444 Lecture 12

Signals

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Day Plan

The Beer-Quiche Game

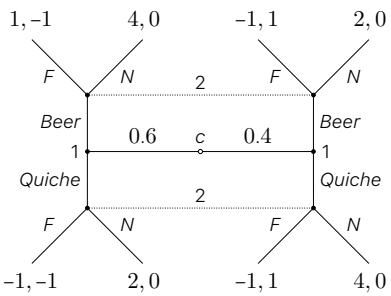
- Sender's car breaks down on the way to work, so he walks into a bar to wait somewhere while the repair truck comes. (I think in the 1985 version he's looking for a phone.)
- He quickly realises this is a rougher bar than he expected, and the patrons are all staring at him.

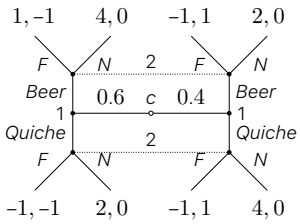
The Beer-Quiche Game

- Sender is smart, and he quickly realises that the patrons are both bullies and cowards. They're bullies, so they are looking for a fight, but cowards, so they won't fight a Tough Guy. And they think it's about 60% likely that he's a Tough Guy.
- Sender really wants to avoid a fight (whether or not he's a Tough Guy).
- He knows that if he just tries to leave, they will conclude that he too is a Wimp, so he better order something

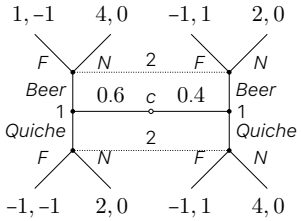
The Beer-Quiche Game

- His choices are beer or quiche.
- He knows that the patrons believe, correctly, that if he's a Tough Guy, he'd prefer beer, and if he's a Wimp, he'd prefer quiche.
- And while they can't read his character, they can hear his order.
- But he would also prefer not to get in a fight either way. Even Tough Guys have better things to do at 8 in the morning.

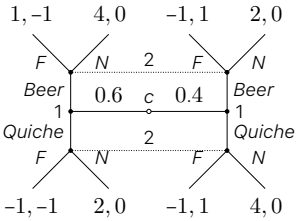




Sender gets (a) 3 points for avoiding fight; plus (b) +1 for liked order, -1 for disliked order.

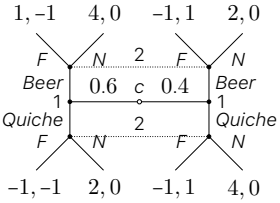


Hearer gets 1 point for fighting Wimp; -1 point for fighting Tough Guy.



Obvious Equilibrium

- Sender orders Beer if either Tough Guy or Wimp.
- Hearer doesn't fight if Beer, fights if Quiche.



Non-Obvious Equilibrium

- Sender orders Quiche if either Tough Guy or Wimp.
- Hearer doesn't fight if Quiche, fights if Beer.

Mathematical Puzzle

- What constraints on equilibrium selection can rule out the non-obvious explanation?
- Really fun puzzle if you like puzzles, but not for us.
- The initial statement of the puzzle, and an idea for a solution, is in Cho and Kreps, *Signaling Games and Stable Equilibrium*, QJE 1987.
- If you like puzzles in this area, I highly recommend that paper.

Our Lessons

- Nature may provide something like a 'character', or what Harsanyi called a 'type', to Sender.
- You don't have to think of this as some random event that occurs at a particular time, like the whimsical assignment of characters to the pre-infants in *Soul*.

Our Lessons (cont.)

- All that matters is that there is some feature of Sender that Sender knows and Hearer doesn't.
- Well, and that Hearer's probability distribution over the possible types of Sender is common knowledge; this game gets nasty if the initial probability for Tough Guy is under 0.5.

Our Lessons (cont)

- This is also a good example of a non-cooperative, but positive-sum, signaling game.
- And that's the kind of game that we're going to spend more time looking at in future lectures.

Day Plan

Beer and Quiche

Going to College

Honest Signaling

The College Game

- Sender is deciding whether to go to college.
- There are two attributes of Sender that we're going to be interested in.
- They are either a High Value or Low Value employee.
- They will either Like or Dislike college.
- Let's assume that these attributes are perfectly correlated: all and only the High Value employees Like college.

Features of College in this Game

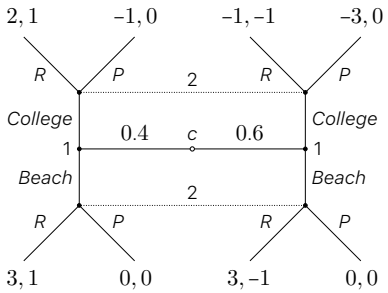
- College does not change anyone's value to employers - High Value employees are high value whether or not they go to college, and Low Value employees are low value either way.
- College is fun for people who Like it (i.e., the High Values), but it's not so much fun to be actually worth the expense. But it's a relatively minor overpay for the people who Like it, and both unbearable and exorbitantly expensive for those who Dislike it.
- I am *not* saying either of these are true, though I don't entirely disagree with the second.

The Hiring Decision

- Hearer is an employer who pays high salaries, but gets good value for this high salary from High Value employees.
- Unfortunately, they have literally no way of telling who is High Value and who is Low Value.
- All they know is that only 40% of people are High Value.

Payouts

- Everyone starts with 0 points, unless one of the conditions below is triggered.
- Sender gets 2 points if they get Recruited.
- They lose 1 point if they Like college and go to college.
- They lose 3 points if they Dislike college and go to college.
- Hearer gets 1 point if they Recruit a High Value Sender.
- They lose 1 point if they Recruit a Low Value Sender.



Some Notes

- In the original Spence game, Sender gets to choose how much to spend on education from a range. They have infinitely many choices, not just the binary College/Beach choice. This doesn't really affect the analysis.
- What is crucial is that education is more costly for Low Value employees.

Some Notes

- There are a lot of equilibria to this game, but the most natural is the separating equilibria, where Like/High go to college, and Dislike/Low go to the Beach.
- For reasons I don't know (but can guess about), the wikipedia page on signaling games is dire. This is odd because most of the game theory pages are really very good.

Plausibility

Here are some ways in which the model (or at least the separating equilibrium of the model) does seem to look a bit like the real world.

- College grads get paid a lot more than non-grads.

Plausibility

Here are some ways in which the model (or at least the separating equilibrium of the model) does seem to look a bit like the real world.

- It isn't immediately obvious how what we do here explains the higher pay.

Plausibility

Here are some ways in which the model (or at least the separating equilibrium of the model) does seem to look a bit like the real world.

- Yet there is a ton of demand for places in college (at least pre-pandemic), and obviously a lot of demand for college grads.

Plausibility

Here are some ways in which the model (or at least the separating equilibrium of the model) does seem to look a bit like the real world.

- College is more fun, i.e., less costly, for people with certain skills (perserverence, curiosity, writing/mathematical aptitude) that are independently valuable to employers.

Implausibility

But there are several ways in which the model does not seem particularly plausible.

- At least after a few weeks/months/years in the job, employers have some ability to tell who is High Value, so if education was purely a signal, it should wear off after a little while.

Implausibility

But there are several ways in which the model does not seem particularly plausible.

- The correlation between High Value and Liking college is a long way from perfect. At least in my day, the people who *really* liked college were not at all what I'd think of as High Value employees for most businesses.

Implausibility

But there are several ways in which the model does not seem particularly plausible.

- Even if the people who Dislike college really really hate calculus class, it's a little hard to see how they could hate it so much to turn down the college wage premium.

Day Plan

Beer and Quiche

Going to College

Honest Signaling

Signaling by Showing

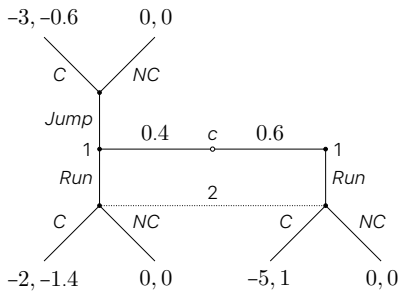
- Change the game so that what options Sender has is a function of what type Sender is.
- In the extreme case, one type of Sender has two options, the other has one.
- In this case, Sender doing the thing that only their type can do is called **honest signaling** or **indexical signaling**.

The Chase

- Sender sees that Hearer is trying to catch them, and it will be bad if Hearer succeeds.
- Maybe Hearer is a mugger, or maybe they are a cheetah and Sender is a springbok.
- Sender is either Strong or Weak.
- If they are Strong, they have the option of Jumping in the air before running away.
- This will slow them down, but will display their type to Hearer.

Payoffs

- Sender loses 10 if they are chased and get caught.
- Hearer gains 5 if they catch Sender; but they lose 3 if they chase and fail (this might be an opportunity cost).
- Fast sender has a 20% chance of being caught if they don't Jump, and a 30% chance of being caught if they Jump.
- Slow sender can't jump, and has a 50% chance of being caught.



Equilibria

- This one really looks like it should only have one equilibrium.
- If everyone does the same thing, i.e., Run, then Hearer's expected utility from Chasing is positive, so they will Chase everyone.
- But Fast Senders don't want this; they would prefer Jump plus No Chase to Run plus Chase.
- And if they Jump, Hearer will know it isn't worth Chasing.
- So the only sensible equilibrium is that Fast Senders Jump, and Hearer chases all and only Senders who Run (rather than Jumping).

College

- Could there be an honest signaling explanation of why there is a college wage premium?
- Maybe; it seems relevant that some people aren't admitted to college and others could not complete it.
- But I don't know what such an explanation could look like.

Can’t/Won’t

- In real life the boundary between a game where signaling is costly for one type and where it is impossible can be hard to draw.
- Especially for non-human animals, what exactly does it mean to say they could do something but choose not to because it is too expensive, rather than say that they can’t.
- And for humans, we don’t even consider some things to be viable options because they are prohibitively expensive.

Can’t/Won’t

- Are these cases where something is not an option, or where it is rationally not chosen for expense.
- It isn’t clear that much could, or should, turn on this.

For Next Time

- Next week we will look more closely at Iterated Prisoners’ Dilemma.
- The main reading is a long-ish ‘handout’ that I’ve posted to Canvas.