen to do, I should not want to go do something else," says Cotton. In the case of the military legends, the researchers found that bluffing arose naturally as the optimal strategy in each situation.

The study says that "when the probability of a weak general is high, the equilibrium involves mix strategies, with weak general sometimes fleeing and sometimes bluffing….when the probability of a weak general is lower (which is reasonable given the reputations of Li Guang and Zhuge Liang), then the unique equilibrium always involves bluffing by the general and retreat by his opponent."

What the researchers are showing is that these famous generals were acting according to optimal strategy, as defined by modern-day strategic reasoning. "They are playing in a way that is consistent to what we would recommend them doing today, even though they were doing it two-

thousand years before any of the modern tools for strategy were developed," Cotton says.

The paper is titled "100 Horsemen and the empty city: A game theoretic examination of deception in Chinese military legend," The co-author is Chang Liu, (PhD Student) in the Department of Finance, at the Georgia Institute of Technology. The study adds to the literature in which game theory is used to gain insight of historic events, it increases understanding on the role of deception in military and defense strategies and explores the logic used by experienced professionals, who unknowingly play strategic games to create innovative solutions to everyday problems.

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