Using Game Theory to Qualitatively Analyze Global Relations

Corliss A. Tacosa, Visiting Assistant Professor
Old Dominion University
ctacosa@odu.edu

Taryn Cuper
MYMIC, LLC
taryn.cuper@mymic.net

Abstract. As the world becomes smaller, the importance of global education increases. Technological advancements have made news instantaneous. The advent of the Internet has made contact with another part of the world just a click away. Such achievements have put pressure on educational institutions to prepare students for the global community in which they already live. They must not only be taught about the world and the interactions among countries, but also, how the decisions are made which facilitate these interactions and what factors might contribute to the chain reactions which might erupt from such decisions. It is critical that students learn the skills of decision-making and analysis in order to be able to operate within a world where threats and crises abound. As tomorrow's leaders, today's students must be exposed to the global world and its mechanisms and learn the tools to navigate within it.

1.0 INTRODUCTION

In teaching international relations/politics, teachers must create an interest in their students for the global community and the issues that plague it. To do this, creative approaches must be incorporated in the classroom curricula to foster enthusiasm for the subject matter, encouraging the students to effectively learn the analytical skills necessary to become knowledgeable global citizens. Political theory offers such tools, but game theory specifically provides a methodology for developing an understanding of why entities execute certain courses of action and the costs and/or benefits associated with such decisions. Furthermore, through such theoretical modeling, insights are acquired as to the results of choices made when addressing an international issue or crisis. This new awareness provides students with the ability to develop astute and perceptive decision-making skills as well as enhances their knowledge and perceptions of global interactions. In the primary author's experience, this vehicle has resulted in great success, generating a deep-seated interest in the "ins and outs" of international relations/politics.

This paper outlines an approach to teaching international relations/politics, utilizing a qualitative approach to game theory. Student learn to model international incidents in the classroom for in-depth evaluation and appreciation. In this particular case, learners consist of American undergraduates enrolled in an International Relations or International Politics course. This method can be used in any political science academic setting to promote understanding and awareness of interactions in the global community. In addition, it provides learners with several tools to further investigate what is happening in the world around them.

2.0 BACKGROUND

Game theory has been recognized as a tool used by academics to make sense of what is happening around them. In political science, it specifically allows for a simplification of actual world phenomena so that students can grasp the core reasons behind decision-making and interactions concerning international events as well as what precipitated such events. In many political science courses that use game theory as a tool for instruction, a quantitative approach is used, measuring the mathematical probability of actions to occur. However, this paper postulates that for undergraduates in basic political science courses, the meaning and purpose behind global relations is more easily understood through a qualitative discussion and modeling. In this way all students can participate whether mathematically inclined or not.

Through game theory, critical factors of a decision making process can be illustrated as well as isolated by scrutinizing the actions and reactions of several world players, weighing each dynamically in terms of costs and benefits. This is done by creating a hypothetical environment using real world issues and by simulating the decision-making process to create awareness and

understanding. R. Hrair Dekmejian labels such an analytical framework as "political physics." [1] While specifically relating his approach through game theory to political violence, the characteristics of his "political physics" can be applied to any international issue analyzed through the game theory approach:

> First, people [entities] behave rationally, with individuals and unitary groups acting in their respective perceived self interest. Second, relations between two individuals or groups are usually interactive, in that each party reacts to the other's actions. Third, neither party is likely to "turn the other cheek" to what it sees as a wrongfully committed act by the other side. [1]

Through the enactment and use of various games, students learn the intricacies of interactions on the international level and the importance of making the right decision when addressing international conflictions. Students also learn the value of perception, as this particular attribute can mean the difference between a peaceful resolution and a devastating conflict.

This newfound awareness also introduces the concept of bias. Students learn that decision makers, while appearing objective, often have their own prejudices and agendas. When using game theory to analyze a given action, this knowledge about known decision makers can be determined and taken into consideration. It is more difficult to make conclusions about unknown decision-makers, but the skills used in playing the games can help students to become more astute in analyzing the actions of such people or states.

3.0 GAMES

With the international community in a state of anarchy, any number of adversarial situations can arise. Since all do not have the same characteristics, different ways to approach them must be studied. Thus, the following sections illustrate how the international environment can be modeled through three types of game theory, each with its own characteristics and purpose. The three are: Prisoner's Dilemma; Zero-Sum; and Non-Zero Sum.

3.1 Prisoner's Dilemma

The first game introduced to students is patterned after the ageless Prisoner's Dilemma Game. This game demonstrates the key role of strategy and trust in making a decision when one's survival is at stake. In the actual game, there are two prisoners accused of robbery. Interrogated in separate rooms, each prisoner must make a decision which will affect his respective future. This decision involves whether he can trust his fellow cohort to keep silent or whether his cohort will confess (defect) to his role in the respective crime. [2] Both prisoners' futures depend upon the decision each will make after weighing the costs and benefits of either confessing or defecting. [2] The game is illustrated by a four square diagram with each quadrant representing a combination of the two possible actions, as shown in Table 1.

Table 1: Illustration of the Prisoner's Dilemma quadrants

Prisoner A Confesses Prisoner B Confesses	Prisoner A Keeps Silent Prisoner B Confesses
Prisoner A Confesses Prisoner B Keeps Silent	Prisoner A Keeps Silent Prisoner B Keeps Silent

Students play the game by strategizing what each prisoner will do and why. This exercise begins the process of learning to consider the consequences of an action and how to come up with the best action with the least amount of punishment. In explaining this example to students, this type of strategic thinking is emphasized.

Extending this example to the international level, the Prisoner's Dilemma type game is demonstrated by using the same four square illustration. To demonstrate how this game can enhance learning in international relations/politics, a historical topic is chosen where the actual outcome is already known. This approach is helpful because students may already know the result, but what they do not know is what might have happened if a major decision had been made differently. Usually, the example used concerns the relations between the United States and Japan during World War II with the actions being to fight or negotiate. Each quadrant has its respective attributes, i.e. fight/fight, negotiate/negotiate, fight/negotiate, or negotiate/fight. The quadrant representing the

actual occurrence (fight/fight) is crossed out, as the decision and its consequences are already known. Then each of the remaining quadrants is discussed, a process which is facilitated by the instructor. The goal is to force students to come up with attributes of what might have resulted if a given quadrant occurred. Based on brainstorming and analysis, alternative consequences for a decision within a given quadrant are eventually arrived at, often amazing students and expanding their recognition of the value of prudent decision-making in a crisis situation. Also, students realize that if a decision concerning this issue had been made differently, even if it was only one decision, their lives today might be very different. In this example, it is a given that the actors are rational entities; therefore, it is easier to predict their respective actions. This, however, is not always the case, especially when the game involves many of the actors on the international stage today.

A more current situation is then presented to the students; this involves a crisis in which the outcome is not known. For example, relations between Iran and Israel with the actions being attack or negotiate can be used. The four quadrant illustration is used with each quadrant representing attack/attack, attack/negotiate, negotiate/attack, and negotiate/negotiate. Through this game, with the outcome unknown, students become aware of consequences of certain actions of which they had not previously thought. They begin to see the key role of perception and the key role of leadership rationality. Predictive skills are honed as they begin to "connect the dots," seeing what could result on an international level or a regional level if two opposing actors engage in violent conflict. They also ascertain the key role of allies for both entities and how certain decisions would widen the scope of the original crisis, regardless of the entities' intentions. Dismissing their own biases as Americans, students learn that in the realm of international politics, the entire world feels the consequence of interactions between two actors and one decision can make all the difference.

3.2 Zero-Sum

The second game presented to the students is referred to as a Zero-Sum Game. In this game, there is one loser and one winner. The most easily understood example is the result of a war; one side wins and the other side loses. In World War II, the Allies won and the Axis Powers lost. However, there were ramifications of this outcome of which most students are not aware, even within this game example. There is no question that the Axis Powers lost, but were the results of this positive or negative? Germany lost, was occupied, and then permanently divided. Previous German-occupied countries received their independence only to be "swallowed up" by the Soviet menace. However, West Germany, through western occupation was able to have its political culture changed from authoritarianism to democracy. So the question of one winner and one loser in this instance is relative.

Another example can be the end of the Cold War. Using an outline map of Europe, the various changes are illustrated. The United States and its allies defeated the Soviet Union and its allies. However, further ramifications occurred; the Soviet Union broke up with Russia emerging as its recognized successor; Eastern Europe was no longer under Russian control as each country became a truly independent state; Russia lost its influence over these countries and, in many cases, its economic ties with them. The loss of the Cold War not only cost the Russians politically and militarily, but also economically. It also caused a security dilemma as the Russians perceived a threat, even though there was no defined threat against them. As a result, Russia has continued to build advanced weaponry which in turn can be perceived as a threat to its neighbors. As with the previous exam, the terms winner and loser are relative.

Students are then assigned a current conflict, unresolved but in which there could be one winner and one loser. They then brainstorm and create a scenario of the ramifications of whomever wins and loses. Through use of this game, students' awareness of international issues and their ramifications are heightened. They begin to become aware that the international landscape that they take for granted has a history behind it. Winning or losing a war sets up new criteria for changing this landscape, perhaps to their detriment.

3.3 Non-Zero-Sum

The third game example is a Non-Zero-Sum game. This game does not have a winner or a loser, but it can illustrate the most dangerous of all situations on the international level. It is often equated with the well-known game of "chicken," where two cars race toward each other to see which one will veer first, thereby becoming the "chicken." The most common way to play this

game, on an international level, is through iterations with each iteration building on the previous iteration.

The students are first given an historic example. The nuclear arms race between the United States and the Soviet Union is a perfect example. Both countries are labeled as rational actors as both participated in the race out of fear for their respective security. When one country achieved one threshold in building a nuclear arm, the other matched it and raised the stakes. The race is illustrated through the dates and respective weapon explosions until the pinnacle was reached. With each side's nuclear arms becoming more and more dangerous and destructive; the pinnacle was reached with the explosion of the Soviet "Tsar Bomba" in October 1961, a 60 megaton explosion in the atmosphere that was the largest nuclear bomb ever exploded in the atmosphere. At this point, each side had to weigh the cost and benefits of continuing such testing. To the credit of the leaders involved, the race was partially stopped with the signing of the Limited Test Ban Treaty in 1963 and further harnessed with the signing of the Non-Proliferation Treaty in 1968.

With a Non-Zero-Sum game, both sides agree to stop or else they continue on until complete catastrophe prevents further continuation. This game shows students how unchecked build-ups from opposing sides can result in complete devastation or cooperation of rational minds, as happened in the nuclear arms race.

After a thorough discussion of the precariousness of build ups, attacks, or actions, students are assigned to develop their own non-zero sum game from current international issues. This provides awareness in them that if there are at least two negative actions of the same type concerning international entities at different times, then a third iteration may occur and how is the world suppose to react to it. As with the other types of games, students learn just how dangerous the world can be, heightening their perception of decisions made that might affect their own futures.

4.0 Conclusion

Students today must be made aware of what is happening in the world. The instantaneousness of news makes it vital to have the rational and analytical foundations upon which to make and understand decisions. Game theory gives students a tool with which to test their respective perceptions and further their awareness of the global world that is just at their doorstep.

References

[1] Dekmejian, R.Hrair. *Spectrum of Terror.* Washington, D.C.: CQ Press, 2007.

[2] Spruyt, Hendrik, *Global Horizons: An Introduction to International Relations.* Toronto, Canada: University of Toronto Press, 2009.