

444 Lecture 12

Signals

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February 16, 2023

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Day Plan

Beer and Quiche

Going to College

Honest Signaling

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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.

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The Beer-Quiche Game

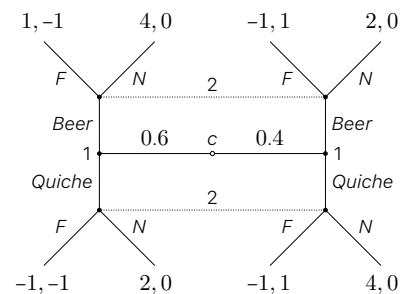
- Sender is smart, and he quickly realises that the patrons are both bullies and cowards. They're bullies, so they are looking for a fight, but cowards, so they won't fight a Tough Guy. And they think it's about 60% likely that he's a Tough Guy.
- Sender really wants to avoid a fight (whether or not 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

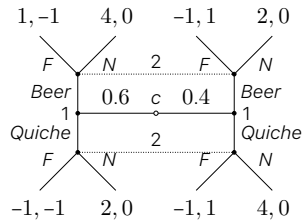
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The Beer-Quiche Game

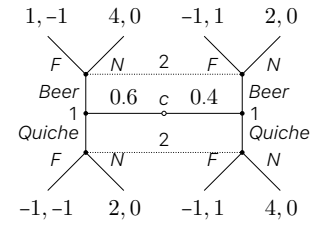
- His choices are beer or quiche.
- He knows that the patrons believe, correctly, that if he's a Tough Guy, he'd prefer beer, and if he's a Wimp, he'd prefer quiche.
- And while they can't read his character, they can hear his order.
- But he would also prefer not to get in a fight either way. Even Tough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

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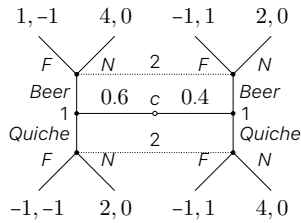




Sender gets (a) 3 points for avoiding fight; plus (b) +1 for liked order, -1 for disliked order.

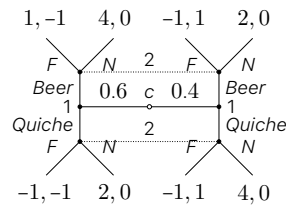


Hearer gets 1 point for fighting Wimp; -1 point for fighting Tough Guy.



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.

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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.

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Day Plan

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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.

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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.

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The Hiring Decision

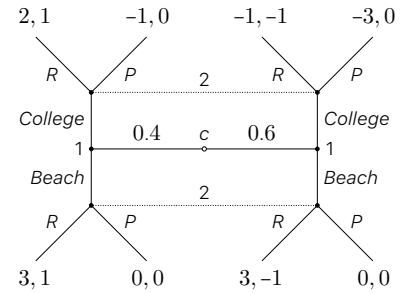
- Hearer is an employer who pays high salaries, but gets good value for this high salary from High Value employees.
- Unfortunately, they have literally no way of telling who is High Value and who is Low Value.
- All they know is that only 40% of people are High Value.

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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.

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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.

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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.

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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.

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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.

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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.

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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 (perseverance, curiosity, writing/mathematical aptitude) that are independently valuable to employers.

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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.

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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.

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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.

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Day Plan

Honest Signaling

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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**.

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The Chase

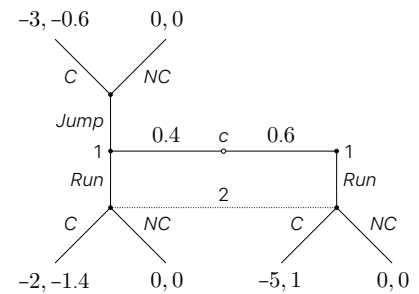
- Sender sees that Hearer is trying to catch them, and it will be bad if Hearer succeeds.
- Maybe Hearer is a mugger, or maybe they are a cheetah and Sender is a springbok.
- Sender is either Strong or Weak.
- If they are Strong, they have the option of Jumping in the air before running away.
- This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

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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.

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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).

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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.

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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.

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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.

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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.

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