CHAPTER 8

Homo Ludens

"We can better satisfy our appetites in an oblique manner, than by their headlong and impetuous motion."
David Hume

The central contribution of game theory to the economics of strategic management is a new language for the under standing of how to formulate and study strategic or inter-company optimisation involving two or more players. There is a wealth of applications in the literature, but we suggest that there are two fundamentally different classes of application of game theory to economic problems in business. The first is the application of two-person zero-sum games to primarily tactical business problems. The second is the application of n-person non-constant-sum-games to strategic issues involving threat analysis and price wars. It is this combined application of games that provides the genesis of the economics of strategy.

When our interests are confined to applications of the two-person zero-sum game, a reasonably strong case can be made for management as **Homo ludens** (game-playing man), as an intelligent, calculating entity with no personality or psychological foibles playing against an equally bloodless opponent. We can extend the concept of individual rational behaviour to the two-person zero-sum game. When our concerns are strategic and the game is naturally a non-zero mixed-motives optimisation, that is, where there is neither total coincidence nor total opposition of interests, the model of an individual actor may not suffice to capture the behaviour of the players. It is in this context that we have introduced the idea of a decision quantum in order to help differentiate between management as an individual and the management team working as a group and the different groups functioning as a product market. A host of assumptions concerning the players and their game environment may have to be introduced later in Chapter 9 in order to facilitate a model of some aspect of business reality for analysis.

Game-playing Man

It has been 50 years since the publication of the seminal work on the theory of games with the interesting essays and approach of both Schelling (1960) and Shubik (1960), who raised a series of questions concerning the application of an intermix of game theory and gamesmanship to strategic analysis. Further, the recognition of the need to study and formulate the principles of war dates back to the writings of Sun Tzu circa 500 BC. Although the seeds were sown many thousands of years ago, the specific development of a mathematical language for the study of conflict, cooperation and negotiation did not occur until the advent of the theory of games.

Notwithstanding the market structure, what is important for management is the degree of entry and their belief system on entrant types. Efficient entry is also best understood within the parameters of the type of competition that prevails in a market, including combat competition, scramble competition and contest competition (McNutt, 2005). It is best characterised by an efficient entry price. The efficient entry price is a long-run equilibrium price of entry.

Market Systems

Whether or not players in a market system cooperate and lock themselves into binding commitments, which may be caught by antitrust legislation, depends on the rules of conduct for player behaviour in a market system. McNutt argued that there is a Boolean network of player behaviour — at its simplest, it is a rule stipulating that each player acts on price if, and only if, two other players act. Player A makes a decision if two other players make a decision, but each player can decide to act or not at each decision point. In many respects it is about aggressive competition. Under scramble competition, for example, there is an exactly equal partitioning of the market and hence an equal division of the effects of competition between the competitors. Scramble may be manifested by changes in the size of players or in the number of players. Combat competition tends to be characteristic of more stable market systems where the acquisition of market share requires constant defence by the incumbent types.

If the market-as-a-game is played just once, allow for a unique payoff of (2,2). It can be any number, but both players receive exactly the same amount. Each player knows exactly what they want to do (they have a dominant strategy), and each player has the easiest of decisions to face — keep prices high and receive 2. Both players would prefer to be in the top left cell of the matrix in Table 8.1, because in four cycles of this game a player could receive a pay-off of 8 = 2+2+2+2. However, player A has a dominant strategy of competing to a low price, trying to do better by obtaining a pay-off of 3. But the 3 is obtainable only if player B continues to keep its prices high.

Table 8.1
Prisoners' Dilemma

	Player A	
	High p	**Low p**
High p	2,**2**	0,**3**
Player B		
Low p	3,**0**	1,**1**

In other words, if B keeps prices high, it is because he trusts A to do likewise and vice versa. So, B trusts A; but A, knowing that, betrays B. Once player B realises that player A has lowered its price, player B follows and they both find themselves in the lower right cell of the matrix with a pay-off of (1,1). A cartel between A and B might seem a solution, but with an inherent incentive to cheat or betray, enforcement of the cooperative solution might prove to be difficult, *vide* the arguments in McNutt, *Law, Economics and Antitrust*. Cartels may not last very long. If one player believes that the other player will always cooperate and keep prices high, then there is an incentive to betray or cheat. The issue is trust: If B keeps its prices high, can B really trust A to do the same? It is collectively that they both as players face a dilemma: How to obtain the cooperative outcome of 8 rather than the non-cooperative outcome of 6 or 4? Player A now ends up with 6 = 2+3+1+0 or with 4 = 1+1+1+1 if B punishes A for the betrayal by always keeping prices low. This is a recognised **punishment strategy**, signalling to A the pay-off 4 in time period t+1 instead of 8. In trying to do better, one can end up worse off! David Hume, philosopher writing in the 18th century, captured the idea: "We can better satisfy our appetites in an oblique manner, than by their headlong and impetuous motion." Remember that the future is not what it used to be a scotish!

Nash Equilibrium

In the exchange of prices, players interact with each other by using prices as signals. An incumbent and an entrant, or two incumbents, can face classic coordination problems. Conflicts can arise. In a two-person game, a pair of strategies will form a Nash equilibrium when each player cannot do better given the strategy the other player has adopted. A **Nash equilibrium** is a pair of strategies such that each is a best response to the other. The pay-off (1,1) in Table 8.1 is an example of a Nash equilibrium. To test whether a strategy combination forms a Nash equilibrium, just consider the following: let us call the strategy for the first player x* and the strategy for the second player y*. A pure strategy equilibrium is a Nash equilibrium in which the equilibrium strategies are played with certainty or with probability equal to 1. When the Nash equilibrium involves only strategies that are played with certainty, we have a pure strategy equilibrium. The alternative to a pure strategy equilibrium is a mixed strategy equilibrium in which, in equilibrium, each player adopts a strategy that selects at random from a number of pure strategies. For additional reading, refer to Dixit and Nalebuff, 2008: *The Art of Strategy*.

We need to ask whether, given that the second player will play y*, the first player can do better by switching to some strategy other than x*. Similarly, we need to ask whether, given that the first player will play x*, the second player can do better by switching to some strategy other than y*. If there is no better strategy for the first player than x* in response to the second player's y*, and if there is no better strategy for the second player than y* in response to x*, then this pair (x*, y*) is a Nash equilibrium for the game. McNutt, in *Law, Economics and Antitrust* looks at this scenario in terms of a semi-ordering of prices, where x* corresponds to a 'reduced' price by a defendant-firm and y* corresponds to a 'lower' price for an entrant-plaintiff. The pair (x*, y*) is aggressive pricing.

First Hurdle Initiative

When we raise the question of solution to a game, interesting issues arise between two-player games and n-person games. Dynamic games with few players, for example, have a leading contender in the perfect equilibrium, but it is not unique. For tactical problems involving two players, the saddle point or maximin-minimax solution provides a reasonable solution to a two-person game of opposition. Strategic problems have been considered primarily as games in extensive, strategic or coalitional form. Taking the first step in a game is crucial for management: if they take a first step and rivals follow, then management assume the mantle of leader. A volunteer is needed, but both players realise that if both of them volunteer, the worst possible outcome will obtain.

Both players have an incentive to volunteer given that the other player does not, and it is because of this incentive it can be argued that the precondition that the other player does not volunteer may not hold and hence to volunteer becomes the optimal strategy. The dilemma here is that it cannot be optimal for both players simultaneously, that is, the players do not have dominant strategies.

Table 8.2
Volunteer's Dilemma

	S3	S4
S1	(2,2)	(2,3)
S2	(3,2)	(1,1)

Unlike in the PD game, where there is a unique Nash equilibrium, in the Volunteer's Dilemma the solution can be characterised by either one of the Nash equilibria (2,3) or (3,2). In the Volunteer's Dilemma, there is no strategy available by which one player can punish the other player for its deviation from a quasi-cooperative path.

Classic Prisoners' Dilemma

Earlier in this chapter, we represented the possible outcomes to demonstrate the maxim of one player seeking to do better than (2,2) by obtaining a 3 but ending up at (1,1). The player can obtain 3 only if the other player receives 0. In other words, one player opts for a low price but only if a second player keeps its price high — that is the only way to secure a 3. But the second player soon realises that 0 is an outcome, so that player also reduces its price to low and both players end up at (1,1).

The only solution is communication, and this is illegal in the real world due to the antitrust legislation on cartels and price fixing. In other words, one player, a price leader, initiates an agreement to remain at the (2,2) outcome. In many markets, a fact finder would observe constant or fixed prices. However, the mere adherence to a fixed price is not sufficient evidence of belonging to a cartel, as there must be some evidence of a rule or mechanism to ensure that the (2,2) outcome obtains across all periods and there is no incentive to cheat because of, say, a punishment strategy.

If both players communicate over a four-period game, then the total pay-offs amount to 2+2+2+2 = 8. If one player deviates from the agreement and cheats by charging a low price in the second period, that player obtains 2+3 = 5. However, the other player observes the cheating behaviour and reduces its price to low and does not move

Table 8.3
Classic Prisoners' Dilemma

	High p	**Low p**
High p	[***2***,***2***] We can both have a 2 pay-off	[***0***,***3***] You want this 3 pay-off instead
Low p	[**3**,**0**]	[**1**,**1**] We both end up with a 1 pay-off

in order to punish the first player who now obtains $2+3+1+1 = 7$ with a realisation of $1+1+1+1 = 4$ for all periods unless there is an agreement not to cheat. But this is difficult to maintain in the real world unless a credible punishment mechanism can be put in place by one of the players. Competition enforcement agencies now rely on whistle-blower legislation to entice a cartel member to come forward and reveal the cartel mechanism. Alternatively, with an incentive for a player to do better, any cartel is inherently unstable.

The Folk Theorem in game theory spells out the means by which firms can attain outcomes that appear collusive without necessarily engaging in overt collusion — or, indeed, even discussing together what to do. It shows how collusive outcomes can be attained 'as (sub-game perfect) non-cooperative equilibria' (Friedman, 2000). However, in producing cooperative behaviour from a conventional non-cooperative equilibrium, the Folk Theorem, it has been argued, blurs the distinction between explicit collusion and tacit collusion. From the standpoint of intent, this makes antitrust investigation rather delicate. In addition, it opens up consideration of partial collusion, wherein players collude on certain choices (prices) and not on others (location or markets) as argued by Friedman, Jehiel and Thisse (1995). It also leads to unintentional cooperation or the asymmetric sameness in price standard discussed in McNutt (2005) and later in this book.

Mixed Strategy

An example of a mixed strategy would arise if one player in an exchange of prices randomly decided to change or not change price with equal probability. This particular mixed strategy in a predatory pricing game may not be part of a Nash equilibrium. A national competition agency or court, for example, would need to discover the other firm's response to this strategy. The other firm would compute the expected pay-offs from each of the pure strategies of changing and not changing price. A national competition agency or court must try to comprehend whether management are acting rationally if they choose a strategy that does not maximise the firms' pay-off. Alternatively, a national competition agency or court must balance this with whether or not the management of an incumbent firm are willing to predate in order to convince entrants that they are aggressive rather than rational.

In the application to strategic business decisions, what is equally important for management is to understand the game, and the strategy may well depend on management's interpretation of the context in which they obtained the move or took the action. This is a classic dilemma in cartel pricing: if player 1 keeps prices high, both players get (10, 10) and the game is over. But it is player 1's move to keep prices high or not. If player 2 ever gets the move, then player 1 is either irrational or has made a blunder of some sort. If player 2 gets the move, he can end the game at a new pay-off or give the move back to player 1. Player 2's strategy will depend on the context in which the move was obtained.

Making decisions and taking actions can be understood only with reference to the subjective behaviour of management, so we find it useful to interpret decision making by differentiating between knowing that (making a decision) and knowing how and when to act (taking an action). The iconic Prisoners' Dilemma in games arises precisely because one player takes an action to break away from the agreed decision on the presumption at this point in time that the other player will not react. Paradoxically, while management may prefer to avoid conflict, individually they may prefer an outcome that can be obtained only by conflict. This is the conundrum embedded in the PD expressed as follows: in trying to do better than the status quo by taking an action, the individual ends up worse off. But someone has to take the first step, otherwise there is no game; there will be no market interaction.

Morphing into a Decision Quantum

Understanding type allows management as a player in a game to minimise a trial-and-error learning process in which they gradually discover that only some strategies work. Management at time period t do not have complete knowledge of details of the game. The market in which they are competing evolves into either a combat system, a contest system or a scramble system (McNutt, 2005). Consequently, management as an individual evolves in the market-as-a-game.

As they recognise the degree of interdependence, management type morphs into a decision quantum (DQ), a player, and the rules of the game, the type of players and the pay-offs become common knowledge. Nokia's completion of the purchase of Symbian in 2008 is an interesting example of management type morphing into a DQ. A signal to Apple, Google and Microsoft was sent in the summer of 2008 when Nokia completed the deal to buy out Symbian, the leading maker of operating system software for advanced mobile phones. The software is used in at least 50 per cent of mobile phones and is an integral part of delivering the functionalities of mobile music and photo sharing. The mobile market is evolving into services, and players have to ask: Will one operating system dominate in the handset market much like Microsoft Windows in the PC market? Much will depend on the game dimension: on other rival players such as Google's Android, BlackBerry, iPhone and Linux but also on the need for handset manufacturers to sign up for one software.

SMIN©

An engineering solution would change the rules of the game. Let us coin a new word and call a new 'want-to-have' product the 'small and thin (SMIN)'. This can combine the functionalities of a smart-phone with the functionalities of a netbook and it could offer a first-mover advantage to any player who first launches it to the market. However, if the new product is more like a netbook, then it may not fit neatly into the jacket pocket or purse; if the new product is more like a smart-phone, it may have limited processing power or the screen may be too small to facilitate word processing. Whatever the dislike, consumers will not buy the product if it does not match their specific set of functionalities, so many players are prepared to wait and secure a second-mover advantage. In the interim, there is a risk that an unknown or smaller player might just get it right and capture that elusive first-mover advantage. But that is a judgement call for management as DQ to make and Framework Tn=3 complements the existing strategic toolbox deployed by management in making that call.

In 2009, Dell launched the Adamo (initially in China); Celio's Redfly C8N received mixed reviews on the launch; Acer displayed the M900 smartphone; and Nokia signalled entry into the laptop market. For small and thin devices like SMIN, the market-as-a-game represents an interesting example of an evolving market system in mobile devices. PC players and mobile phone players do see an opportunity but are cautious. There is history in the market-as-a-game from the 1990s *viz* Apple's Newton PDA failed, Dell's MP3 player and HP's line of televisions failed as products. Consumers with time-dependent preferences and changing demand for mobile devices are creating a challenge for the players in this market-as-a-game. An engineering solution may exist and potentially offer a DQ player a first-mover advantage. Mistakes can be costly. However, with changing demand and ever-changing new technology, mistake proofing is mandatory in order to at least predict the reaction of competitors and to prepare to react to the uncertainty created by type, technology and time.

The 'Nash Trap': Always Best to Confess

To understand game theory is to understand the delicate balance of the Nash trap: My friend and I are thieves and we have just been caught by the police, but the prosecutor has enough evidence to put us away for five years for carrying a concealed weapon rather than a maximum of 10 years for the robberies.

As long as we cooperate and do not confess, we will get a year in prison. The prosecutor comes to my cell and points out that if my friend pleads guilty and I do not, he will receive a reduced sentence for pleading guilty but I will get a maximum of 10 years. I know that I can do better than a year in prison by doing a deal with the prosecutor, but actually do worse as we both end up with a (–5) if we plead guilty at the same time (see Table 8.4 on the following page). Hence, both will be worse off. I am better off confessing; we are both better off by not confessing. One way to escape the Nash trap is to signal your intent to cooperate or engage in bargaining.

Table 8.4
Nash trap

	Do not confess Plead not guilty	Confess Plead guilty
Do not confess Plead not guilty	–1,–1	–10,0 (go free)
Confess Plead guilty	0 (go free),–10	–5,–5

Hypothesis: 'I think you think I think'

The true state in a game occurs when you can think like your opponent; if you do not think like your opponent, you would put too much emphasis on the pay-off corresponding to the true state instead of treating all states equally. This is called the curse of knowledge. In decoding strategy, it is of interest to management to know not only about behaviour but to know about other minds. A theory of other minds would come in handy for any business person.

Dennett (1996) points out that an animal does not necessarily need to consult any internal model of the mind in order to anticipate behaviour. The animal could just be equipped with a large list of **if-then** contingencies. He advocates that all individuals (in all species) learn through evolution; a surprising number of species find themselves compelled to learn in a second way — what he referred to as conditioned learning — and some select species are then pressured to learn in a third way, by using information of the mind. Here, we have consciousness and as the philosopher Karl Popper puts it, as quoted by Dennett, consciousness 'permits our hypotheses to die in our stead'.

In *The Singing Gorilla* (1999, p. 189), Page observes a hungry lioness — hunkered behind a mound — considering a grazing buffalo 30 meters away. A buffalo is no wildebeest. It is a different matter altogether, being one of the most aggressive and dangerous animals in Africa. The lioness understands this. Yes, she is hungry, and so are her cubs; but no, she is not that hungry and not that good a mother. She will let her hypothesis dies in its stead. She strolls away.

Sub-game: g ⊂ G

A player will have incomplete information on type — it is not always possible to know the opponent type. Type is based on the actions observed as signals in the game, such as reducing price, entering a market or launching a new product or service after an initial move by an opponent. The action leads to an observed reaction in a game in the time continuum, that is, Player A moves first in a sequence of moves and Player B reacts in time. However, if Player A reacts in time to a move by Player B, a sub-game has been observed.

A game, G, and sub-game, g ⊂ G, can occur in parallel; in this scenario, the players have imperfect information on how the game is played. In both cases, players are bounded rationally, the Penrose effect is triggered and more intelligence gathering on type — coupled with more actions filtered into information cones — will support a degree of probability on likely reaction.

Prisoners' Dilemma

The classic representation of the prisoners' dilemma (PD) with a dominant strategy (2,2) is that strategy 'confess' is a dominant strategy for both players — no matter what any one player does (regardless of another player's move), a better choice for the other player is to confess. Taylor and Pacelli (2009, p. 118) identify an intuitive response: 'I wish I knew what my partner is doing', and argue that this is wrong because what your partner is doing is irrelevant: you should confess.

Case 1

Player A chooses Silent: In this case, Player B's choice of Confess yields an outcome for B of 4 from (4,1) as opposed to 3 from outcome (3,3) that would have resulted from B's choice of the strategy Silent (see Table 8.5).

Case 2

Player A chooses Confess: In this case, Player B's choice of Confess yields an outcome for B of 2 from (2,2) as opposed to 1 from outcome (1,4) that would have resulted from B's choice of the strategy Silent (see Table 8.5).

Table 8.5
Silence *vs* Confession

	A: Silent	A: Confess
B: Silent	3,3	1,4
B: Confess	4,1	2,2

Grim Strategy

We have shown that regardless of what Player A does, Case 1 or Case 2, the strategy Confess yields a better outcome for Player B than the strategy Silent. Cooperation arises if players can infer from past behaviour that their opponent is likely to be trustworthy. In the **folk theorem**, players must be forward-looking. In each time period, there is a short-term benefit from cheating. Players refrain from cheating in order to gain future benefits. If an opponent has a reputation as a trustworthy type, a player will use the experience to determine whether they believe this reputation. Otherwise, there will be punishment in the form of **grim strategy**.

Type is important in a game, and 'keeping to type' is the cradle that rocks strategic play in a game. Players forego short-term gains for long-term benefits. It is a form of altruism or the non-selfish behaviour present in the animal kingdom (Page, 1999). A **Griselda type** of player withdraws from a preferred selfish move and remains silent, observes cooperation and cooperates with the other players.