

THINKING STRATEGICALLY

What is Strategic Behaviour?

The following few pages provide an overview of the course, Strategic Game Theory for Managers.

How should people behave in society? Our answer does not deal with ethics or etiquette. Nor do we aim to compete with philosophers, preachers, or even Emily Post. Our theme, although less lofty, affects the lives of all of us just as much as do morality and manners. This course is about strategic behavior. All of us are strategists, whether we like it or not. It is better to be a good strategist than a bad one, and this course aims to help you improve your skills at discovering and using effective strategies.

Work, even social life, is a constant stream of decisions. What career to follow, how to manage a business, whom to marry, how to bring up children, whether to stand for election, are just some examples of such fateful choices. The common element in these situations is that you do not act in a vacuum. Instead, you are surrounded by active decision-makers whose choices interact with yours. This interaction has an important effect on your thinking and actions.

To illustrate the point, think of the difference between the decisions of a logger and those of a general. When the logger decides how to chop wood, he does not expect the wood to fight back; his environment is neutral. But when the general tries to cut down the enemy's army, he must anticipate and overcome resistance to his plans. Like the general, you must recognize that your business rivals, prospective spouse, and even your child are intelligent and purposive people. Their aims often conflict with yours, but they include some potential allies. Your own choice must allow for the conflict, and utilize the coöperation. Such interactive decisions are called strategic and the plan of action appropriate to them is called a strategy.

This course aims to help you think strategically, and then translate these thoughts into action. The branch of social science that studies strategic decision-making is called game theory. The games in this theory range from chess to child-rearing, from tennis to takeovers, and from advertising to arms control. As the Hungarian humorist George Mikes expressed it, "Many continentals think life is a game; the English think cricket is a game." We think both are right.

Playing these games requires many different kinds of skills. Basic skills, such as shooting ability in basketball, knowledge of precedents in law, or a blank face in poker, are one kind; strategic thinking is another. Strategic thinking starts with your basic skills, and considers how best to use them. Knowing the law, you must decide the strategy for defending your client. Knowing how well your team can pass or run, and how well the other team can defend against each choice, your decision as the coach is whether to pass or to run. Sometimes, as in the case of superpowers contemplating an adventure that risks nuclear war, strategic thinking also means knowing when not to play.

Our aim is to improve your strategy I.Q. But we have not tried to provide a course

of recipes for strategies. We develop the ideas and principles of strategic thinking; to apply them to a specific situation you face and to find the right choice there, you will have to do some more work. This is because the specifics of each situation are likely to differ in some significant aspects, and any general prescriptions for action we might give could be misleading. In each situation, you will have to pull together principles of good strategy we discuss, and also other principles from other considerations. You must combine them and, where they conflict with each other, evaluate the relative strengths of the different arguments. We cannot solve every question you might have. The science of game theory is far from being complete, and in some ways strategic thinking remains an art.

We do provide guidance for translating the ideas into action. We begin by offering several examples showing how strategic issues arise in a variety of decisions. We point out some effective strategies, some less effective ones, and even some downright bad ones. Then we proceed to build these examples into a system or a framework of thought. Later, we take up several broad classes of strategic situations — such as bargaining and tendering — where you can see the principles in action. The examples may range from the familiar, trivial, or amusing — usually drawn from literature, sport, or movies — to the frightening — nuclear confrontation. The former are merely a nice and palatable vehicle for the game-theoretic ideas. As to the latter, at one point many readers would have thought the subject of nuclear war too horrible to permit rational analysis. But with the cold war gone, we hope that the game-theoretic aspects of the arms race can be examined for their strategic logic in some detachment from their emotional content.

By the end of the course we hope that you will emerge a more effective manager.

As preparation, we present ten tales of strategy from different aspects of life and offer preliminary thoughts on how best to play. Many of you will have faced similar problems in everyday life, and will have reached the correct solution after some thought or trial and error. For others, some of the answers may be surprising. But surprise is not the primary purpose of the examples. Our aim is to show that such situations are pervasive, that they amount to a coherent set of questions, and that methodical thinking about them is likely to be fruitful. In the course we develop these systems of thought into prescriptions for effective strategy. Think of these tales as a taste of dessert before the main course. They are designed to whet your appetite, not fill you up.

1. To lead or not to lead

After the first four races in the 1983 American's Cup final, Dennis Conner's *Liberty* led 3-1 in a best-of-seven series. On the morning of the fifth race, "cases of champagne have been delivered to *Liberty*'s dock. And on their spectator yacht, the wives of the crew were wearing red-white-and-blue tops and shorts, in anticipation of having their picture taken after their husbands had prolonged the United States' winning streak to 132 years." It was not to be.

At the start, *Liberty* got off to a 37-second lead when *Australia II* jumped the gun and had to recross the starting line. The Australian skipper, John Bertrand, tried to catch up by sailing way over to the left of the course in the hopes of catching a wind shift. Dennis Conner chose to keep *Liberty* on the right-hand side of the course. Bertrand's

gamble paid off. The wind shifted five degrees in *Australia II*'s favor and she won the race by one minute and forty-seven seconds. Conner was criticized for his strategic failure to follow *Australia II*'s path. Two races later, *Australia II* won the series.

Yacht racing offers the chance to observe an interesting reversal of a "follow the leader" strategy. The leading yacht usually copies the strategy of the trailing boat. When the follower tacks, so does the leader. The leader imitates the follower even when the follower is clearly pursuing a poor strategy. Why? Because in yacht racing (unlike ballroom dancing) close doesn't count: only winning matters. If you have the lead, the surest way to stay ahead is to play monkey see, monkey do.*

Stock-market analysts and economic forecasters are not immune to this copycat strategy. The leading forecasters have an incentive to follow the pack and produce predictions similar to everyone else's. This way people are unlikely to change their perception of these forecasters' abilities. On the other hand, newcomers take the risky strategies: they tend to predict boom or doom. Usually, they are wrong and are never heard of again, but now and again they are proven correct and move to the ranks of the (rich and) famous.

Industrial and technological competitions offer further evidence. In the personal-computer market, IBM is less known for its innovation than for its ability to bring standardized technology to the mass market. More new ideas have come from Apple, Sun, and other start-up companies. Risky innovations have been their best and perhaps only chance of gaining market share. This is true not just of high-technology goods. Proctor and Gamble, the IBM of nappies, followed Kimberly Clark's innovation of resealable nappy tape, and recaptured its commanding market position.

There are two ways to move second. You can imitate as soon as the other has revealed his approach (as in yacht racing) or wait longer until the success or failure of the approach is known (as in computers). The longer wait is more advantageous in business because, unlike sport, the competition is usually not winner-take-all. As a result, market leaders will not follow the upstarts unless they also believe in the merits of their course.

2. The Hot Hand

Do athletes ever have a "hot hand"? Sometimes it seemed that the Boston Celtics' Larry Bird could never miss a basket, or the New York Rangers' Wayne Gretzky or Argentina's Diego Maradona a shot on goal. Sporting commentators see these long streaks of consecutive successes and proclaim that the athlete has a "hot hand." Yet according to psychology professors Thomas Gilovich, Robert Vallone, and the late Amos Tversky, this is a misperception of reality. They point out that if you flip a coin long enough, you will find some very long series of consecutive heads. The psychologists suspect that sporting commentators, short on insightful things to say, are just finding patterns in what amounts to a long series of coin tosses over a long playing season. They propose a more rigorous test. In basketball, they look at all the instances of a player's baskets, and observe the percentage of times that player's next shot is also a basket. A similar calculation is made for the shots immediately following misses. If a basket is more likely to follow a basket

* This strategy no longer applies once there are more than two competitors. Even with three boats, if one boat tacks right and the other tacks left, the leader has to choose which (if either) to follow.

than to follow a miss, then there really is something to the theory of the hot hand.

They conducted this test on the Philadelphia 76ers basketball team. The results contradicted the “hot hand” view. When a player made his last shot, he was less likely to make his next; when he missed his previous attempt, he was more likely to make his next. This was true even for Andrew Toney, a player with the reputation for being a streak shooter. Does this mean we should be talking of the “strobe hand,” like the strobe light that alternates between on and off?

Game theory suggests a different interpretation. While the statistical evidence denies the presence of streak shooting, it does not refute the possibility that a “hot” player might warm up the game in some other way. The difference between streak shooting and a hot hand arises because of the interaction between the offensive and the defensive strategies. Suppose Andrew Toney does have a truly hot hand. Surely, the other side would start to crowd him. This could easily lower his shooting percentage.

That is not all. When the defence focuses on Toney, one of his teammates is left unguarded and is more likely to shoot successfully. In other words, Toney’s hot hand leads to an improvement in the 76ers’ team performance, although there may be a deterioration in Toney’s individual performance. Thus, we might test for hot hands by looking for streaks in team success.

Similar phenomena are observed in many other team sports. A brilliant running-back on a gridiron team improves its passing game and a great pass-receiver helps the running game, as the opposition is forced to allocate more of its defensive resources to guard the stars. In the 1986 soccer World Cup final, the Argentine star Diego Maradona did not score a goal, but his passes through a ring of West German defenders led to two Argentine goals. The value of a star cannot be assessed by looking only at his scoring performance; his contribution to his teammates’ performance is crucial, and assist statistics help measure this contribution. In ice hockey, assists and goals are given equal weight for ranking individual performance.

A player may even assist himself when one hot hand warms up the other. The Boston Celtics’ star, Larry Bird, preferred shooting with his right hand (though his left hand was still better than most). The defence knew that Bird was right-handed, so they concentrated on defending against right-handed shots. But they did not do so exclusively, since Bird’s left-handed shots were too effective to be left unguarded.

What happens when Bird spends his off season working to improve his left-handed shooting? The defence responds by spending more time covering his left-handed shots. The result is that this frees his right hand more often. A better left-handed shot results in a more effective right-handed shot. In this case not only does the left hand know what the right hand is doing, it’s helping it out.

It is also true that when the left hand is stronger it may even be used less often. Many of you will have experienced this seemingly strange phenomenon when playing tennis. If your backhand is much weaker than your forehand, your opponents will learn to play to your backhand. Eventually, as a result of all this backhand practice, your backhand will improve. As your two strokes become more equal, opponents can no longer exploit your weak backhand. You will play more evenly between forehands and backhands. You get to use your better forehand more often; this could be the real advantage of improving your backhand.

3. Go directly to gaol

The conductor of an orchestra in the Soviet Union (during the Stalin era) was travelling by train to his next engagement and was looking over the score of the music he was to conduct that night. Two KGB officers saw what he was reading and, thinking that the musical notation was some secret code, arrested him as a spy. He protested that it was only Tchaikovsky's Violin Concerto, but to no avail. On the second day of his imprisonment, the interrogator walked in smugly and said, "You'd better tell us all. We have caught your friend Tchaikovsky, and he's already talking."

So begins one telling of the Prisoner's Dilemma, perhaps the best known strategic game.* Let us develop the story to its logical conclusion. Suppose the KGB has actually arrested someone whose only offence is that he is called Tchaikovsky, and are separately subjecting him to the same kind of interrogation. If the two innocents withstand this treatment, each will be sentenced to 3 years' imprisonment.† If the conductor makes a false confession that implicates the unknown "collaborator," while Tchaikovsky holds out, then the conductor will get away with 1 year (and the KGB's gratitude), while Tchaikovsky gets the harsh sentence of 25 years for his recalcitrance. Of course, the tables will be turned if the conductor stands firm while Tchaikovsky gives in and implicates him. If both confess, then both will receive the standard sentence of 10 years.

Now consider the conductor's thinking. He knows that Tchaikovsky is either confessing or holding out. If Tchaikovsky confesses, the conductor gets 25 years by holding out and 10 years by confessing, so it is better for him to confess. If Tchaikovsky holds out, the conductor gets 3 years if he holds out, and only 1 if he confesses; again it is better for him to confess. Thus, confession is clearly the conductor's best action. In a separate cell in Dzerzhinsky Square, Tchaikovsky is doing a similar mental calculation and reaching the same conclusion. The result, of course, is that both of them confess. Later, when they meet in the Gulag Archipelago, they compare stories and realize that they've been had. If they'd both stood firm, they'd both have got away with much shorter sentences.

If only they'd had an opportunity to meet and talk things over before they were interrogated, they could have agreed that neither would give in. But they are quick to realize that at in all probability such an agreement would not have done much good. Once they were separated and the interrogations began, each person's private incentive to get a better deal by doublecrossing the other would have been quite powerful. Once again they would have met in the Gulag, there perhaps to settle the score of the betrayals (not of the concerto). Can the two achieve enough mutual credibility to reach their jointly preferred solution?

Many people, firms, and even nations have been gored on the horns of the Prisoner's Dilemma. Look at the life-or-death issue of nuclear arms control. Each superpower liked best the outcome in which the other disarmed, while it kept its own

* John Nash, of *A Brilliant Mind* fame, was the first to describe the Prisoner's Dilemma, in 1951. For an exposition, see www.agsm.edu.au/~bobm/papers/ccp.pdf

† There is the story of the newcomer to the Gulag who was asked by the residents, "How long is your sentence?" The answer was "Ten years." "What did you do?" "Nothing." "No, there must be some mistake. The sentence for that is only three years."

arsenal “just in case.” Disarming yourself while the other remains armed was the worst prospect. Therefore no matter what the other side did, each preferred to stay armed. But they could join in agreeing that the outcome in which both disarm is better than the one in which both are armed. The problem is the interdependence of decisions: the jointly preferred outcome arises when each chooses its individually worse strategy. Could the jointly preferred outcome be achieved, given each side’s clear incentive to break the agreement and to arm itself secretly? In this case it needed a fundamental change in Soviet thinking to get the world started on the road to nuclear disarmament.

For one’s comfort, safety, or even life itself, one needs to know the ways to get out of the Prisoner’s Dilemma. And there are ways.

The story of the Prisoner’s Dilemma also carries a useful general point: most economic, political, or social games are different from games such as football or poker. Football, poker, and tug-o’-war are zero-sum games: one person’s gain is another person’s loss. But in the Prisoner’s Dilemma there are possibilities for mutual advantage as well as conflict of interest; both prisoners prefer the no-confession result to its opposite. Similarly, in employer-union bargaining, there is an opposition of interests in that one side prefers low wages and the other high ones, but there is agreement that a breakdown of negotiations leading to a strike could be more damaging for both sides. In fact such situations are the rule rather than the exception. Any useful analysis of games should be able to handle a mixture of conflict and concurrence of interests. We usually refer to the players in a game as “opponents,” but you should remember that on occasion, strategy makes strange bedfellows.

4. Here I stand

When the Catholic Church demanded that Martin Luther repudiate his attack on the authority of popes and councils, he refused to recant: “I will not recant anything, for to go against conscience is neither right nor safe.” Nor would he compromise: “Here I stand, I cannot do otherwise.” Luther’s intransigence was based on the divinity of his positions. When defining what was right, there was no room for compromise. His firmness had profound long-term consequences; his attacks led to the Protestant Reformation and substantially altered the mediæval Catholic Church.*

Similarly, Charles de Gaulle used the power of intransigence to become a powerful player in the arena of international relations. As his biographer Don Cook expressed it, “[De Gaulle] could create power for himself with nothing but his own rectitude, intelligence, personality and sense of destiny.” But above all his was “the power of intransigence.” During the Second World War, as the self-proclaimed leader in exile of a defeated and occupied nation, he held his own with Roosevelt and Churchill. In the 1960s, his presidential “*Non!*” swung several decisions France’s way in the European Economic Community.

In what way did his intransigence give him power in bargaining? When de Gaulle took a truly irrevocable position, the other parties in the negotiation were left with just

* Luther’s reputation extended beyond the Church and behind the Iron Curtain. The Wartburg, East Germany’s domestically produced car, was jokingly referred to as “The Luther:” apparently it could be equally immobile.

two options — to take it or to leave it. For example, he single-handedly kept Britain out of the European Economic Community, once in 1963 and again in 1968; the other countries were forced either to accept de Gaulle's veto or to break up the EEC. De Gaulle judged his position carefully to ensure that it would be accepted. But that often left the larger (and unfair) division of the spoils to France. De Gaulle's intransigence denied the other party an opportunity to come back with a counteroffer that was acceptable.

In practice, this is easier said than done, for two kinds of reasons. The first kind stems from the fact that bargaining usually involves considerations beside the pie on today's table. The perception that you have been excessively greedy may make others less willing to negotiate with you in the future. Or, next time they may be firmer bargainers as they try to recapture some of their perceived losses. On a personal level, an unfair win may spoil business relations, or even personal relations. Indeed, biographer David Schoenbrun faulted de Gaulle's chauvinism: "In human relations, those who do not love are rarely loved: those who will not be friends end up by having none. De Gaulle's rejection of friendship thus hurt France." A compromise in the short term may prove a better strategy over the long haul.

The second kind of problem lies in achieving the necessary degree of intransigence. Luther and de Gaulle achieved this through their personalities. But this entails a cost. An inflexible personality is not something you can just turn on and off. Although being inflexible can sometimes wear down an opponent and force him to make concessions, it can equally well allow small losses to grow into major disasters.

Ferdinand de Lesseps was a mildly competent engineer with extraordinary vision and determination. He is famous for building the Suez Canal in what seemed almost impossible conditions. He did not recognize the impossible and thereby accomplished it. Later, he tried using the same technique to build the Panama Canal. It ended in disaster.* Whereas the sands of the Nile yielded to his will, tropical malaria did not. The problem for de Lesseps was that his inflexible personality could not admit defeat even when the battle was lost. How can one achieve selective inflexibility? Although there is no ideal solution, there are various means by which commitment can be achieved and sustained.

5. Belling the cat

In the children's story about belling the cat, the mice decide that life would be much safer if the cat were stuck with a bell around its neck. The problem is, who will risk his life to bell the cat?

This is a problem for both mice and men. How can relatively small armies of occupying powers or tyrants control very large populations for long periods? Why is a planeload of people powerless before a single hijacker with a gun? In both cases, a simultaneous move by the masses stands a very good chance of success. But the communication and coordination required for such action is difficult, and the oppressors,

* The Suez Canal is a sea-level passage. The digging was relatively easy since the land was already low-lying and desert. Panama involved much higher elevations, lakes along the way, and dense jungle. Lesseps' attempt to dig down to sea level failed. Much later, the U.S. Army Corps of Engineers succeeded using a very different method — a sequence of locks, using the lakes along the way.

knowing the power of the masses, take special steps to keep it difficult. When the people must act individually and hope that the momentum will build up, the question arises, “Who is going to be the first?” Such a leader will pay a very high cost — possibly his life. His reward may be posthumous glory or gratitude. There are people who are moved by considerations of duty or honour, but most find the costs exceed the benefits.

Khrushchev first denounced Stalin’s purges at the Soviet Communist Party’s 20th Congress. After his dramatic speech, someone in the audience shouted out, asking what Khrushchev had been doing at the time. Khrushchev responded by asking the questioner to please stand up and identify himself. The audience remained silent. Khrushchev replied: “That’s what I did, too.”

In a sense, we have seen these examples before. They are just a Prisoner’s Dilemma with more than two people; one might call this the hostages’ dilemma. Here we want to use this dilemma to make a different point — namely, the frequent superiority of punishment over reward. The dictator might keep the populace peaceful by providing it material and even spiritual comforts, but this can be a very costly proposition. Oppression and terror relying on the Hostages’ Dilemma can be a much cheaper alternative.

There are many examples of this principle. In a large taxi fleet, cars are often assigned to drivers by a dispatcher. The fleet has some good cars and some clunkers, The dispatcher can use his assignment power to extract a small bribe from each of the drivers. Any driver who refuses to pay is sure to get a clunker, while those who coöperate are given the luck of the draw from the remainder.* The dispatcher gets rich, and the drivers as a group end up with the same set of cabs that they would have if no one used bribery. If the drivers acted in collusion, they probably could stop this practice. The problem lies in getting the movement organized. The point is not so much that the dispatcher can reward those who bribe him, but that he can punish severely those who don’t.

A similar story can be told about evicting tenants from rent-controlled apartments. If someone buys such a building in New York, she has the right to evict one tenant so as to be able to live in her own building. But this translates into a power to clear the whole. A new landlord can try the following argument with the tenant in Apartment 1A: “I have the right to live in my building. Therefore, I plan to evict you and move into your apartment. But if you coöperate and leave voluntarily, then I will reward you with \$5,000.” This is a token amount in relation to the value of the rent-controlled apartment (although it still buys a few subway tokens in New York). Faced with the choice of eviction with \$5,000 or eviction without \$5,000, the tenant takes the money and runs. The landlord then offers the same deal to the tenant in 1B, and so on.

The United Auto Workers have a similar advantage when they negotiate with the U.S. auto manufacturers sequentially. A strike against Ford alone puts it at particular disadvantage when General Motors and Chrysler continue to operate; therefore Ford is more likely to settle quickly on terms favorable to the Union. Such a strike is also less costly to the Union as only one third of their members are out. After winning against

* Even if everyone pays, some drivers will end up with a clunker. But if the clunkers are randomly assigned, no driver faces a great chance of the bad draw. In contrast, the first driver who refuses to pay can expect to drive to the clunker quite regularly.

Ford, the Union takes on GM and then Chrysler, using each previous success as precedent and fuel for their fire. The Japanese coal buyers use similar tactics every year when buying from Australian coal mines. In contrast, Japanese union incentives work the other way, since they are organized by company and have more profit sharing. If the Toyota unions strike, their members' incomes suffer along with Toyota's profits, and they gain nothing from the precedent effect.

We are not saying that any or all of these are good outcomes or desirable policies. In some cases there may be compelling arguments for trying to prevent the kinds of results we have described. But to do so effectively, one has to understand the mechanism by which the problem arose in the first place namely, an "accordion effect," where each fold pushes or pulls the next. This phenomenon arises again and again; but it can be countered.

6. The thin end of the wedge

Most countries use tariffs, quotas, and other measures to restrict import competition and protect domestic industries. Such policies raise prices, and hurt all domestic users of the protected product. U.S. economists have estimated that when import quotas are used to protect industries such as steel, textiles, or sugar, U.S. consumers pay higher prices amounting to roughly \$100,000 for each job saved. How is it that the gains to a few always get priority over the much larger aggregate losses to the many?

The trick is to bring up the cases one at a time. First, 10,000 jobs in the shoe industry are at risk. To save them would cost a billion dollars to U.S. consumers, or just over \$4 each. Who wouldn't agree to pay \$4 to save 10,000 jobs even for total strangers, especially when nasty foreigners can be blamed for their plight? Then along comes the garment industry, the steel industry, the auto industry, and so on. Before they know it, U.S. consumers have agreed to pay over \$50 billion, which is more than \$200 each, or nearly \$1,000 per family. If they had foreseen the whole process, they might have thought the cost too high, and insisted that workers in each of these industries bear the risks of foreign trade just as they would have to bear any other economic risk. Decisions made case by case can lead to undesirable results overall. In fact, a sequence of majority votes can lead to an outcome that everyone regards as worse than the status quo.

These problems arise because myopic decision-makers fail to look ahead and see the whole picture.

7. Look before you leap

It is all too common for people to get themselves into situations that are difficult to get out of. Once you have a job in a particular city, it is expensive to resettle. Once you buy a computer and learn its operating system, it becomes costly to learn another one and rewrite all your programs. Travellers who join the frequent-flyer program of one airline thereby raise their cost of using another. And, of course, a marriage is expensive to escape.

The problem is that once you make such a commitment, your bargaining position is weakened. Companies may take advantage of their workers' anticipated moving costs and give them fewer or smaller salary raises. Computer companies can charge higher prices for new, compatible peripheral equipment knowing that their customers cannot

easily switch to a new, incompatible technology. Airlines, having established a large base of frequent flyers, will be less inclined to engage in fare wars. A couple's agreement that they will split the housework 50:50 may become subject to renegotiation once a child is born.

Strategists who foresee such consequences will use their bargaining power while it exists, namely, before they get into the commitment. Typically, this will take the form of a payment up front. Competition among the would-be exploiters can lead to the same result. Companies will have to offer more attractive initial salaries, computer manufacturers will have to charge sufficiently low prices for their central processing units (CPUs), and airline frequent-flyer programs will have to offer larger signing-on mileage bonuses. As for married couples, exploitation may be a game that two can play.

The same foresight is what prevents many curious but rational people from trying addictive drugs such as heroin. A Tom Lehrer song describes the drug dealer's ploy:

He gives the kids free samples
Because he knows full well
That today's young innocent faces
Will be tomorrow's clientele.

Smart kids know it too, and turn down the free samples.

8. Mix your plays

Let us return for a moment to the world of sport. In boxing, both opponents mix right- and left-handed jabs, which might or might not be successfully anticipated and deflected. In tennis, Lleyton the server might aim at the forehand or the backhand of Pete the receiver, while Pete, in turn, can try to return crosscourt or down the line. In these examples, each side has an idea of its own strong points and of its opponent's weaknesses. It will have a preference for the choice that exploits these weaknesses, but not exclusively. It is well understood, by players and barrackers alike, that one should mix one's plays, randomly throwing in the unexpected move. The point is that if you do the same thing all the time, the opposition will be able to counter you more effectively by concentrating its resources on the best response to your one strategy.

Mixing your plays does not mean rotating your strategies in a predictable manner. Your opponent can observe and exploit any systematic pattern almost as easily as he can the unchanging repetition of a single strategy. It is unpredictability that is important when mixing.

Imagine what would happen if there were some known formula that determined who would be audited by the ATO. Before you submitted a tax return, you could apply the formula to see if you would be audited. If an audit was predicted, but you could see a way to "amend" your return until the formula no longer predicted an audit, you probably would do so. If an audit was unavoidable, you would choose to tell the truth. The result of the ATO being completely predictable is that it would audit exactly the wrong people. All those audited would have anticipated their fate and chosen to act honestly, while those spared an audit would have only their consciences to watch over them. When the ATO audit formula is somewhat fuzzy, everyone stands some risk of an audit; this gives an added incentive for honesty.

There are similar phenomena in the business world. Think of competition in the

market for razors. Imagine that Gillette runs a coupon promotion on a regular schedule — say, the first Sunday of every other month. Bic can preempt Gillette by running a competing coupon promotion the week before. Of course, Bic's move is then predictable and Gillette can preempt the week before. This process leads to cutthroat competition and both make less profit. But if each uses an unpredictable or mixed strategy, together they might reduce the fierceness of the competition.

The importance of randomized strategies was one of the early insights of game theory. The idea is simple and intuitive but needs refinement if it is to be useful in practice. It is not enough for a tennis player to know that he should mix his shots between the opponent's forehand and backhand. He needs some idea of whether he should go to the forehand 30% or 64% of the time and how the answer depends on the relative strengths of the two sides.

9. Never give a sucker an even bet

In *Guys and Dolls*, gambler Sky Masterson relates this valuable advice from his father: "Son, one of these days in your travels a guy is going to come to you and show you a nice brand-new deck of cards on which the seal is not yet broken, and this guy is going to offer to bet you that he can make the jack of spades jump out of the deck and squirt cider in your ear. But, son, do not bet this man, for as sure as you stand there you are going to wind up with cider in your ear."

The context of the story is that Nathan Detroit had offered Sky Masterson a bet about whether Mindy's in New York sold more strudel or cheesecake. Nathan had just discovered the answer (strudel) and was willing to bet if Sky would bet on cheesecake.

This example may sound somewhat extreme. Of course, no one would take such a sucker bet. But look at the market for futures contracts on the Sydney Futures Exchange. If another speculator offers to sell you a futures contract, he will make money only if you lose money. This deal is a zero-sum game, just like sporting competitions, in which one team's victory is the other's loss. Hence, if someone is willing to sell a futures contract, you should not be willing to buy it. And vice versa.

The strategic insight is that other people's actions tell us something about what they know, and we should use such information to guide our own action. Of course, we should use this in conjunction with our own information concerning the matter and use all strategic devices to elicit more from others. In the *Guys and Dolls* example, there is a simple device of this kind. Sky should ask Nathan at what odds he would be willing to take the cheesecake side of the bet. If the answer is "not at any odds," then Sky can infer that the answer must be strudel. If Nathan offers the same odds for both strudel and cheesecake, he is hiding his information at the cost of giving Sky the opportunity to take an advantageous gamble.

In stock markets, foreign exchange markets, and other financial markets, people are free to take either side of the bet in this way. Indeed, in some organized exchanges, including the London stock market, when you ask for a quote on a stock the market-maker is required to state both the buying and selling prices before he knows which side of the transaction you want. Without such a safeguard, market-makers could stand to profit from private information, and the outside investors' fear of being suckered might cause the entire market to fold. The buy and sell prices are not quite the same; the

difference is called the bid-ask spread. In liquid markets the spread is quite small, indicating that little information is contained in any buy or sell order. On the other hand, Nathan Detroit is willing to bet on strudel at any price and on cheesecake at no price; his bid-ask spread is infinity. Beware of such market-makers.

We should add that Sky had not really learned his father's teaching very well. A minute later he bet Nathan that Nathan did not know the color of his own bow-tie. Sky cannot win: if Nathan knows the color, he takes the bet and wins; if he does not, he declines the bet and does not lose.

10. Game theory can be dangerous to your health

Late one night, after a conference in Jerusalem, two American economists found a licensed taxicab and gave the driver directions to their hotel. Immediately, recognizing them as American tourists, the driver refused to turn on his meter; instead, he proclaimed his love for Americans and promised them a lower fare than the meter. Naturally, they were somewhat skeptical of this promise. Why should this stranger offer to charge less than the meter when they were willing to pay the metered fare? How would they even know whether or not they were being overcharged? *

On the other hand, they had not promised to pay the driver anything more than what would be on the meter. If they were to start bargaining and the negotiations broke down, they would have to find another taxi. Their theory was that once they arrived at the hotel, their bargaining position would be much stronger. And taxis were hard to find.

They arrived. The driver demanded 2,500 Israeli shekels (\$2.75). Who knew what fare was fair? Because people generally bargain in Israel, they protested and counter-offered 2,200 shekels. The driver was outraged. He claimed that it would be impossible to get from there to here for that amount. Before negotiations could continue, he locked all the doors automatically and retraced the route at breakneck speed, ignoring traffic lights and pedestrians. Were they being kidnapped to Beirut? No. He returned to the original position and ungraciously kicked the two economists out of his cab, yelling, "See how far your 2,200 shekels will get you now."

They found another cab. This driver turned on his meter, and 2,200 shekels later they were home. Certainly, the extra time was not worth the 300 shekels to the economists. On the other hand, the story was well worth it. It illustrates the dangers of bargaining with those who have not yet been to our course. More generally, pride and irrationality cannot be ignored. Sometimes, it may be better to be taken for a ride when it costs only twenty cents.

There is a second lesson to the story. Think of how much stronger their bargaining position would have been if they had begun to discuss the price after getting out of the taxi. (Of course, for hiring a taxi, this logic should be reversed. If you tell the driver where you want to go before getting in, you may find your taxi chasing after some other customer. Get in first, then say where you want to go.)

* If the driver had wanted to prove that he was going to charge less than the meter, he could have turned on the meter as asked and then charged 80% of the price. The fact that he did not should have told something about his intentions; see the Sky Masterson story just above.

11. The shape of things to come

The examples have given us glimpses of principles that guide strategic decisions. We can summarize these Principles with a few “morals” from our tales.

The story of the hot hand told us that in strategy, no less than in physics, “For every action we take, there is a reaction.” We do not live and act in a vacuum. Therefore, we cannot assume that when we change our behavior everything else will remain unchanged.

De Gaulle’s success in negotiations suggests that “the stuck wheel gets the grease.”

* But being stubborn is not always easy, especially when one has to be more stubborn than an obstinate adversary.

The tale from the Gulag and the story of belling the cat demonstrate the difficulty of obtaining outcomes that require coördination and individual sacrifice. The example of trade policy highlights the danger of solving problems piece by piece. In technology races no less than in yacht races, those who trail tend to employ more innovative strategies; the leaders tend to imitate the followers.

Tennis and tax audits point out the strategic advantage of being unpredictable. Such behavior may also have the added advantage that it makes life just a little more interesting.

We could go on offering more examples and drawing morals from them, but this is not best way to think methodically about strategic games. That is better done by approaching the subject from a different angle. We pick up the principles for example, commitment, coöperation, and *coopetition* — one at a time. In each instance, we select examples that bear centrally on that issue, until the principle is clear. Then you will have a chance to apply and discuss the principle in class.

The reading is adapted from Barry Nalebuff and Avinash Dixit’s *Thinking Strategically* (New York: Norton).

* You may have heard this expression as the “squeaky wheel” — a stuck wheel needs even more grease. Of course, sometimes it gets replaced.