

LECTURE 8

COMMUNICATION AND SIGNALING



Introduction

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- Aim of the lecture: explore how (pre-game) communication and information manipulation may alter the outcome of the game.
- **“Cheap talk”**: Direct costless communication between players where by players announce which actions they will take.
- **Signaling/screening**: In game of incomplete information, agents may manipulate information by taking certain actions.

Communication: Perfectly aligned interests

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- Coordination game: Entry game example

	market A	market B
market A	0,0	1,1
market B	1,1	0,0

- Without pre-game communication, there is a risk of coordination failure, where both firms enter the same market.
- We add a first stage, where communication is possible.

Communication: Perfectly aligned interests

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- Suppose Firm 1 can announce at no cost its choice of action before Firm 2 gets to choose. The announcement is nonbinding, **“cheap talk.”**
- “I will enter market A”
 - If Firm 2 believes Firm 1, it will choose B.
 - By sending a truthful message, Firm 1 can prevent coordination failure.
- Firm 1 will be truthful, and Firm 2 has no reason not to believe Firm 1.
- Coordination can be easily achieved. Pre-game communication benefits both players.

Communication: Partially aligned interests

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	market A	market B
market A	0,0	2,1
market B	1,2	0,0

- Firm 1 is given the opportunity to say “I am going to market A”. Firm 1 benefits from being truthful, and Firm 2 is likely to believe it.
- Cheap talk can enable a player to obtain his preferred outcome.

Communication: Conflicting interests

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- Example: Employee/manager interactions

		Manager	
		Monitor	No monitor
Employee	Work	50, 90	50, 100
	Shirk	0, -10	100, -100

- The interests are conflicting.
- Suppose the manager has the opportunity to send a message to announce whether monitoring will take place today.

Communication: Conflicting interests

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- If the manager says “I will monitor today”, then the employee will choose “Work” if he believes the manager.
- But then, the manager has no incentive to actually monitor, and is better off doing the opposite of what the signal said. The signal is not truthful.
- But if the manager always does the opposite of what he says, the employee will choose to shirk. Knowing this, the manager will monitor...etc.
- The employee should just disregard the signal. When players have conflicting interests, pre-game communication is uninformative. (babbling equilibrium)

Incomplete information

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- So far we have considered games with **complete information**
 - players know all the rules of the game - all players, all possible strategies, and payoffs.

		Manager	
		Monitor	No monitor
Employee	Work	50,90	50,100
	Shirk	0, -10	100,-100

- In complete information games, pre-game communication is limited to announcing the choice of future actions, i.e. cheap talk.

Incomplete information

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- In incomplete information games, players may not have some information about the other players, e.g. about their type and payoffs.
 - Producers may not know each others' costs functions.
 - An entrant may not know how costly it would be for the incumbent to fight a new entrant.
 - In a bargaining games, parties may not know each other's degree of impatience and outside option.
- Players know more about themselves than about other players.

Incomplete information

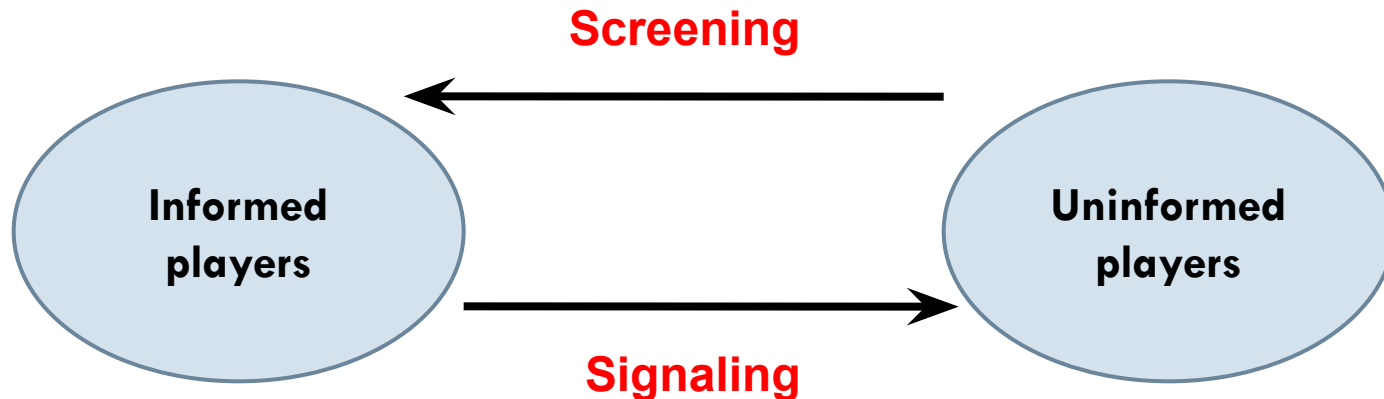
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- Possessing superior information is often an advantage, and allows greater flexibility to adjust to the other player's profile
- Bargaining game: The optimal offer depends on the other player's degree of impatience and outside option.
- Entry game: the entrant may want to know how tough the incumbent is; the incumbent may want to know how committed the entrant is.

Information manipulation

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- Because information can be so important, players may try to manipulate information, to alter the outcome. Manipulation of information becomes a strategy, a game within the game.



- Unlike cheap talk, signaling and screening is not costless.

Signaling/screening

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- Signaling: The better-informed attempts to signal something about his type.
 - Reveal information truthfully, e.g. reveal that you are patient in a bargaining game.
 - Reveal misleading information, e.g. hide the fact that you are impatient.
- Screening: The less-informed player tries to elicit information and filter truth from falsehood
 - Employer wants to find out how hard-working its employees are.
 - Consumers wish to learn if a seller is trustable or not.

Adverse selection and signaling: the lemon problem

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- Market for second-hand cars:
 - Two types of cars.
 - Good cars: valued at \$12,500 by the seller
 - Bad cars: valued at \$3,000 by the seller
- The potential buyer is willing to pay:
 - \$16,000 for a good car
 - \$6,000 for a bad car (the lemon)
- Depending on bargaining power of the two players, the price of the good car will be between \$12,500 and \$16,000. The price of the bad car between \$3,000 and \$6,000.

The lemon problem: Asymmetric information

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- Information is asymmetric: Sellers know the value of the car, but buyers don't.



- Sellers of good car would like to indicate that their cars are good, but so do sellers of bad cars. Direct communication is not credible, and buyers remain uninformed.
- When quality is unobservable, there can only be one price p for both types of cars.

The lemon problem: Asymmetric information

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- In the population of cars,
 - A fraction f is of good quality.
 - A fraction $1-f$ is of bad quality.
- For the buyer, the expected value of the car purchased is:
 - $16,000f + 6,000(1-f) = 6,000 + 10,000f$
- He will buy the car if:
 - **$6,000 + 10,000f > p$**
- The seller of a bad car will sell if **$p > 3,000$** . The seller of a good car will sell if **$p > 12,500$** .

The lemon problem: Condition on f

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- To meet the requirements of all sellers and buyers:

A Venn diagram with two overlapping circles. The left circle is labeled 'buyer' and contains the red equation $6,000 + 10,000f > p > 12,500$. The right circle is labeled 'seller' and contains the red equation $10,000f > 12,500 - 6,000$. The intersection of the two circles is shaded.

buyer

seller

$6,000 + 10,000f > p > 12,500$

$10,000f > 12,500 - 6,000$

- i.e. $f > 0.65$, more than 65% of cars are of good quality.
- If $f > 0.65$, the expected value of a random car is more than 12,500. Buyers are willing to pay more than 12,500 for a random car, and sellers of good cars will agree to sell.
- If $f < 0.65$, the expected value of a random car is less than 12,500. Buyers are not willing to pay more than 12,500 for a random car, and sellers of good cars will not agree to sell.

The lemon problem: adverse selection

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- When $f < 0.65$, there is an adverse selection problem. Sellers of good cars will drop out, and only low quality cars will remain on the market.
- Potential buyers will recognize this, and pay at most 6,000. Bad cars drive the good cars out.
- More generally, because of asymmetric information, producers of high quality products may not expect proper profit, so will not participate in the market.

Solving adverse selection: warranties

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- Adverse selection originates from information asymmetry. Cheap talk is not going to work. Sellers of high quality cars may signal high quality using warranties.
- If the product is faulty or damaged, the seller will replace it.
- Suppose that buyers perceive any car with a warranty to be of good quality, and any car without a warranty to be of bad quality.
- Suppose that:
 - For sellers of good cars, the cost of offering warranties is \$0. Good cars never fail.
 - For sellers of bad cars, the cost of offering warranties is \$11,000. Low quality cars are more likely to fail.

Solving adverse selection: warranties

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- Sellers of good cars will choose to offer a warranty:
 - Costs \$0.
 - With warranty they can sell the car for \$16,000, without warranty they can sell it for \$6,000.
- Sellers of bad cars will choose not to offer a warranty:
 - Costs \$11,000.
 - With warranty they can sell the car for \$16,000, without warranty they can sell it for \$6,000. (difference of \$10,000)

Solving adverse selection: warranties

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- Sellers of good cars can use warranties to credibly signal the quality of the car. □ **Signaling**
- Signaling works because good quality producers provide warranties which low quality producers cannot imitate.
- Warranties act as a “separating mechanism”. Whether warranty is offered depends on the quality of the car.

Solving adverse selection: advertising

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- Sellers of high-quality products advertise to signal the quality of their products.
- For advertising to be worthwhile, consumers must buy the product repeatedly.
 - Low-quality sellers do not find it worthwhile to advertise
 - High-quality sellers find it worthwhile to advertise
- It is not the advertising message itself that is effective in convincing consumers. Rather, the simple fact of advertising signals that the product must be of high quality.

Solving adverse selection: value of the brand

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- Over the long-term, high-quality sellers may be able to acquire a strong reputation and increase the value of their brand.
- Once reputation has been established, adverse selection is less of an issue, and the signaling motive for warranties and advertising may be less important.
- Over the long-term, the brand itself may act as a signal.

Signaling in the labor market:

Spence education model

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- What credible signal can be used to convince employers that you are highly skilled and they should hire you?
- Spence argues that attending university, and taking tough courses can be used to signal skills.
- Consider an employer and two types of potential workers (students):
 - Able (A), Challenged (C).
 - Employers are willing to pay \$160k for A type and \$60k for a C type. The student's type is not observable to the employer.

Spence education model

Setting

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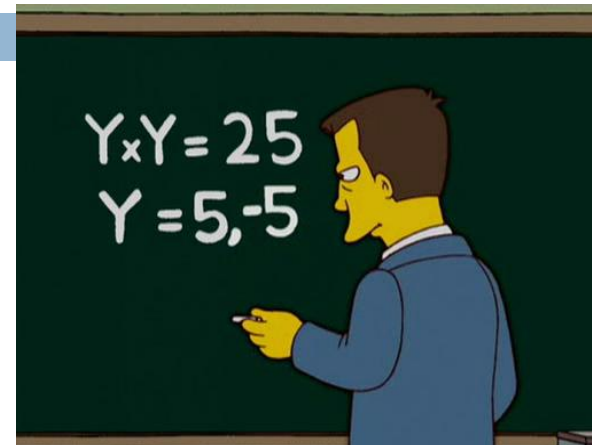
- What each player tries to achieve:
 - Employer: find out students' types.
 - Able students want to separate themselves from the challenged.
 - Challenged students want to mimic able students.
 - Cheap talk is not credible, all students will claim to be able.
 - Able students may use signaling strategies

Spence education model

Setting

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- Key assumption: Able students are more willing to take difficult courses than challenged students
 - For A-type: cost of each tough course is \$3,000 (low risk of failing the course)
 - For C-type: cost of each tough course is \$15,000



Spence education model

Hiring policy

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- Consider the following employer's policy:
 - Any student taking more than n tough courses is paid \$160,000.
 - Any student taking less than n tough courses is paid \$60,000.
- Assumption of the employer:
 - Any student taking at least n tough courses is assumed to be type A.
 - Any student taking less than n tough courses is assumed to be type C.
- Can this assumption be justified?

Spence education model

Hiring policy

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- A-type will try to take many tough courses to signal their ability, but so will C-type. However, taking courses is more costly for C-type.
- The employer assumption that only A-type will select to take n course may be correct if it is too costly for C-type to take n tough courses.

Spence education model

Incentive compatibility

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- C-type may “reveal their type” and take 0 tough course.
 - they are paid \$60,000.
- C-type may take n tough courses and pretend to be A-type:
 - $\$160,000 - \$15,000n$
- C-type prefer revealing their type to taking n tough courses if:

$$60,000 \geq 160,000 - 15,000n$$

$$\Rightarrow n \geq 6.67$$

Spence education model

Incentive compatibility

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- A-type prefer take n tough courses and prove their type if:

$$160,000 - 3,000n \geq 60,000$$

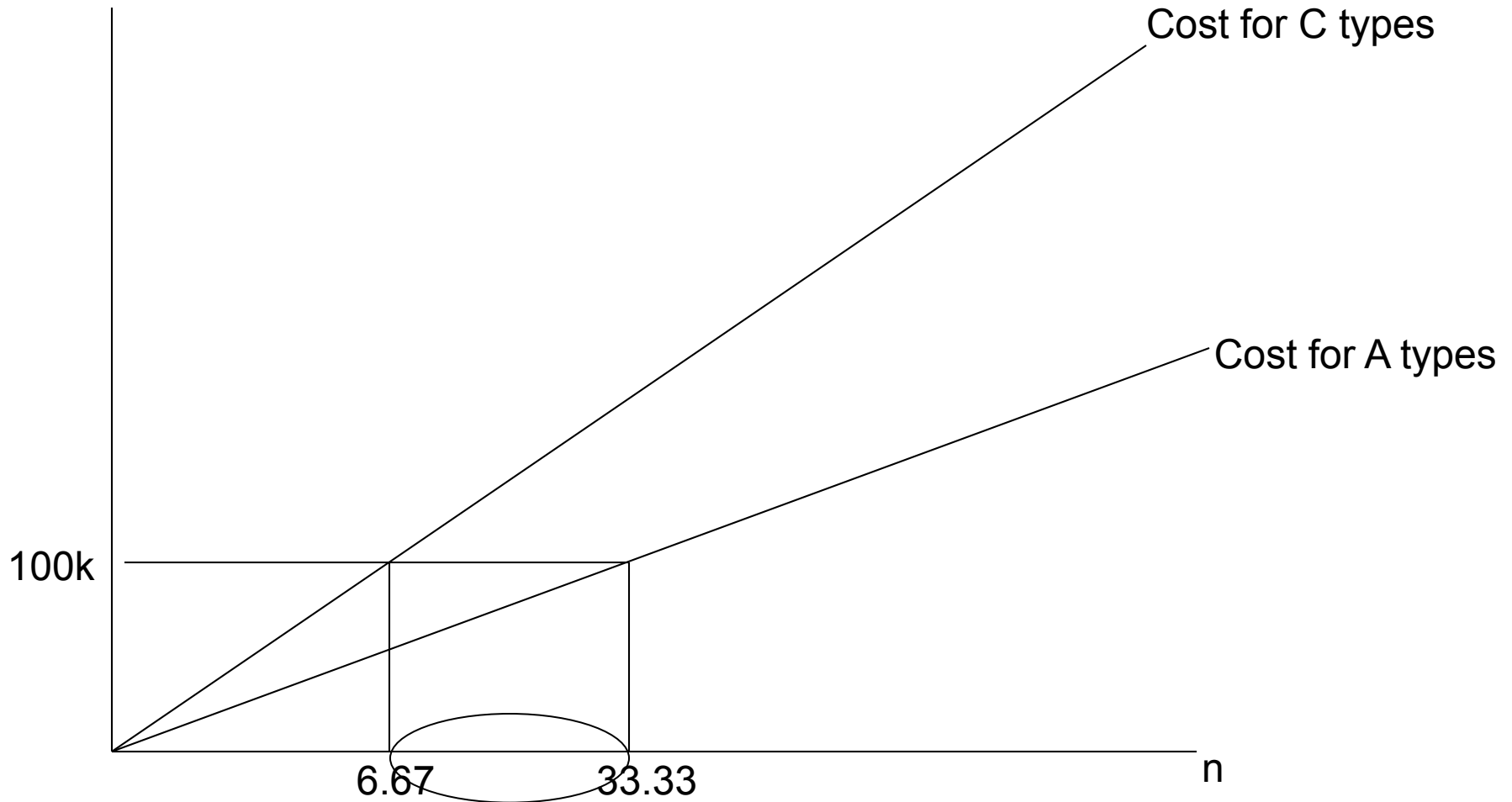
$$\Rightarrow n \leq 33.33$$

- In order to separate the two types:
 - The value of n must be set between 6.67 and 33.33.
 - A-type are willing to take more than n tough courses
 - C-type prefer taking less than n tough courses

Spence education model

Incentive compatibility

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Spence education model

Payoffs

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- Employers can set $n=7$.
 - A types choose $n=7$
 - C types choose $n=0$
- Intuition:
 - A-type can signal they type and separate themselves from C-type because the cost of tough courses is low to them.
 - C-type reveal their true types, because this is better than taking too many tough courses.
- Payoff for A= $160,000 - 7 * 3,000 = \$139,000$
- Payoff for C= $\$60,000$

Spence education model

Implications

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- A positive relationship between years of education and wages does not necessarily show that education improve skills.
- Instead, education can act as a screening device used to identify the ability of job candidates.
- Go to university to signal your ability, go to the best universities to send an even stronger signal on your ability.

Summary

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- Possibilities of manipulating information with cheap talk depend on whether players have aligned or conflicting interests.
- With incomplete information, players may manipulate information to obtain a favorable outcome: signaling.
- Signaling can be used to lessen the information asymmetries leading to adverse selection.
- Signaling can be used in the job market to signal your skills.