PRINCIPLES OF BEHAVIORAL ECONOMICS

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Week 59

Lecture 59

Hello everyone, this is the course on Principles of Behavioral Economics and we are at lecture 59. In the last two modules, we were discussing behavioral games, and under that, we basically discussed the ultimatum game and one variant of it. Namely, the dictator game. In this module, I am going to speak a little more on the ultimatum game and then move on to public goods games. So here in the previous module while we ended we were discussing certain factors or group of variables which can be considered or categorized in different buckets

and their culture played one important role. So here, we are going to present some examples of how, culturally, the outcomes of the ultimatum game may vary. We begin with the example where we are considering farmers from Kenya and students from the US. And we'd like to see how farmers in Kenya and students in the US played the ultimatum game. In order to do that,

we can have a look at the following figure. Here we are measuring the fraction of the pie offered by the proposer to the responder. So it can be 0%, 10%, 20%, 30%, 40%, or 50%. And on the vertical axis, we are measuring fraction of respondents who would accept the offer.

So understandably, we can see that 0 offer was not accepted by either the farmers or the students. But the blue bars represent students of Emory University in the US and the red bars are farmers from Kenya. And you can see that the acceptance percentage is consistently higher for the students from the US compared to the farmers from the Kenya from Kenya for example when it comes to 10% when 10% are offered by the proposers to the respondents then very small percentage may be something like 4% or so even 10% was acceptable to a substantial percentage of students from the US, like more than 50%.

It is nearly 60%. Similarly, for all fractions of or all percentage of offers proposed, we can see that students' bars are pretty much taller, up to 30%. When it comes to 40%, Then

Kenyan farmers are accepting more as compared to the students and of course when it is 50% then 100% accepts. That is considered to be a fair distribution in any culture.

The height of each bar as suggested indicates the fraction of responders who are willing to accept the offer indicated on the horizontal axis. Offers of more than half of the pie were acceptable to all of the subjects in both countries. So this is the 50% as you would expect. Notice that the Kenyan farmers are very unwilling to accept low offers, presumably regarding them as unfair, while the US students are much more willing to do so. For example, virtually all 90% of the farmers would say no to an offer of one-fifth, that is, 20% of the pie, while 63% of the students would accept such a low offer.

So, 63% accepted a low offer as low as 20%. So, broadly, we observe that farmers are more believers in fairness. So, that is why we call them fair farmers, while students are self-interested. They are self-regarding. Their results are more akin to what is predicted by classical or analytical game theory.

Whatever is offered is better than zero. So, students act more like self-interested individuals compared to the farmers. More than half of the students would accept just 10% of the pie. So, this is—you can see—just 10% of the pie, but almost none of the farmers would. Although the results indicate that attitudes differ toward what is fair and how important fairness is, nobody in the Kenyan and US experiments was willing to accept an offer of zero,

even though by rejecting it, they would also receive zero. So basically, they should be indifferent between accepting and rejecting it. Nevertheless, nobody accepted it. So that broadly was the observation or where the observations from this experiment conducted across Kenya and US considering farmers and students, how their behavior varied not only across different culture and countries, also their social status,

social status, educational status, or professional status, and we observed significant differences in their behavior. Next, we talk about something called the punishment game. Basically, we already introduced peer punishment while discussing, or we would be talking about peer punishment while discussing the public goods game. Here, just a brief discussion on the punishment game. The game involves asking a student the following.

You have been paired with two students who played the dictator game. So, two different students who played the dictator game previously, one we are calling E, who divided the money evenly. So, while playing the dictator game, this individual divided the money evenly, while the other, we are calling him— U, divided the money unevenly so basically while playing the dictator game these two individuals were dictators. Previously one offered an even split, the other offered an uneven split. Now he took $18 and gave his counterpart $2 we are talking about this individual, U.

So, the uneven split was $18 kept for himself and only $2 was offered. While the individual we are calling E basically went for an even split, in the sense, kept $10 for himself and $10 for the responder. You have the following choice. Would you like to evenly split $12 with U or $10 with E? So you are asked to split, make a choice between splitting $12 evenly with U.

That is you are going to get $6 and U is going to get $6. Or the other option is to split $10 with E where you are going to get $5 and E is going to get $5. Fully 81% of the subjects chose to share $10 with a fair allocator rather than $12 with an unfair allocator. Now, see here that most people—a majority, actually a large majority of 81%—chose to split evenly with E, who is considered a fair allocator. And this is despite the fact that when you choose to split evenly with E, it implies a loss for you, because here you are going to get only $5, whereas here you would get $6.

There is clear evidence that people dislike unfair offers and are willing to take a financial hit to punish those who make them. So, having said that, we now discuss public goods games. Many people around the world face social dilemmas and the problem of free riding. These concepts have already been discussed in the previous modules. For example, as in Spain, many farmers in Southeast Asia rely on shared irrigation facilities to produce their crops.

The system requires constant maintenance and new investment. Each farmer faces the decision of how much to contribute to these activities. These activities benefit the entire community, and if a farmer does not volunteer to contribute, others may do the work anyway. Imagine there are four farmers deciding whether to contribute to the maintenance of an irrigation project. For each farmer, the cost of contributing to the project is $10.

So, we are now explaining the game where each farmer needs to contribute $10. But when one farmer contributes, all four of them will benefit from an increase in their crop yields made possible by irrigation. So, they will each gain $8. Contributing to the irrigation project is called a public good. When one individual bears the cost to provide the good, everyone receives a benefit.

This is how we broadly define public goods. Public goods are all around us, as you can see that a lot of infrastructure provided by the government using taxpayers' money are examples of public goods. So, basically, the government does not have many sources of earnings. One important source of earnings is taxation. So, we pay taxes—you know, we pay direct taxes as well as indirect taxes.

So when we willingly pay taxes, then we are basically contributing to government exchequer where this money is going to be utilized for many purposes. One such important purpose is to provide infrastructure, including public goods. A good that, when used by one person, does not reduce its availability to others is known as a public good. For example, roads are the most common example of public goods. And as we say, this is a good which, when used by one person, does not reduce its availability to others—in the sense that if I walk on a road,

That doesn't mean that others cannot take the road or others cannot use the road, walk on the road, drive on the road, and things like that. Two properties of public goods are, first of all, public goods are non-excludable. Once a public good is provided, individuals cannot be effectively excluded from its use. So, as we know, most roads are available for the public to use, and that's why there is this property of non-excludability. And the second one is that public goods are non-rivalrous.

That is, use by one individual does not reduce availability to others. As I just mentioned, when I drive on a particular road, it does not mean that others cannot drive on it, cannot walk on it, cannot ride their bicycles, or cannot stand on it. There are people who sell things on the roads and do various other kinds of activities. So, two very important things. Properties of public goods are, first of all, they are non-excludable, and the second one is that they are non-rivalrous.

Also, this implies that use by one individual does not actually reduce the amount available for others to use. The road remains the same. It is not that if I am walking on it, the road shrinks in size, because of which others cannot use it. A related problem is of free ride which we probably have already talked about previously which basically tells us that benefiting from the contributions of others to some cooperative project without contributing oneself.

For example, environmental protection and public goods contributions are actually very good examples of free riding. There are many people, individuals, and organizations in India who try to evade taxes. Evading taxes actually is a very good example of free riding in the sense that everybody uses these public goods. But then those who are evading taxes, they are actually not contributing actively or denying to contribute actively to the creation of these public goods. So basically they are free riding on others.

Some people are contributing to the formation of these public goods and some are not. But then they are used by everybody because public goods are non-excludable and non-rivalrous. So that's how creation of public goods is a problem. And most often they are undertaken by the government because otherwise creating them is not profitable for private organizations or companies and then there is of course this problem of free riding.

Now consider the decision facing Kim, one of the four farmers. So we are now going back to the public goods game. We talked about farmers. The farmers need to contribute $10 each to the formation of some public goods. That's of course voluntary.

One may contribute, one may not contribute. But if one contributes, then that provides also benefits to the other. So if I contribute, being a farmer, $10, then that would accrue benefit of $8 to each of the farmers. Suppose there are only four farmers in the community, and one such farmer is called Kim.

The figure below shows how her decision depends on her total earnings but also on the number of other farmers who decide to contribute to the irrigation project. So, here we are denoting Kim's payoff if she contributes by the blue bars and by red if she does not contribute—Kim's payoff if she does not contribute. So, for example, if nobody contributes—no farmer contributes— and only Kim contributes, then what happens is that Kim personally gets a benefit of $8 while she contributed $10. So, $8 minus $10 makes it a benefit of minus $2.

So, this is how you can say that when nobody contributes, but Kim contributes, then her benefit—Kim's payoff measured on the vertical axis—is minus 2. Now consider the situation where one farmer contributes. Let us consider the red bar, of course, only when one farmer contributes and Kim does not contribute. Then Kim gets a benefit of $8, so this is how Kim gets a benefit of $8.

Now, if suppose one farmer contributes and Kim is also contributing, in that case, the benefit is $8 multiplied by two people—other than, basically, including Kim two people are contributing. So the benefits are $8 multiplied by 2, which is basically $16, and then Kim contributed $10. So, minus 10 makes it $6. In a similar fashion, We can calculate Kim's payoffs when two farmers contribute and three farmers contribute. And these are situations when we are considering the blue bars; then, of course, we are including Kim. So, these are contributions by two farmers other than Kim. These are also contributions by two farmers other than Kim. So, let us consider the third one.

If two of the others contribute, so we are talking about this column, Kim will receive a benefit of $8 from each of the contributions. So, that is why it is $16. But if she makes no contribution herself, her total payoff, shown in red, is $16. But if she herself also contributes, then that will be $8 multiplied by 3 minus $10, her contribution, so that makes it $14. If she decides to contribute, she will receive an additional benefit of $8, but she will incur a cost of $10, so her total payoff is $14.

Whatever the other farmers decide to do, Kim makes more money if she doesn't contribute than if she does. Not contributing is a dominant strategy. You can see that the height of all the red bars are actually greater than the blue bars, which implies that Kim is always benefited more by not contributing.

So that is why not contributing is a dominant strategy. She can free ride on the contributions of the others and this is the social dilemma. This is also extremely prevalent in large number of countries. The problem of free riding. And this is the problem of social dilemma.

This is a prisoner's dilemma with multiple players. The dominant strategy equilibrium is where no one contributes and their payoffs are all zero and irrespective of what others do, each farmer does better by free riding on the others. Altruism helps since if all contributed, each would get $22. I just briefly go back to this one. So, if all of them had contributed, then all of them would get $22.

Though the dominant strategy is never to contribute, but if you do not know whether others are contributing or not, you definitely do not contribute. But if you know that others are also going to contribute, then of course, not contributing gives you more money, but then as you will see that people would also like to punish you. So in that case, contributions from everyone or everyone contributing is basically the best possible solution. So that's why we say that each would get $22.

But if large numbers of people are involved in a public good scheme, it is less likely that altruism will be sufficient to sustain a mutually beneficial outcome. Yet, around the world, real farmers and fishing people have faced public goods situation in many cases with great success. The evidence gathered by Eleanor Ostrom, a political scientist, and other researchers on common irrigation projects in India, Nepal, and other countries shows that the degree of cooperation varies. In some communities, a history of trust encourages cooperation. In others, cooperation does not happen.

So historically, if communities are cooperating with each other, then of course that continues. But then there are situations where cooperation does not happen. In South India, for example, villages with extreme inequalities in land and caste status had more conflicts over water usage. Less unequal villages maintained irrigation systems better. It was easier to sustain cooperation.

So basically, as we have social systems where there is discrimination on the basis of race, caste, and all, if there is more discrimination, then there is less cooperation. So villages having less discrimination experienced more cooperation and were observed to maintain their irrigation systems better. Now, what if we introduce repetition in the public goods scheme? Free-riding today on the contributions of other members of one's community may have unpleasant consequences tomorrow or years from now.

Ongoing relationships are an important feature of social interactions that were not captured in the models we have used so far. Life is not a one-shot game. So, as we are trying to tell you here, in a village community, one has been living there for ages and will also have to live there for several years coming forward or going forward. So, the point is that cooperation is actually very important.

You cannot live in a not-so-amicable environment. You understand that cooperating with each other is actually beneficial. So, that is why people would cooperate with each other because they would see that in the long term cooperation is going to give you more payoffs. An experiment demonstrates that people can sustain high levels of cooperation in a public goods game as long as they have opportunities to target free riders

once it becomes clear who is contributing less than the norms. So first of all, you are willing to cooperate because you understand that cooperating, at the end of the day, benefits all of you together or all of us together. And the second point is that in repeated games, if we can punish the individuals who are not cooperating, then that is also one way of making everyone do the same thing. So everyone contributes to the public good scheme. Most people contribute to the public good scheme and ensure cooperation from most individuals.

Laboratory experiments that mimic the costs and benefits of contributions to public goods in the real world were conducted in cities around the world. In each experiment, participants played 10 rounds of a public goods game. In each round, the subjects were given $20. They were randomly sorted into small groups of four people who did not know each other. They were asked to decide on a contribution from their $20 to a common pool of money.

The pool is a public good. For every dollar contributed, each person in the group receives $0.40, including the contributor. So there is a 40% gain for each dollar contributed. Imagine that you are playing the game and you expect the other three members of your group each to contribute $10. Then if you don't contribute, you will get $32.

So basically, in the group, everybody is contributing. If everybody contributes $10, that is other three members contribute $10, then 40% of $10 is $4. You are getting $12 of benefit from each one of them and you are initially getting or you are initially given $20. So that makes it a benefit of $32 when you are not contributing. If you happen to contribute, then what happens is then your benefit would be basically it would be $16 from all of you and then $10 because you have also contributed $10.

So, you are left with $10 that makes it $26. So, the others pay $10. So, they only get $32 minus $10, $22 each. On the other hand, if you also contribute $10, then everyone including you will get $22 plus $4, another way of arriving at $26.

Basically, each one of you are going to get $26. So, again, the same point, if you do not contribute, your payoffs are always higher, provided that others are contributing. And in that case, others will have lower payoff. But if all of you contribute, then all of your payoffs increase. Of course, that is lower than the situation when others contribute, but you do not.

unfortunately for the group you do better by not contributing that is because the reward for free riding $32 is greater than for contributing which is $26 and the same applies to each of the other members. After each round, the participants are told the contributions of other members of the group. The experiment demonstrates that people are definitely not solely self-interested; there are altruistic behaviors, so people are willing to contribute to the public goods. In every population where the game was played, contributions to the public good were high in the first period, although much more so in some cities, for

example, Copenhagen than in others like Melbourne. So, I am now going to show you the graph of that. So, these are the large number of cities where the game was played. We have at the top Copenhagen, where the initial contribution was very high. So, it was nearly, you know, $15 out of the initial $20.

And then Melbourne is probably the one with the lowest amount, which is roughly $8. But then there are many cities which have contributions like $10. For example, Chengdu in China began with a $10 contribution. What is more important to notice is that in the initial period, the contributions were higher, and as they played the game repeatedly, contributions decreased because there were always some free riders, and you can punish the free rider by not contributing.

So that is how it happened. This is remarkable. If you care only about your own payoff, contributing nothing at all is the dominant strategy. The high initial contributions could have occurred because the participants in the experiment valued their contribution to the payoffs more than others received. They were altruistic.

But the difficulty, or the tragedy, is obvious. Everywhere, the contributions to the public good decreased over time. Nevertheless, the results also show that, despite a large variation across societies, most of them still have high contribution levels at the end of the experiment. The most plausible explanation of the pattern is not altruism. It is likely that contributors decreased their level of cooperation if they observed that others were contributing less than expected,

and were therefore free-riding on them. So, basically, the idea was to punish the free riders, because of which the contributions decreased. It seems as if those people who contributed more than the average liked to punish the low contributors for their unfairness or for violating a social norm of contributing. Since the payoffs of free riders depend on the total contributions to the public good, the only way to punish free riders in the experiment was to stop contributing.

This is the tragedy of the commons. Many people are happy to contribute as long as others reciprocate. A disappointed expectation of reciprocity is the most convincing reason that contributors fell so regularly in later rounds of this game. To test this, peer punishment was introduced, as individual players could punish other players by making them pay a $3 fine. So now we are introducing the concept of peer punishment.

You can punish the free riders by making them pay a fine of $3. The punisher remained anonymous but had to pay $1 per player punished. So, if you want to punish two players, you have to pay $2 additionally to punish each one of them. Now, this is the graph once peer punishment was introduced. Now, you can see that things have changed.

It is no longer downward sloping. If something started at five, it remained roughly, or maybe six, it remained roughly at six or slightly higher than that. This is Athens, and similarly, Copenhagen again, we have it nearly at the top. This is the second line, Copenhagen, and of course, we observe that for some countries there has been some upward trend also, for example if we consider this one Chengdu again.

They began somewhere from 7 or 7.5, but then the line has gone upward. In a similar fashion this yellow line, Seoul also experienced increase in contributions where peer punishment was introduced. For the majority of subjects, including those in China, South Korea, Northern Europe, and the English-speaking countries, contributions increased when they had the opportunity to punish free riders. That's exactly what we observed. People who think that others have been unfair or have violated a social norm may retaliate even if the cost to themselves is high.

Their punishment of others is a form of altruism because it costs them something to help deter free-riding behavior, which is detrimental to the well-being of most members of the group. This experiment illustrates how, even in large groups of people, a combination of repeated interactions and social preferences can support high levels of contributions to the public good. The public goods game, like the prisoner's dilemma, is a situation in which there is something to gain for everyone by engaging with others in a common project, such as pest control, maintaining an irrigation system, or controlling carbon emissions.

But there is also something to lose when others free ride. Next, we talk about altruistic preferences in the prisoner's dilemma. We have already discussed that altruism probably does not solve the problem when there are a large number of participants. It is actually not a solution to social dilemmas many times. We will talk about the summary later also.

But for the time being, I will briefly talk about how the prisoner's dilemma or how the outcome in the prisoner's dilemma may change when we include altruistic preferences. For that, I bring in one game where there are two individuals, we call them A and B. Player 1 is A, player 2 is B. Now, they are farmers and their harvests are going to be destroyed by some pests. So, they need to do some treatment to their fields. There are two alternatives.

One is an integrated pest control system, and the other one is using a chemical called Terminator. So there are certain characteristics of these treatments that are mentioned here. IPCs or integrated pest control systems are treatment where beneficial insects spread over both fields, eliminate pests and there is no water contamination. Now if one of them use IPC and the other one uses Terminator then what happens is that the chemicals in the

Terminator spread to the other's field also who is using IPC and kills his beneficial insects as well. There is limited water contamination.

So is the case when one individual uses Terminator and the other uses IPC. And when both of them use Terminator, then what happens? It eliminates all pests, but there is heavy water contamination, and that requires a costly filtration system. So, these are the basic characteristics of IPC and Terminator. Now, Terminator is inexpensive relative to IPC.

IPC is more expensive. These are the payoffs or possible payoffs when these two individuals are using IPC and Terminator. If both of them use IPC, then they get a payoff of 3-3. This is beneficial, but since it is expensive, the payoffs are at 3-3 compared to when A is using IPC and B is using Terminator.

		B	
		IPC	Terminator
A	IPC	3, 3	1, 4
	Terminator	4, 1	2, 2

So this is the payoff. These are the payoffs. A's payoff is lower because he used an expensive treatment, but the good insects were all killed. As a result, that became ineffective. At the same time, there would be some water contamination, though limited.

So, from the use of cheap chemicals like Terminator, B is definitely benefiting because water contamination is less. Terminator is also inexpensive, but A experiences huge losses, and that is why the payoff is lower at 1, while B's payoff is higher at 4. Similarly, if A uses Terminator, he gets 4, and if B uses IPC, he gets 1. If both of them use Terminator, their payoffs are 2-2 because Terminators are inexpensive, but they also require a heavy water filtration system.

So, overall expenses may go up. A's best response is Terminator, and so is B's. So, now if you try to find the Nash equilibrium, you would find that Terminator-Terminator is always the Nash equilibrium. So, both of them are better off by using Terminator. When A uses IPC, B is better off using Terminator.

When A uses Terminator, again B is better off using Terminator. In a similar fashion, for each strategy of B, A is always better off using Terminator. So, that is why Terminator is the best response of A to B and B to A. But both could be better off by choosing IPC-IPC because Terminator gives a payoff of 2, 2, while IPC-IPC gives a payoff of 3, 3. When A and B wanted to get rid of pests, they found themselves in a prisoner's dilemma.

One reason for the unfortunate outcome was that they did not account for the costs that their actions inflicted on the other. The choice of pest control regime using the insecticide implied a free ride on the other farmers' contributions to ensuring clean water. If A cares about B's well-being as well as his own, the outcome can be different. So now we are bringing in the concept of altruism. You are not caring only about yourself but about the other individual also.

So these vertical lines are basically the indifference curves when A is completely selfish. If you remember, when A is selfish, then 4, basically using Terminator, is one strategy when B is using IPC. And 2, when both of them are using Terminators. And these are indifference curves when A is somewhat altruistic. So, when A is taking into consideration the possibility of what to do or taking into consideration the payoff of B as well, which is measured on the vertical axis,

then the indifference curves are basically downward sloping. Here, I have one point where both of them are using IPC, IPC. And that is certainly superior to the point where both of them are using terminator-terminator, a 2-2 combination. The feasible set has 4 points. So, these are basically, this is the feasible set which has 4 points: IT, TI, TT, and II.

The movements upward and to the right from TT to II are win-win. Both get higher payoffs. On the other hand, moving up and to the left or down and to the right from IT to TI or the reverse are win-lose changes. These are win-lose changes because if one wins, the other loses. If A is making a profit, B is basically losing.

If B is making a profit, then A is losing. If both cared for the other's loss, then they would choose IPC and both would have been better off. The main lesson is that if people care about one another, social dilemmas are easier to resolve. This helps us understand the historical examples in which people mutually cooperate for irrigation or enforce the Montreal Protocol to protect the ozone layer rather than free-riding on the cooperation of others.

With this, I conclude this module on a few other behavioral games, for example, the public goods game. These are the references used. And in the next, we will conclude behavioral games as well as strategic interactions with a discussion on trust games. Thank you.