THINKING STRATEGICALLY

Outline of the program:

Theme	*Topic*
A	Strategic Decision Making (Sessions 1 and 2)
B	Credible Commitment (Session 3)
C	Repetition and Reputation (Session 4)
D	Bargaining (Session 5)
E	Tenders, Auctions, and Bidding (Session 6)
F	Choosing the Right Game (Sessions 7 and 8)

>

Quotable Quotes — Game Theory:

“When government auctioneers need worldly advice, where can they turn? To mathematical economists, of course ... As for the firms that want to get their hands on a sliver of the airwaves, their best bet is to go out first and hire themselves a good game theorist.”
The Economist, **July 23, 1994, p.70.**

the “most dramatic example of game theory’s new power ... It was a triumph, not only for the FCC and the taxpayers, but also for game theory (and game theorists).”
Fortune, **February 6, 1995, p.36.**

“Game theory, long an intellectual pastime, came into its own as a business tool.”
Forbes, **July 3, 1995, p.62.**

Game Theory

“Conventional economics takes the structure of markets as fixed. People are thought of as simple stimulus-response machines. Sellers and buyers assume that products and prices are fixed, and they optimize production and consumption accordingly. Conventional economics has its place in describing the operation of established, mature markets, but it doesn’t capture people’s creativity in finding new ways of interacting with one another.

But ...

Game theory is a different way of looking at the world. In game theory, nothing is fixed. The economy is dynamic and evolving. The players create new markets and take on multiple roles. They innovate. No one takes products or prices as given. If this sounds like the free-form and rapidly transforming marketplace, that's why game theory may be the kernel of a new economics for the new economy.”

— Brandenburger & Nalebuff
Foreword to *Co-opetition*

Theme A: Strategic Decision Making

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- **Cooperation in creating value.**
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⇨ **Co-opetition**

(See Theme F later and Brandenburger & Nalebuff in the Folder.)

Manual for “Co-opetition”

How to:

— **cooperate without being a saint**

— **compete without killing the opposition.**

⇨ **Game Theory**

A Case: The New York Post v. the New York News

➢ **Rupert Murdoch's *New York Post* takes on the *New York Daily News*.**

	N.Y. Post	***N.Y. News***
January 1994	**40¢**	**40¢**

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July 1994	50¢	50¢

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So both were now priced at 50¢ everywhere in NYC.

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- **the game is made up of five PARTS (see below)**
- **success comes from *playing the right game***

So game theory provides a framework for an ever-rapidly changing world.

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Ways to raise yours, or lower theirs.

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***Rules*: give structure to the game; in business —**
no universal set of rules
from law, custom, practicality, or contracts
Can revise exiting rules, or devise new ones

More PARTS ...

***Tactics*: moves to shape the way:**

— players perceive the game, and hence
— how they play

Tactics to reduce misperception, or to create or maintain misperception.

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PARTS does more than give a framework, it also provides a complete set of levers.

PARTS provides a method to promote non-routine thinking.

Wider issues.

In Theme F we go beyond the more micro issues → wider issues:

Which game should your firm/organisation be in?

It's no good sticking to your knitting if there's no demand for jumpers.

We elaborate on the five PARTS, and introduce the Value Net.

Question: Left or Right?

You can choose Left or Right:

Profits:

	Left	Right
You	**$40 m**	**$80 m**
Rival	**$20 m**	**$160 m**

(Write down your answer.)

2. A Gentle Introduction

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Its decision:

— price *high* or *low* for today's pies?

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A naïve option:

simply optimise its pricing policy given its beliefs about rivals' prices, or

Think strategically...

Alternative:

try to predict those prices,

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Game Theory →

- **Piemax should build a *model* of the behaviour of each individual competitor,**
- **Which behaviour would be most reasonable to expect?**

Later: what is an equilibrium?

Later: ought Piemax to believe that the market outcome

Now: what kind of model?

The simplest kind of model.

— All bakers operate *for one day only* (a so-called one-shot model)

— All bakers know the production technologies and objectives of the others

— Study with the tools of:

➢ *payoff matrix* games and

➢ *Nash equilibrium*

John Forbes Nash Equilibrium.

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In two-player games, a Nash equilibrium prescribes strategies that are mutually best response (not universally best responses, as with dominant strategies).

Repeated interactions.

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e.g. low price today may:

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e.g. baking a large batch of pies may

→ allow learning by doing by the staff

& lower production costs in the future.

But there are dangers!

Its rivals may be influenced by Piemax's price today

→ a low Piemax price may trigger

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Such dynamic games can be dealt with using:

— extensive-form game trees and

— the solution concept of *subgame perfection*

Subgame Perfect Equilibrium:
a Nash equilibrium that does not rely on non-credible threats (that satisfies backwards induction).

How about information?

- What if Piemax is *uncertain* of the cost functions or the long-term objectives of its rivals?
  — Has Cupcake Pty Ltd just made a breakthrough in large-batch production?
  — Does Sweetstuff plc care more about market share than about current profits?
  — And how much do these rivals know about Piemax?

Incomplete information games.

Acting in a fog: perceptions rule!

And learning?

- If the industry continues for several periods, then Piemax ought to *learn* about Cupcake's and Sweetstuff's private information *from their current pricing behaviour*
  and use this information to improve its future strategy.
- In anticipation, Cupcake and Sweetstuff may be loath to let their prices reveal information that enhances Piemax's competitive position:
- They may attempt to *manipulate Piemax's information*.

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- ***Rational behaviour*: players do the best they can, in their eyes;**
- **Because of the players’ interdependence, a rational decision in a game must be based on a prediction of others’ responses.**

  ***Put yourself in the other’s shoes* and predicting what action the other person will choose, you can decide your own best action.**

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Look forward and reason backwards!

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Which tyre?

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— designing *a managerial incentive system*

— *how low to bid* for a government procurement contract

— ***how high to bid*** **in an auction**

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- ***collective bargaining*** **between a trade union/employees and an employer**

4. Some Interactions

4.1 Auctioning a Five-Dollar Note

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Rules:

- ➢ **First bid: 20¢**
- ➢ **Lowest step in bidding: 20¢ (or multiples of 20¢)**
- ➢ **The auction lasts until the clock starts ringing.**
- ➢ **The highest bidder pays bid to auctioneer and gets $5 in return.**
- ➢ **The second-highest bidder also pays her bid to auctioneer, but gets nothing.**

The Five-Dollar Auction

Write down the situation as seen by

1. **the high bidder, and**
2. **the second highest bidder.**

The Five-Dollar Auction

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What happened?

Escalation and entrapment

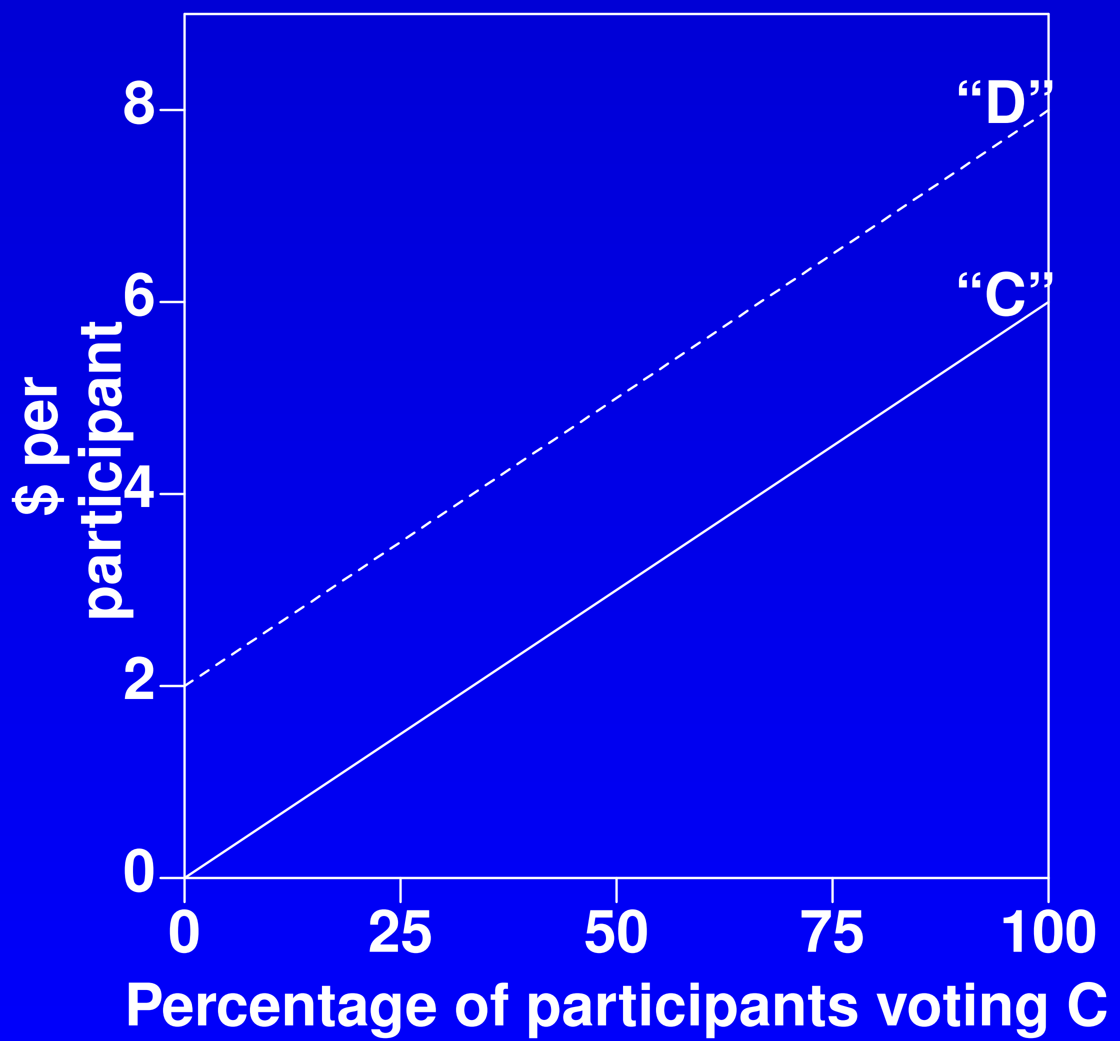
Examples?

4.2 Schelling's Game

Rules:

- ➢ **Single play, $4 to play: by writing your name on the slip**
- ➢ **Vote "C" (Coöperate) or "D" (Defect).**
- ➢ **Sign your ballot. (and commit to pay the entry fee.)**
- ➢ **If *x*% vote "C" and (100 – *x*)% vote "D":**
  - **then "C"s' net payoff =** $\left(\frac{x}{100} \times \$6\right) - \$4$
  - **then "D"s' net payoff = "C" payoff + $2**
- ➢ **Or: You needn't play at all.**

Schelling’s Game



Note: the game costs $4 to join.

Schelling's Game

What happened?

- **numbers & payoffs.**
- **previous years?**

Dilemma: $\left\{ \begin{array}{l} \text{coöperate for the common good } \textbf{\textit{or}} \\ \text{defect for oneself} \end{array} \right.$

Public/private information

Schelling's n-person Game

Examples?

— price
— tax avoidance
— individual negotiation
— coal exports
— market development
— others?

4.3 The Ice-Cream Sellers

(See Marks in the Folder)

L C R

^ ^ ^

- **Demonstration**
- **Payoff matrix**
- **Incentives for movement?**
- **Examples?**

Modelling the ice-cream sellers.

We can model this interaction with a simplification: each seller can either:

- ➢ **move to the centre of the beach (M), or**
- ➢ **not move (stay put) (NM).**

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Since each has two choices for its location, there are $2 \times 2 = 4$ possibilities.

Analysing the Interaction

We use *arrows* and a *payoff matrix*, which clearly outlines the possible actions of each and the resulting outcomes.

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- **What are the sales if neither moves (or both NM)? Each sells to half the beach.**
- **What are the sales if You move to the centre (M) and your rival stays put (NM) at the three-quarter point?**

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- **What if you both move (both M)?**

Given the analysis, what *should* you do?

The Sellers’ Payoff Matrix

		The Other Seller	
		M	**NM**
You	**M**	**40, 40**	**50, 30**
	NM	**30, 50**	**40, 40**

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A non-cooperative, zero-sum game, with a *dominant strategy*, or dominant move.

Real-World Ice-Cream Sellers

Think of the beach as a product spectrum, each end representing a particular niche, and the centre representating the most popular product.

Demand is largest for the most popular product, but so is competition.

This simple model: a tendency to avoid extremes, especially with barriers to entry for new players.

Examples:

— the convergence of fashions?

— the similarity of commercial TV and radio programming?

— the copy-cat policies of political parties?

— the parallel scheduling of Qantas/JetStar and Ansett/Virgin?

A twist: What if the centre is too far for some bathers (at the ends of the beach) to walk?

Then the tendency for the sellers to offer the same product (at the centre) is reduced, and they might differentiate their products.

4.4 The Prisoner’s Dilemma

(See Marks in the Folder)

Case: Telstra and Optus and advertising.

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Telstra and Optus independently must decide how heavily to advertise.

Advertising is expensive, but if one telco chooses to advertise moderately while the other advertises heavily, then the first loses out while the second does well.

Payoffs

Let’s assume if both Advertise Heavily then Telstra nets $70,000, while Optus nets $50,000.

But if Telstra Advertises Heavily while Optus Advertises Moderately only, then Telstra nets $140,000 while Optus nets only $25,000, and vice versa.

If both Advertise Moderately, then Telstra nets $120,000 and Optus nets $90,000.

What to do?

Consider the payoff matrix:

The Advertising Game

		Optus	
		Heavy	**Moderate**
Telstra	**Heavy**	**70, 50**	**140, 25**
	Moderate	**25, 140**	**120, 90**

The Advertising Game

		Optus	
		Heavy	Moderate
Telstra	Heavy	70, 50	140, 25
	Moderate	25, 140	120, 90

The Advertising Game

		Optus Heavy	Moderate
Telstra	Heavy	70, 50	140, 25
	Moderate	25, 140	120, 90

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		Optus	
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The Advertising Game

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		Heavy	**Moderate**
Telstra	**Heavy**	**70, 50**	**140, 25**
	Moderate	**25, 140**	**120, 90**

Both choose Heavy advertising, although each would be better off with Moderate advertising.

The Advertising Game

		Optus	
		Heavy	**Moderate**
Telstra	**Heavy**	**70, 50**	**140, 25**
	Moderate	**25, 140**	**120, 90**

Both choose Heavy advertising, although each would be better off with Moderate advertising. ***A Prisoner's Dilemma.***

Each player's *rankings* are sufficient:

Or, could rank outcomes for each player: 4 is best, 1 is worst.

		Optus Heavy	*Optus* Moderate
Telstra	Heavy	2, 2	4, 1
Telstra	Moderate	1, 4	3, 3

Each player’s *rankings* are sufficient:

Or, could rank outcomes for each player: 4 is best, 1 is worst.

		Optus	
		Heavy	**Moderate**
Telstra	**Heavy**	2, 2	4, 1
	Moderate	1, 4	3, 3

Each player’s *rankings* are sufficient:

Or, could rank outcomes for each player: 4 is best, 1 is worst.

		Optus	
		Heavy	**Moderate**
Telstra	**Heavy**	**2, 2**	**4, 1**
	Moderate	**1, 4**	**3, 3**

Each player’s *rankings* are sufficient:

Or, could rank outcomes for each player: 4 is best, 1 is worst.

		Optus	
		Heavy	**Moderate**
Telstra	**Heavy**	**2, 2**	**4, 1**
	Moderate	**1, 4**	**3, 3**

Each player’s *rankings* are sufficient:

Or, could rank outcomes for each player: 4 is best, 1 is worst.

		Optus	
		Heavy	**Moderate**
Telstra	**Heavy**	2, 2	4, 1
	Moderate	1, 4	3, 3

Each player's *rankings* are sufficient:

Or, could rank outcomes for each player: 4 is best, 1 is worst.

		Optus	
		Heavy	**Moderate**
Telstra	**Heavy**	**2, 2**	**4, 1**
	Moderate	**1, 4**	**3, 3**

Needn't have exact knowledge of the payoffs.

The Traditional, Symmetric Payoffs for the Prisoner’s Dilemma:

The Payoff Matrix:

- **The Cheater’s Reward = 5**
- **The Sucker’s Payoff = 0**
- **Mutual defection = 2**
- **Mutual coöperation = 4**

These are chosen so that: 5 + 0 < 4 + 4
so that C,C is *efficient* in a repeated game.

The Prisoner's Dilemma

A need for:

- ✷ **communication**
- ✷ **coördination**
- ✷ **trust**
- ✷ ***or*?**

Efficient Outcome: **there is no other combination of actions or strategies that would make at least one player better off without making any other player worse off.**

The Prisoner's Dilemma

		Kelly Spill	*Kelly* Mum
Ned	Spill	8, 8	0, 20
Ned	Mum	20, 0	1, 1

The Prisoner's Dilemma

		Kelly Spill	Mum
Ned	Spill	8, 8	0, 20
	Mum	20, 0	1, 1

The Prisoner’s Dilemma

		Kelly	
		Spill	**Mum**
Ned	**Spill**	**8, 8**	**0, 20**
	Mum	**20, 0**	**1, 1**

The Prisoner’s Dilemma

		Kelly	
		Spill	**Mum**
Ned	**Spill**	**8, 8**	**0, 20**
	Mum	**20, 0**	**1, 1**

The Prisoner’s Dilemma

		Kelly	
		Spill	**Mum**
Ned	**Spill**	**8, 8**	**0, 20**
	Mum	**20, 0**	**1, 1**

The Prisoner's Dilemma

		Kelly	
		Spill	**Mum**
Ned	**Spill**	**8, 8**	**0, 20**
	Mum	**20, 0**	**1, 1**

Years of prison (Ned, Kelly).

The choices: Spill the beans to the cops, or keep Mum.

The Prisoner’s Dilemma

		Kelly	
		Spill	**Mum**
Ned	**Spill**	**8, 8**	**0, 20**
	Mum	**20, 0**	**1, 1**

Years of prison (Ned, Kelly).

The choices: Spill the beans to the cops, or keep Mum.

Nash Equilibrium = {Spill, Spill}, despite the longer sentences.

Case: Du Pont’s Titanium doxide capacity.

Titanium dioxide is a whitener for paint, paper, and plastics.

In 1972 du Pont, with 34% of the U.S. market for titanium dioxide, announced additional capacity which would after six years result in its share rising to 65%.

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Du Pont resisted others’ price rises, but slackening demand growth meant its plans were reduced in size and delayed.

Nonetheless, it is now the global leader in titanium dioxide supply and its exclusive ilmenite production is the lowest-cost technology.

Du Pont’s *credibility* was important.

4.5 The Capacity Game

Two firms each produce identical products and each must decide whether to Expand (E) its capacity in the next year or not (DNE).

A larger capacity will increase its share of the market, but at a lower price.

The simultaneous capacity game between Alpha and Beta can be written as a 2 $\times$ 2 payoff matrix.

The Capacity Game

		Beta DNE	*Beta* Expand
Alpha	DNE	\$18,\$18	\$15, \$20
Alpha	Expand	\$20, \$15	\$16, \$16

The Capacity Game

		Beta	
		DNE	Expand
Alpha	DNE	$18,$18	$15, $20
	Expand	$20, $15	$16, $16

The Capacity Game

		Beta DNE	*Beta* Expand
Alpha	DNE	\$18,\$18	\$15, \$20
Alpha	Expand	\$20, \$15	\$16, \$16

The Capacity Game

		Beta	
		DNE	Expand
Alpha	DNE	$18,$18	$15, $20
	Expand	$20, $15	$16, $16

The Capacity Game

		Beta	
		DNE	**Expand**
Alpha	**DNE**	**$18,$18**	**$15, $20**
	Expand	**$20, $15**	**$16, $16**

The Capacity Game

		Beta	
		DNE	**Expand**
Alpha	**DNE**	**$18,$18**	**$15, $20**
	Expand	**$20, $15**	**$16, $16**

The payoff matrix (Alpha, Beta).

The Capacity Game

		Beta	
		DNE	**Expand**
	DNE	**$18,$18**	**$15, $20**
Alpha			
	Expand	**$20, $15**	**$16, $16**

The payoff matrix (Alpha, Beta). A non-cooperative, positive-sum game, with a dominant strategy.

Nash Equilibrium at ______

Equilibrium.

At a *Nash equilibrium*, each player is doing the best it can, given the strategies of the other players.

We can use *arrows* in the payoff matrix to see what each player should do, given the other player's action.

The Nash equilibrium is a self-reinforcing focal point, and expectations of the other's behaviour are fulfilled. Not necessarily efficient.

An example of the Prisoner's Dilemma: in its one-shot version there is a conflict between collective interest and self-interest.

5. Modelling Players’ Preferences

Without uncertainty or any dice-rolling,

we need only *rank* the four combinations:

best, good, bad, worst:

$\rightarrow$ payoffs of 4, 3, 2, and 1, respectively, in a 2 $\times$ 2 interaction.

6. More Interactions

6.1 Battle of the Bismark Sea

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6.1 Battle of the Bismark Sea

It's 1943: *Actors*:

- ➢ **Admiral Imamura: ordered to transport Japanese troops across the Bismark Sea to New Guinea, and**
- ➢ **Admiral Kenney: wishes to bomb Imamura's troop transports.**

***Decisions/Actions*:**

➢ **Imamura chooses:**

- **— a shorter Northern route (2 days) or**
- **— a longer Southern route (3 days)**

***Decisions/Actions*:**

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- **Kenney: where to send his planes to look for Imamura’s ships; he can recall his planes if the first decision was wrong, but then loses one day of bombing.**

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Some ships are bombed in all four combinations.

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  - **— a longer Southern route (3 days)**

- **Kenney: where to send his planes to look for Imamura's ships; he can recall his planes if the first decision was wrong, but then loses one day of bombing.**

Some ships are bombed in all four combinations.
Kenney and Imamura each have the same action set — {*North*, *South*} — but their payoffs are never the same. Imamura's losses are Kenney's gains: a *zero-sum game*.

The Battle of the Bismark Sea

➢ Does any player have a dominant strategy?

➢ What is the most obvious way the game should be played?

Let’s look at the payoff matrix:

The Battle of the Bismark Sea

		Imamura North	South
Kenney	North	2, –2	2, –2
	South	1, –1	3, –3

The Battle of the Bismark Sea

Imamura

Kenney		North	South
	North	2, –2	2, –2
	South	1, –1	3, –3

The Battle of the Bismark Sea

		Imamura	
		North	**South**
Kenney	**North**	2, –2	2, –2
	South	1, –1	3, –3

The Battle of the Bismark Sea

		Imamura North	*Imamura* South
Kenney	North	2, –2	2, –2
Kenney	South	1, –1	3, –3

The Battle of the Bismark Sea

		Imamura North	South
Kenney	North	2, –2	2, –2
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The Battle of the Bismark Sea

		Imamura North	South
Kenney	North	2, –2	2, –2
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The payoff matrix (Kenney, Imamura).

A non-cooperative, zero-sum game, with an iterated dominant strategy equilibrium.

The Battle of the Bismark Sea

		Imamura	
		North	South
Kenney	North	2, –2	2, –2
	South	1, –1	3, –3

The payoff matrix (Kenney, Imamura).

A non-cooperative, zero-sum game, with an iterated dominant strategy equilibrium.

No other equilibrium: with all other combinations, at least one of the players stands to gain by changing his action, given the other's action.

Players' choices.

Neither player has a *dominant strategy*:

- **Kenney would choose**
  - — ***North* if he thought Imamura would choose *North*, but**
  - — ***South* if he thought Imamura would choose *South*.**
  - — **So Kenney's best response is a function of what Imamura does.**

➢ **Imamura would choose**

— ***North*** **if he thought Kenney would choose** ***South*****, but**

— ***either*** **if he thought Kenney would choose** ***North*****.**

— **For Imamura,** ***North*** **is** ***weakly dominant.***

And Kenney knows it and chooses ***North*** **too.**

- **Imamura would choose**
  - **— *North* if he thought Kenney would choose *South*, but**
  - **— *either* if he thought Kenney would choose *North*.**
  - **— For Imamura, *North* is *weakly dominant.***

And Kenney knows it and chooses *North* too.

(*North, North*) is an *iterated dominant strategy equilibrium.* (It was the outcome in 1943.)

Equilibrium.

(*North, North*) is a (Nash) equilibrium:

- Kenney has no incentive to alter his action from *North* to *South* so long as Imamura chooses *North*, and
- Imamura gains nothing by changing his action from *North* to *South* so long as Kenney chooses *North*.
- And neither player has a (strictly) dominant strategy.
- *South* is a (weakly) dominated strategy for Imamura.

A market analogue ?

Two companies, K and I, trying to maximise their shares of a market of constant size by choosing between two product designs *N* and *S*.

K has a marketing advantage, and would like to compete head-to-head with I,

while I would rather carve out its own niche instead of head-to-head competition.

6.2 The Battle of the Sexes

A coordination game:

video VHS v. Sony’s Betamax;

now the competing standards for digital audio disks: SACD (Sony & Philips) v. DVD-A (Toshiba, Matsushita, Pioneer etc.)

and DVD recording: DVD+R, DVD-R, DVD-RAM.

and the high-definition DVD: Blu-ray DVD v. HD-DVD.

The Players & Actions:

- **a man (Hal) who wants to go to the Theatre and**
- **a woman (Shirl) who wants to go to a Concert.**

While selfish, they are deeply in love, and would, if necessary, sacrifice their preferences to be with each other.

The Players & Actions:

- ➢ **a man (Hal) who wants to go to the Theatre and**
- ➢ **a woman (Shirl) who wants to go to a Concert.**

While selfish, they are deeply in love, and would, if necessary, sacrifice their preferences to be with each other.

The payoff matrix (measuring the scale of happiness) is below.

What are all equilibria?

(Which pairs of actions are mutually best response?)

The Battle of the Sexes

		Shirl	
		Theatre	Concert
Hal	Theatre	2, 1	–1, –1
	Concert	–1, –1	1, 2

The Battle of the Sexes

		Shirl Theatre	Concert
Hal	Theatre	2, 1	–1, –1
	Concert	–1, –1	1, 2

The Battle of the Sexes

		Shirl	
		Theatre	Concert
Hal	Theatre	2, 1	–1, –1
	Concert	–1, –1	1, 2

The Battle of the Sexes

		Shirl	
		Theatre	Concert
Hal	Theatre	2, 1	–1, –1
	Concert	–1, –1	1, 2

The Battle of the Sexes

		Shirl	
		Theatre	**Concert**
Hal	**Theatre**	**2, 1**	**–1, –1**
	Concert	**–1, –1**	**1, 2**

The Battle of the Sexes

		Shirl	
		Theatre	**Concert**
Hal	**Theatre**	**2, 1**	**–1, –1**
	Concert	**–1, –1**	**1, 2**

The payoff matrix (Hal, Shirl).

The Battle of the Sexes

		Shirl	
		Theatre	Concert
Hal	Theatre	2, 1	–1, –1
	Concert	–1, –1	1, 2

The payoff matrix (Hal, Shirl).

A non-cooperative, positive-sum game, with two Nash equilibria.

The Battle of the Sexes

There is no iterated dominant strategy equilibrium.

There are two *Nash equilibria*:

- **(*Theatre, Theatre*): given that Hal chooses *Theatre*, so does Shirl.**
- **(*Concert, Concert*), by the same reasoning.**

How do the players know which to choose?

(A coordination game.)

Players' choices.

If they do not talk beforehand, Hal might go to the Concert and Shirl to the Theatre, each mistaken about the other's beliefs.

Players’ choices.

If they do not talk beforehand, Hal might go to the Concert and Shirl to the Theatre, each mistaken about the other’s beliefs.

Focal points?

Players’ choices.

If they do not talk beforehand, Hal might go to the Concert and Shirl to the Theatre, each mistaken about the other’s beliefs.

Focal points?

Repetition?

Each of the Nash equilibria is collectively rational (efficient): no other strategy combination increases the payoff of one player without reducing that of the other.

Players’ choices.

If they do not talk beforehand, Hal might go to the Concert and Shirl to the Theatre, each mistaken about the other’s beliefs.

Focal points?

Repetition?

Each of the Nash equilibria is collectively rational (efficient): no other strategy combination increases the payoff of one player without reducing that of the other.

There is a *first-mover advantage* in this sequential-move game.

Market analogue ?

- Battle over an industry-wide standard.
- The choice of language used in a contract when two firms want to formalise a sales agreement but prefer different terms.
- Bought a DVD player recently?
  DVD, CDV, MP3, CD, DVD+, etc.
  Digital audio disks: SACD (Sony & Philips) v. DVD-A (Toshiba, Matsushita, Pioneer)
  Emerging standards mean choice and decisions for early adopters.
- others?

6.3 The Ultimatum Game

- Your daughter, Maggie, asks for your sage advice.
- She has agreed to participate in a lab experiment.
- The experiment is two-player bargaining, with Maggie as Player 1.
- She is to be given $10, and will be asked to divide it between herself and Player 2, whose identity is unknown to her.

- **Maggie must make Player 2 an offer,**
- **Then Player 2 can either:**
  - **— accept the offer, in which case he will receive whatever Maggie offered him, or**
  - **— he can reject, in which case neither player receives anything.**

- **Maggie must make Player 2 an offer,**
- **Then Player 2 can either:**
  - **— accept the offer, in which case he will receive whatever Maggie offered him, or**
  - **— he can reject, in which case neither player receives anything.**

- **How much should Maggie offer?**

Maggie’s choices.

➢ **Distinguish:**

① ***the rationalist’s answer*** **from**

② ***the likely agreement*** **in practice from**

③ ***the just agreement.***

The rationalist:

- Player 1 should offer Player 2 5¢ (the smallest coin).
- Player 2 will accept, since 5¢ is better than nothing.
- But offering only 5¢ seems risky, since, if Player 2 is insulted, it would cost him only 5¢ to reject it.
- Maybe Maggie should offer more. But how much more?

In-class exercise.

6.4 The Inheritance Game

***The players*:**

- ➢ **Elizabeth, an aged mother, wishes to give an heirloom to one of**
- ➢ **her several daughters.**

***The game*:**

- ➢ **E. wants to benefit the daughter who values it most.**
- ➢ **But the daughters may be dishonest: each has an incentive to exaggerate its worth to her.**

A second-price auction.

➢ **so E. devises the following scheme:**

- **asks the daughters to tell her confidentially (i.e. a sealed bid) their values, and**
- **promises to give it to the one who reports the highest value**
- **the highest bidder gets the heirloom, but only pays the second-highest reported valuation.**

Will Elizabeth's scheme (a Vickrey auction, or *second-price* auction) make honesty the best policy?

A second-price auction.

➢ so E. devises the following scheme:

— asks the daughters to tell her confidentially (i.e. a sealed bid) their values, and

— promises to give it to the one who reports the highest value

— the highest bidder gets the heirloom, but only pays the second-highest reported valuation.

Will Elizabeth’s scheme (a Vickrey auction, or *second-price* auction) make honesty the best policy?

Yes.

Why? Thinking through the options.

Consider your reasoning as one of the daughters:

- **three options: *truthfulness, exaggeration, or understatement.***
- **The amount you pay is independent of what you say it's worth,**
- **so the only effect of your report is to determine whether or not you win the heirloom, and hence what you must pay.**

Exaggeration

➢ ***Exaggeration*: the possibility that you make the highest report when you would not otherwise have, had you been honest.**

i.e., that the second-highest report, the one you now exceed, is higher than your true valuation.

But $\rightarrow$ that what you must pay (the second-highest report) is more than what you think the heirloom is worth.

$\therefore$ Exaggeration not in your interest.

Understatement

➢ *Understating* changes the outcome only when you would have won with an honest report;

but now you report a value lower than that of one of your sisters, so you do not win the heirloom.

∴ Not in your interest either.

It works.

So the mother's scheme works, and the truth is obtained—but at a price, to Elizabeth, the Mum.

E. receives a payment less than the successful daughter's valuation,

so this daughter earns a profit:

= her valuation – the 2nd-highest valuation.

= the premium the mother forgoes to induce honesty

Market Analogue ?

Think: how can the neighbours who propose building a park overcome each household’s temptation to *free-ride* on the others’ efforts by claiming not to care about the park, when contributions should reflect the household’s valuation of the park?

How can the users of a satellite be induced to reveal their profits so that the operating cost of the satellite can be divided according to the profit each user earns?

7. Concepts Used:

Best response **means the player's best action when faced with a particular action of his or her rival**

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Nash equilibrium **is the outcome that results when all players are simultaneously using their best responses to the others' actions;**

Thus at an equilibrium all players are doing the best they can, given the others' decisions; that is, all are playing their best responses.

If, conversely, the game is *not* at an equilibrium, then at least one of the players could have done better by acting differently.

∴ A Nash equilibrium is self-reinforcing: given that the others don't deviate, no player has any incentive to change his or her strategy.

If, conversely, the game is *not* at an equilibrium, then at least one of the players could have done better by acting differently.

∴ A Nash equilibrium is self-reinforcing: given that the others don't deviate, no player has any incentive to change his or her strategy.

An *efficient* outcome is an outcome when there exists no other outcome that all players prefer.

8. What Have We Learnt?

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Rule 3: **Eliminate any dominated strategies from consideration, and go on doing so successively.**

Rule 4: **Look for an equilibrium, a pair of strategies in which each player's action is the best response to the other's.**

9. Summary of Strategic Decision Making

The following *concepts & tools* are introduced:

The Ice-Cream Sellers:

- **payoff matrix**
- **incentives to change — use arrows!**
- **dominant strategy**

The Prisoner's Dilemma The Capacity Game:

- **possibility of repetition**
- **efficient outcome**
- **non-zero-sum game**
- **inefficient equilibria**

The Battle of the Bismark Sea:

zero-sum game
iterated dominant strategy
Nash equilibrium

The Battle of the Sexes:

coordination, not rivalry
first-mover advantage
focal points