

Game Theory in Negotiations

Introduction to Game Theory and Negotiation

1. <http://en.wikipedia.org>
2. In game theory, the Nash equilibrium (named after John Nash, who proposed it) is a kind of optimal collective strategy in a game involving two or more players, where no player has anything to gain by changing only his or her own strategy. If each player has chosen a strategy and no player can benefit by changing his or her strategy while the other players keep theirs unchanged, then the current set of strategy choices and the corresponding payoffs constitute a Nash equilibrium
3. <http://encyclozone.com>

Game theory is a branch of applied mathematics that studies strategic situations where participants choose different actions in an attempt to maximize their returns. It may be used to explain, to predict, and to evaluate human behaviour in contexts where the outcome of action depends on what other parties choose to do and where their choices depend on what others choose to do.

Game theory consequently is relevant and can be applied to negotiations.

Negotiation is concerned with bringing about co-operation and co-ordination, however game theory assumes a win/lose scenario.

P&SM professionals who adopt the game theory approach to their negotiations do not act carelessly, quite the contrary: they are supposed to carefully think about their choices and the possible choices of the other negotiating party.

In the context of this paper, negotiations will be referred to as 'games'.

Types of games and examples

Game theory categorizes approaches into many classifications that will determine which specific methods that can be applied.

Zero-sum and non-zero sum

In zero-sum games the total benefit to all participants in the game, for whatever combinations of strategies are applied, always adds to zero. (or put more informally, a participant benefits only at the expense of others) a distributive one issue approach to negotiations exemplifies a zero-sum game, most real life examples of the zero-sum, non zero-sum approach can be found in business.

Co-operative games

A co-operative game is characterised by an enforceable contract. Both participants reach a mutually convenient agreement. The theory behind co-operative games gives justifications of credible contracts. The probability of a contract is closely related with stability.

Axiomatic bargaining

Negotiating participants may bargain how much share they want in a contract. The theory of axiomatic bargaining tells you how much share is reasonable for you. For example **Nash Bargaining**² demands that share is fair and efficient. However, some P&SM professionals may not be overly concerned with fairness and may be quite demanding.

Games of complete information

In these types of games each participant has the same relevant information pertinent to the game they are involved in. 'The Prisoner's dilemma which will be shown later exemplifies this. However these types of games occur rarely in the business world and can realistically only be used as a simulation exercise to help determine approximations of the actual game played.

The classical prisoner's dilemma

Earlier we touched upon non zero-sum games; the prisoner's dilemma is one such game. In this game theory problem, it is assumed that each participant is trying to maximize their own advantage without the concern of the well-being of the other.

Will the two prisoners cooperate to minimise total loss of liberty or will one of them, trusting the other to cooperate, betray him so as to go free? Let's see....

The dilemma is as follows:

Two suspects, you and another person, are arrested by the police. The police have insufficient evidence for a conviction, and having separated the both of you, visit each of you and offer the same deal: if you confess and your accomplice remains silent, he gets the full 10-year sentence and you go free. If he confesses and you remain silent, you get the full 10-year sentence and he goes free. If you both stay silent, all they can do is give you both 6 months for a minor charge. If you both confess, you each get 6 years.

This can be summarised as:

| | You Deny | You Confess |
|--------------|----------------------------------|---------------------------------|
| He Denies | Both serve 6 months | He serves 10 years, you go free |
| He Confesses | He goes free, you serve 10 years | Both serve 6 years |

Let's assume both prisoners are completely selfish and their only goal is to minimize their own jail terms. As a prisoner you have two options: to cooperate with your accomplice and stay quiet, or to betray your accomplice and confess. The outcome of each choice depends on the choice of your accomplice; unfortunately, however, you don't know the choice of your accomplice. Even if you were able to talk to him, you couldn't be sure whether to trust him.

If you expect your accomplice will choose to cooperate and stay quiet, the optimal choice for you would be to confess, as this means you get to go free immediately, while your

accomplice lingers in jail for 10 years. If you expect your accomplice will choose to confess, your best choice is to confess as well, since then at least you can be spared the full 10 years serving time and have to sit out 6 years, while your accomplice does the same. If however you both decide to cooperate and stay quiet, you would both be able to get out in 6 months.

Confessing is a dominant strategy for both players. No matter what the other player's choice is, you can always reduce your sentence by confessing. Unfortunately for the prisoners, this leads to a poor outcome where both confess and both get heavy jail sentences. This is the core of the dilemma.

If reasoned from the perspective of the optimal interest of the group (of two prisoners), the correct outcome would be for both prisoners to cooperate with each other, as this would reduce the total jail time served by the group to one year total. Any other decision would be worse for the two prisoners considered together. However by each following their selfish interests, the two prisoners each receive a lengthy sentence.

If you had an opportunity to punish the other player for confessing, then a cooperative outcome could be sustained. The iterated form of this game (discussed below) presents an opportunity for such punishment. In that game, if your accomplice cheats by confessing this time, you can punish him by cheating next time yourself. Thus, the iterated game builds in an opportunity for punishment absent in the classic one-period game.

In the iterated prisoner's dilemma cooperation may arise as an equilibrium outcome. Here the game is played repeatedly. Since the game is repeated, each player is afforded an opportunity to punish the other player for previous non-cooperative play. Thus, the incentive to cheat may be overcome by the threat of punishment, leading to a superior, cooperative outcome.³

In summary

This paper has lightly touched upon varying aspects of game theory; the paper has attempted to show the many approaches that can be adopted within any negotiation depending upon your objective and the circumstances surrounding the negotiations. There is one conclusion that this paper does draw upon, game theory is relevant and can be applied to negotiation.