Experiments in Economics
Playing Fair with Money

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Introductory remarks

- I would like to begin by thanking Senior Associate Dean Jilnaught Wong for the introduction

- I would also like to express my gratitude to Dean Greg Whittred and to Jilnaught Wong for their support over the past few years

- A big thank you to the Business School Events Team – Mandy, Melanie and Beth - for all their good work

- And thank you all for coming along for this talk
Introductory remarks

• This talk is meant for a general audience but it is, after all, an academic lecture and there will be some graphs and charts; but I will explain them carefully as I go along.

• But please feel free to ask questions during the presentation, especially if something is not clear.

• The kinds of things I will talk about are quite interdisciplinary in nature and I would love to hear from you about thoughts, ideas or possibilities for collaboration.

• If you could please shut off your cell phones or put them on silent mode for the duration of the presentation that would be great.
Overview of my research

• I use experiments with human participants to understand decision-making in an economic context

• especially in situations that involve strategic decision making, where what happens to one person’s monetary payoff is determined jointly by her actions and the actions of other members of her group

• Economists typically rely on the tools of game theory to understand decision making in such contexts
Overview of my research

• This type of work has overlaps with research in other disciplines, particularly social psychology

• but with some crucial differences in the methods adopted

• Economic experiments are often derived from theoretical models of behaviour

• Economists emphasize extrinsic incentives and typically pay the participants; the amounts they earn depend on the decisions they make during the experiment

• Economists do not use deception
Overview of my research

• A major strand of my research

  – how do social norms and norm-driven behaviour – such as preferences for fairness, generosity, trust and reciprocity – impact upon a variety of economic transactions

  – The context being the maintained assumption of “rational self-interest” in much of the game theoretic literature
Overview of my research

- A lot of my work in this area focuses on social dilemma games (viz. prisoner’s dilemma, voluntary contributions to charity etc.) where there is tension between co-operation and self-interest

- These are situations where cooperation makes society as a whole better off; yet the individually rational course of action is to behave in a self-interested manner
One major output from this line of work

- *Experiments in Economics: Playing Fair with Money*

- *published by Routledge (London and New York), January 2009*
One major output from this line of work

• Provides an easy to follow guide – suitable for a general audience - to economic experiments, specifically those that explore notions of fairness, altruism and trust in economic transactions.

• how these findings can influence the way we approach economic problems such as pricing by firms, writing contracts between parties, making voluntary contributions to charity or the provision of micro-credit to small entrepreneurs.
One possible way of figuring out economic laws ... is by controlled experiments. ... **Economists (unfortunately)** ... *cannot perform the controlled experiments* of chemists or biologists because they cannot easily control other important factors. Like astronomers or meteorologists, they generally must be content largely to observe.” (Samuelson and Nordhaus, 1985, p. 8)
Experiments in Economics
A Brief History

• In some ways it is precisely this view of economics that is being challenged

• It was not until the last two decades of the 20th century that experimental economics really became a part of the mainstream.

• Prior to that economics was viewed as an essentially non-experimental discipline.

• This is in contrast to a long tradition of experiments in psychology.
Nobel Prize in Economics, 2002 went to Daniel Kahneman and Vernon Smith
Nobel Prize in Economics, 2002

• The Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel 2002

• Vernon Smith: “for the use of laboratory experiments as a tool in empirical economic analysis, in particular, for the study of different market mechanisms”.
  – “Pioneer” of experimental economics.

• Daniel Kahneman: “for the introduction of insights from psychological research into economics, in particular with regard to judgements and decisions under uncertainty”. Kahneman’s research is based on psychological experiments and questionnaires.
  – “Pioneer” of behavioral economics.
Cooperation in a social dilemma

An experiment with a public goods game
A public goods game

• Here is the key point

• Any amount that is contributed to the public account

• is **Doubled**

• and *re-distributed equally among all four*
What would you do in this situation?

Let’s find out…
Suppose everyone puts $5.00 into the public account. $5.00

Doubled to $40.00

Redistributed equally gives everyone $10.00.
A public goods game

• Analogous to a multi-person Prisoner’s Dilemma game

• From society’s point of view the best outcome is for each player to invest all $5 into the public account

• A total of $20 which gets doubled to $40

• Each player gets back $10; 100% return on investment
A public goods game

- But self-regarding behaviour suggests otherwise.

- Suppose I contribute $1 into the public account; and suppose no one else puts in anything...

- $1 gets doubled to $2.

- Redistributed equally: $0.50 for each member.

- I lose $0.50 while the others, who have not contributed anything, gain $0.50.
A public goods game

• Rational self-interest suggests that an individual player has no incentive to contribute

• *Economists refer to this as “free-riding”*
Example: From Catch 22 by Joseph Heller

- Sharing a tent with a man who was crazy wasn’t easy but Nately didn’t care. He was crazy, too, and had gone every free day to work on the officers’ club that Yossarian had not helped build.

- Actually, there were many officers’ clubs that Yossarian had not helped build, but he was the proudest of the one on Pianosa. It was a sturdy and complex monument to his powers of determination. Yossarian never went there to help until it was finished; then he went there often, so pleased was he with the large, fine, rambling shingled building. It was truly a splendid structure, and Yossarian throbbed with a mighty sense of accomplishment each time he gazed at it and reflected that none of the work that had gone into it was his.
A public goods game

• But if everyone thinks like that, no one will contribute as everyone tries to free-ride!

• *Economists suggest that the inevitable outcome of this process is zero contribution!*
“Suppose we let you pick your missions and fly milk runs,” Major Major said. “That way you can fly the four missions and not run any risks.”

“I don’t want to fly milk runs. I don’t want to be in the war any more.”

“Would you like to see our country lose?” Major Major asked.

“We won’t lose. We’ve got more men, more money and more material. There are ten million people in uniform who can replace me. Some people are getting killed and a lot more are making money and having fun. Let somebody else get killed.”

“But suppose everybody on our side felt that way.”

“Then I’d certainly be a damned fool to feel any other way. Wouldn’t I?”
Problems of cooperation

- Voluntary contributions of money and/or effort to charitable causes
- Cooperative hunting and warfare
- Exploitation of common pool resources
- Clean environment
- Teamwork in organizations
- Collective action
- Voting
Problems of cooperation

- Public goods (non-rival and non-excludable)
  - National Defense
  - Highways
  - Public Parks, schools and hospitals
- Cannot be provided on the basis of voluntary contributions
- Must be financed in other ways
  - such as tax revenue
So what did you decide?

Are you Yossarian or are you Nately?
A typical pattern of contributions when the game is played ten times with a known end-point

Chaudhuri & Paichayontvijit (2006)
A public goods game

• So there is good news and bad news…

• Clearly people are not as self-interested as the theory suggests, given that contributions are high in the beginning

• But over time, self-interested behaviour becomes more pronounced and free-riding increases
A public goods game

• There are actually *two separate* questions here

• Why do the contributions decay over time?

• How can we sustain cooperation by reducing free-riding over time?
Why do people do what they do?

• Not everyone contributes in the middle to start with

• Some people contribute everything at the beginning while others contribute less

• Some contribute nothing from the very beginning
Why do people do what they do?

• Why do people cooperate at the beginning and free-ride later?

• If they are going to free-ride why do they not start to do so immediately?

• Why do contributions start around 40% - 60%?
Why do people do what they do?

• We have already argued that free-riding is the self-interested course of action
  – So maybe that is easier to understand

• But how about the ones who contribute a lot?
  – Are they being purely altruistic?
  – That is, do they contribute because they care about the welfare of others?
The role of beliefs and conditional cooperation

- It turns out that the motivation behind cooperation is far more nuanced than (unconditional) altruism.

- People are \textit{conditional cooperators}.

- Beliefs regarding the actions of fellow group members play a crucial role.
The role of beliefs and conditional cooperation

- Fischbacher, Gächter and Fehr (2001)
- Players are asked to choose
  - An *unconditional contribution*
  - A *conditional contribution*, i.e., for *every given average contribution of the other members* they decide how much to contribute.
    - A selfish player is predicted to always choose a conditional contribution of zero.
The role of beliefs and conditional cooperation

• After this players play the actual game
• Some are free to choose any contribution regardless of what they said they would choose
• But, some others, picked randomly, have to contribute what they said they would contribute based on others’ contributions
  – This means…
Diagram showing the relationship between the average tokens contributed to the public account by the other group members and the participant's own contribution. The line indicates free riders, while the 45 degree line represents equal contributions.

Fishchbacher, Gächter and Fehr, (2001); Chaudhuri and Paichayontvijit (2006)
Average tokens contributed to the public account by the other group members

Participant's own contribution (in tokens)

Fishchbacher, Gächter and Fehr, (2001); Chaudhuri and Paichayontvijit (2006)
Hump-shaped
Strong Conditional cooperation
Free riding
45 degree line

Average tokens contributed to the public account by the other group members

Fishchbacher, Gächter and Fehr, (2001); Chaudhuri and Paichayontvijit (2006)
Hump-shaped Strong Conditional cooperation
Free riding Weak conditional cooperation
45 degree line

Average tokens contributed to the public account by the other group members

Fishchbacher, Gächter and Fehr, (2001); Chaudhuri and Paichayontvijit (2006)
Implications of conditional cooperation

• Across many studies, a plurality of participants are *conditional cooperators*

• But conditional cooperators can have optimistic beliefs or pessimistic beliefs

• In order to enhance cooperation one must generate beliefs that are optimistic about others’ contributions
Implications of conditional cooperation

• This in turn suggests one reason why contributions may decay over time
• Those with optimistic beliefs start out with high contributions…
• But over time they begin to understand that there are others who are contributing less…
  • Maybe because they have pessimistic beliefs…
• Inducing the optimists to reduce their contribution over time
  – But this view has been challenged in a recent paper and is an open research question
Manipulating feedback in a public goods game

• Groups of 4 play a public goods game for 24 rounds with 10 tokens in each round

• In one treatment, they **do not get any feedback** about others’ contributions or their own earnings; in other treatments they get feedback as usual

• Participants classified into three groups (based on their *prior* beliefs about others’ contributions)
  – **Optimists** (others will contribute 7 tokens or more)
  – **Realists** (others will contribute 4 - 6 tokens)
  – **Pessimists** (others will contribute 3 tokens or less)
Pattern of contributions over time

No feedback treatment; Virtually no decay in contributions

Chaudhuri and Paichayontvijit (2010)
Pattern of contributions over time

Chaudhuri and Paichayontvijit (2010)
Contributions in the no feedback treatment by the three types

- **Optimists**

Chaudhuri and Paichayontvijit (2010)
Contributions in the no feedback treatment by the three types

Chaudhuri and Paichayontvijit (2010)
Contributions in the no feedback treatment by the three types

Chaudhuri and Paichayontvijit (2010)
Role of communication

Isaac and Walker (1988)
Dawes, McTavish and Shaklee (1977)
Role of communication

Communication No communication

Percentage Contributions to the Public Account

Rounds
Altruistic punishments  
Fehr and Gächter (2000, 2002)

• Stage 1: typical public goods game
• Stage 2: Punishment opportunity
  – Subjects are informed about each member’s contribution.
  – Subjects can punish other group members

• *Punishments are costly!*
  – Eg. If you are willing to give up $1 to punish a particular group member then the latter’s earnings are reduced by $3
Costly punishments
Fehr and Gächter (2000, 2002)

• Either groups are \textit{fixed}

  – “\textit{partners}” protocol

• Or players are \textit{randomly re-matched} at the end of each round

  – “\textit{strangers}” protocol
Who gets punished?

Received punishment points per deviation from average and percentage of decisions

Deviation from the mean contribution of the other group members
Even non-monetary punishments (scoldings?) seem to matter!

- Masclet et al. (2003) look at a “partners” treatment where participants play for 30 periods divided into 3 segments
  - No sanction (periods 1 through 10)
  - Monetary Sanction OR Non-Monetary Sanction (Periods 11 through 20)
  - No sanction (Periods 21 through 30)
Drawbacks of costly punishments

• Punishment creates a *second-order* public good
  – No longer enough to punish free-riders but must also punish non-punishers…

• Punishments are costly
  – Contributions may be higher, but earnings typically are not…
  – Ethnographic evidence: punishments in tribal societies more often take the form of *ostracism* or *expulsion* rather than imposing material costs

• Possibility of “*anti-social*” as opposed to “pro-social” punishments
  – *Free-riders punish cooperators!*
Most people are not WEIRD!
(Western, Educated, Industrialized, Rich and Democratic)

Hermann, Thöni and Gächter (2008)
Punishments may be sufficient but are they necessary? Creating culture in the laboratory

- Two views

- Hobbesian view that mutual cooperation is impossible in the absence of *leviathan* (in the form of costly punishments)

- *Moral suasion* in the form of exhortative messages appealing to participants’ goodwill might achieve a similar goal.
Punishments may be sufficient but are they necessary? Creating culture in the laboratory

• After all, a society where cooperation is achieved

• on the basis of moral suasion would probably be a more benign one to live in

• than one where cooperation is sustained only by the use (or threat) of punishments
The Inter-generational paradigm

• A group of 5 subjects play the public goods game for 10 periods.

• After her participation, each agent is replaced by another, who plays the game for 10 periods again.

  • Chaudhuri, Graziano and Maitra (Review of Economic Studies, 2006)
The Inter-generational paradigm

• Players in any generation can leave free-form written advice to their successors

• Players get two payoffs – what they earn plus what their progeny earn
Three Different Treatments

- In the *private advice* treatment advice from generation “t” player is given only to her successor in generation “t+1”

- In the *public knowledge advice treatment* advice from *all* players in generation “t” is given to *all* the players in generation “t+1”
Three Different Treatments

• In the *common knowledge advice treatment* advice from *all* players in generation “t” is given to *all* the players in generation “t+1” and is also *read aloud by the experimenter*

• The advice treatments are compared to behaviour in a control group where there is no opportunity to leave advice
The Inter-generational Paradigm

- In real-life when we are confronted with a social dilemma we often access to the wisdom of the past

- in the sense that predecessors, or at least immediate predecessors, are available to give us advice.
Proportion of participants contributing entire token endowment in each round

![Graph showing the proportion of participants contributing their entire token endowment over ten periods. The graph has a y-axis labeled 'Proportion contributing their entire token endowment' and an x-axis labeled 'Period'. The line graph is marked 'No Advice'.]
Proportion of participants contributing their entire token in each round

![Graph showing the proportion of participants contributing their entire token in each round with two conditions: No Advice and Private Advice. The graph illustrates the trend over periods 1 to 10, with the proportion decreasing in both conditions.](image-url)
Proportion of participants contributing their entire token in each round
Proportion of participants contributing their entire token in each round

Common knowledge Advice

Proportion contributing their entire token endowment

Period

No Advice  Private Advice  Common Knowledge  Public Knowledge
Evolution of Contributions Across Generations – Private Advice
Evolution of Contributions Across Generations – Private Advice
Evolution of Contributions Across Generations – Private Advice
Contributions Across Generations – Common Knowledge
Contributions Across Generations – Common Knowledge
Contributions Across Generations – Common Knowledge
Role of Advice

• Subjects were asked to indicate a specific contribution in addition to providing free-form advice

• Often, advice specified a dynamic rule:
  – “I would pick a high number for the first round like 9. But when you see the average start to drop, pick a small number so you don’t lose money.”
Role of Advice

• In the later generations of common knowledge public advice, subjects advised unconditional contribution:
  
  – “Keep faith! No one should mess it up for the others. All 10 for all 10 rounds!”
  
  – “For goodness’ sake don’t be that morally vacant girl who prioritizes her own profit & takes advantage of everyone else!”
Histogram of Advice Left – Private Advice
Histogram of Advice Left – Private Advice
Histogram of Advice Left – Private Advice
Histogram of Advice - Common Knowledge
Histogram of Advice - Common Knowledge
Histogram of Advice - Common Knowledge
The Inter-generational Paradigm

• In order to sustain cooperation it appears that

• Everyone needs to get the same message

• But also everyone needs to be convinced that everyone else is getting the same message
Recommended play and punishments

• I mentioned before that while punishments can certainly increase contributions
• Their effect on earnings is ambiguous
• This is because you need to waste a lot of resources in punishing one another
• Other mechanisms where you do not incur such punishment costs might have similar earnings implications
Recommended play and punishments

• Chaudhuri and Paichayontvijit (2010)
• Public goods game with 20 rounds
• Three treatments
• In each treatment, participants play 10 rounds at the beginning without any intervention
• In the control treatment, after the first set of 10 rounds end, they are told to continue playing for another 10 rounds
Recommended play and punishments

- **Recommendation treatment**
- Prior to beginning of round 11 and at the beginning of each successive round, public announcement:
  - “You should contribute 10 tokens in each round. **NOTICE** that if all participants in a group follow the message then every participant will make 100% return on their contributions. For example, if in a particular round all 4 players in your group contribute all 10 tokens to the public account, then each group member will receive 20 tokens in return of their investment of 10 tokens. You will be helping yourself and everyone else in the group if you contribute all 10 tokens in every round.”
Recommended play and punishments

- **Punishment treatment**
  - Beginning with round 11, in the second stage of each round participants allowed to engage in costly punishment of group members

- Two matching protocols
  - Participants are either
    - in *fixed groups for all rounds*
    - *randomly re-matched from one round to the next*
Contributions in randomly re-matched groups

Percentage Contribution

Round

Control
Contributions in randomly re-matched groups

- Control
- Recommendation
- Punishment

Round

Percentage Contribution
Contributions in fixed groups

![Graph showing contributions in fixed groups with 'Control' and 'Punishment' groups over 20 rounds. The 'Control' group shows a steady decrease in contribution percentage, while the 'Punishment' group shows a more erratic pattern, with a sharp decline after round 14.]
Contributions in fixed groups

- **Recommendation**
- **Punishment**
- **Control**

Round

- Control
- Recommendation
- Punishment

Percentage Contribution
Earnings in randomly re-matched groups

![Graph showing average earnings over rounds for a control group. The x-axis represents round numbers from 0 to 20, and the y-axis represents average earnings ranging from 0 to 1. The graph shows a downward trend in earnings as the rounds progress.]
Earnings in randomly re-matched groups

![Graph showing earnings in randomly re-matched groups for Control and Punishment conditions. The graph displays the average earnings over 20 rounds, with Control showing a steady decrease and Punishment showing an increase after round 10.]
Earnings in randomly re-matched groups

- **Control**
- **Recommendation**
- **Punishment**

Graph showing the average earnings over rounds for Control, Recommendation, and Punishment groups.
Earnings in fixed groups

Round

Average Earning

Control
Earnings in fixed groups

Control

Punishment

Round

Average Earning
Earnings in fixed groups
Punishments more effective in the longer term?

- Henrich and Boyd (2001)
- Gächter, Renner and Sefton (2008)
- 50 round public goods game
- Punishments more effective over time because the threat of punishments is enough to sustain cooperation
- There is no need for punishments to be actually carried out and so no costs incurred
- One would then need to compare other mechanisms played out over a similar time horizon
- This is an open research question
Applications to Economics

• The applications of these ideas to real life economic problems are probably obvious to all of you

• They range from creating a cleaner environment to preserving common-pool resources

• Besides the other examples I talked about at the outset such as contributions to public goods or to charitable causes
Elinor Ostrom, Winner of the Nobel Memorial Prize in Economics, 2009

- Elinor Ostrom has challenged the conventional wisdom that common property is poorly managed and should be either regulated by central authorities or privatized. Based on numerous studies of user-managed fish stocks, pastures, woods, lakes, and groundwater basins, Ostrom concludes that the outcomes are, more often than not, better than predicted by standard theories. She observes that resource users frequently develop sophisticated mechanisms for decision-making and rule enforcement to handle conflicts of interest, and she characterizes the rules that promote successful outcomes.
Homework
http://homes.eco.auckland.ac.nz/acha192/


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