Games of Strategy

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INTRODUCTION

We think strategically whenever there are interactions between our decisions and other people's decisions. In order to decide what we should do, we must first reason through how the other individuals are going to act or react. What are their aims? What options are open to them? In the light of our answers to these questions, we can decide what is the best way for us to act.

Most business situations are interactive in the sense that the outcome of each decision emerges from the synthesis of firm owners, managers, employees, suppliers, and customers. Good decisions require that each decision-maker anticipate the decisions of the others. Game theory offers a systematic way of analysing strategic decision-making in interactive situations. It is a technique used to analyse situations where for two or more individuals the outcome of an action by one of them depends not only on their own action but also on the actions taken by the others (Binmore, 1992; Carmichael, 2005; McMillan, 1992). In these circumstances, the plans or strategies of one individual depend on their expectations about what the others are doing. Such interdependent situations can be compared to games of strategy.

Games can be classified according to a variety of categories, including the timing of the play, the common or conflicting interests of the players, the number of times an interaction occurs, the amount of information available to the players, the type of rules, and the feasibility of coordinated action. Strategic moves manipulate the rules of the game to a player's advantage. There are three types of strategic moves: commitments, threats, and promises. Only a credible strategic move will have the desired effect.

In strategic games, the actions of one individual or group impact(s) on others and, crucially, the individuals involved are aware of this. By exposing the essential features of one situation we can find a hitherto hidden common core to many apparently diverse strategic situations. The aim of this article is to examine the key lessons, which these games can teach us.

BACKGROUND

Game theory began with the publication of *The Theory of Games and Economic Behaviour* by John Von Neumann and Oskar Morgenstern (first published in 1944, second and third editions in 1947 and 1953).[1] Von Neumann and Morgenstern (1944) defined a game as any interaction between agents that is governed by a set of rules specifying the possible moves for each participant and a set of outcomes for each possible combination of moves. They drew an analogy between games like chess, poker, backgammon, and tic-tac-toe with other situations in which participants make decisions that affect each other. Their book provided much of the basic terminology that is still in use today.

The next major contributor to this field was John Nash (1951, 1953). He demonstrated that finite games always have an equilibrium point, at which all players choose actions that are best for them given their opponents' choices. Another key contributor as Thomas Schelling (1960), whose book *The Strategy of Conflict* was among the first to apply the tools of game theory.[2]

In the 1970s, game theory, as a tool for analysing strategic situations, began to be applied to areas such as business, politics, international relations, sociology, psychology, evolution, and biology. In business, for example, the decision-maker must anticipate the reactions of others. Your competitor or employee or supervisor or customer makes decisions that both respond to yours and affect you in some way. The game-theoretic analysis of such actions and reactions is now at the centre of economic research.

Nobel prizes were awarded to John Nash, John Harsanyi, and Reinhard Selton in 1994 for their contributions to game theory and to Thomas Schelling and Robert Aumann in 2005 for their contributions to strategy. Now we are at a point where terms from game theory have become part of the language. As Paul Samuelson says, “to be literate in the modern age, you need to have a general understanding of game theory” (Dixit & Skeath, 1999).

WHAT IS GAME THEORY?

Game theory is not about “playing” as usually understood. It is about conflict among rational but distrusting beings. The nominal inspiration for game theory was poker, a game John von Neumann played occasionally and not especially well. In poker you have to consider what the other players are thinking. This distinguishes game theory from the theory of probability, which also applies to many games. Consider a poker player who naively tries to use probability theory alone to guide his play. The player computes the probability that his hand is better that the other players’ hands, and wagers in direct proportion to the strength of the hand. After a number of hands, the other players will know that (say) his willingness to sink 12 chips in the pot means he has at least a three of a kind and will react accordingly. As poker players know, that kind of predictability is bad (a good “poker face” betrays nothing).

Good poker players do not simply play the odds. They take into account the conclusions other players will draw from their actions, and sometimes try to deceive other players. Von Neumann realised that this devious way of playing was both rational and amenable to rigorous analysis. Game theory is based on simple concepts and these are introduced and illustrated with the following example.

CAKE DIVISION

How can a parent divide a cake between two bold children? No matter how carefully a parent divides it, one child (or both!) feels he has been slighted with the smaller piece. The solution is to let one child divide the cake and let the other choose which piece she wants. Rationality and self interest ensures fair division. The first child cannot object that the cake was divided unevenly because he did it himself. The second child cannot complain since she has her choice of pieces.

This homely example is not only a game in von Neumann’s sense, but it is also about the simplest illustration of the “minimax” principle upon which game theory is based. The cake problem is a conflict of interest. Both children want the same thing—as much of the cake as possible. The ultimate division of the cake depends both on how one child cuts the cake and which piece the other child chooses. It is important that each child anticipates what the other will do. This is what makes the situation a game.

Game theory searches for solutions—rational outcomes—of games. Dividing the cake evenly is the best strategy for the first child, since he anticipates that the other child’s strategy will be to take the biggest piece. Equal division of the cake is therefore the solution to this game. This solution does not depend on a child’s generosity or sense of fair play. It is enforced by both children’s self interest. Game theory seeks solutions of precisely this sort.

GAMES AS TREES

Many games take place as a sequence of moves by the players. The point of decision can be represented diagrammatically as a square or node with each possible choice represented by a line emanating from that node. In the cake division game, the child cutting the cake faces two options: cut the cake as evenly as possible or make a non-even split. The second child face the options: take the larger piece or take the smaller piece. These give four possible outcomes. As the number of possible moves increases, the diagram branches out like a tree (see Figure 1).

Now that we have a complete picture of our simple game, we can determine the solution by looking for the “rational” choices by working backwards from the final outcomes. We know that the second child will always choose the larger piece so that eliminates outcomes 2 and 4. The first child then starts with a choice between outcome 1 and outcome 3. Clearly one is the preferred choice and the non-even split is eliminated. This process shows what the solution to this game will be for any pair of rational self interested players.

This can be done for almost any two-person game with no hidden information. The main restriction is that the game must be finite. It cannot go on forever,

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