Behavioral Economics

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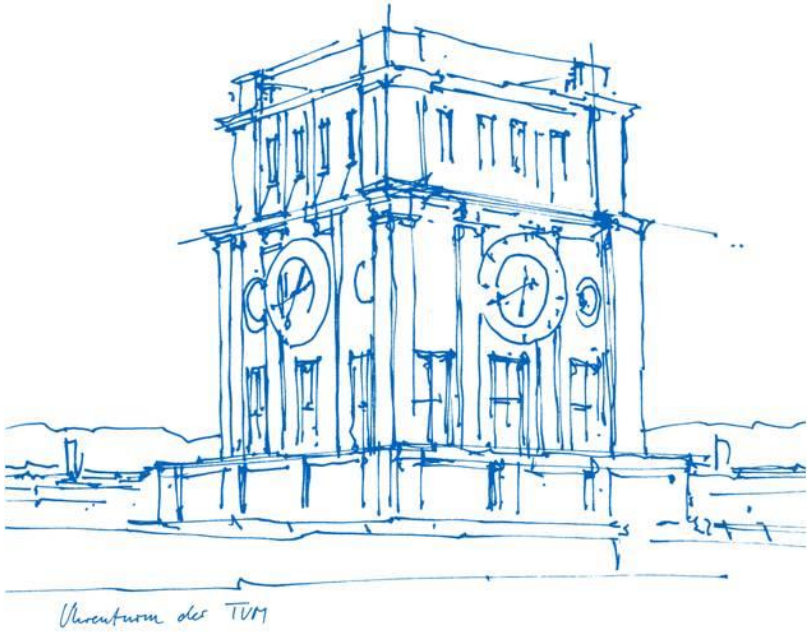
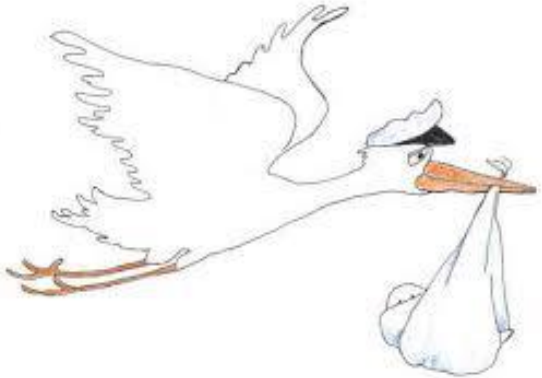


The problem with causal inference

Imagine aliens observing human behaviour
They observe that most of the times that humans leave their house
carrying an umbrella, it rains.
They conclude that humans have developed a device that controls the weather!

Why Conduct an Experiment?

- Do storks deliver babies?



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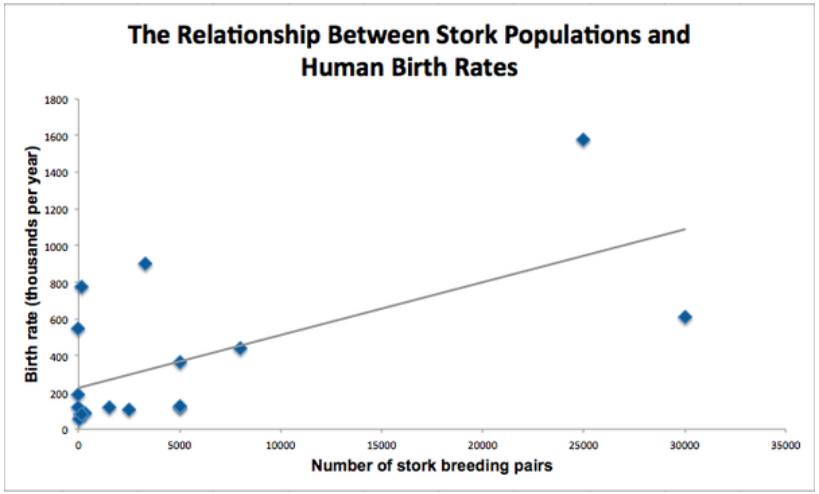
Why Conduct an Experiment?

- Do storks deliver babies?

Positive **relationship** between number of storks breeding and the birth rate of babies

→ **Conclusion:** storks really do deliver babies



Are there **confounding variables** (factors that are common to both storks and birth rates)?

Matthews, R. (2000). Storks deliver babies (p= 0.008). *Teaching Statistics*, 22(2), 36-38.

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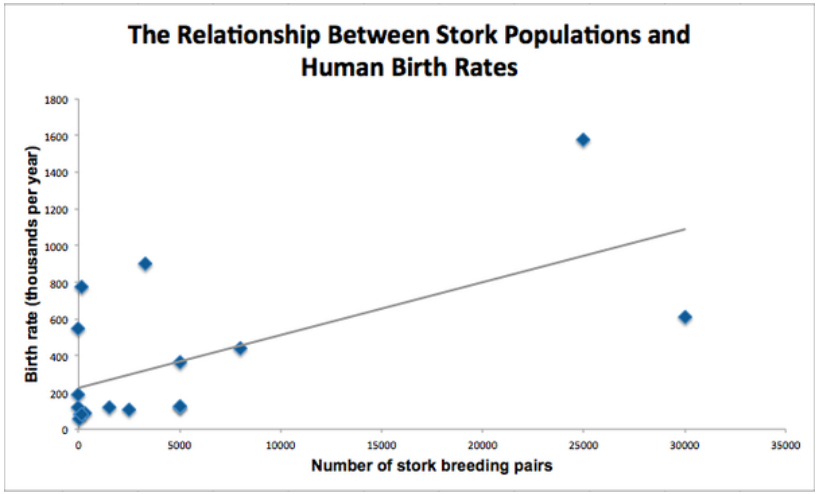

Country	Area (km^2)	Storks (pairs)	Humans (10^6)	Birth rate (10^3/yr)
Albania	28,750	100	3.2	83
Austria	83,860	300	7.6	87
Belgium	30,520	1	9.9	118
Bulgaria	111,000	5000	9.0	117
Denmark	43,100	9	5.1	59
France	544,000	140	56	774
Germany	357,000	3300	78	901
Greece	132,000	2500	10	106
Holland	41,900	4	15	188
Hungary	93,000	5000	11	124
Italy	301,280	5	57	551
Poland	312,680	30,000	38	610
Portugal	92,390	1500	10	120
Romania	237,500	5000	23	367
Spain	504,750	8000	39	439
Switzerland	41,290	150	6.7	82
Turkey	779,450	25,000	56	1576

Table 1. Geographic, human and stork data for 17 European countries

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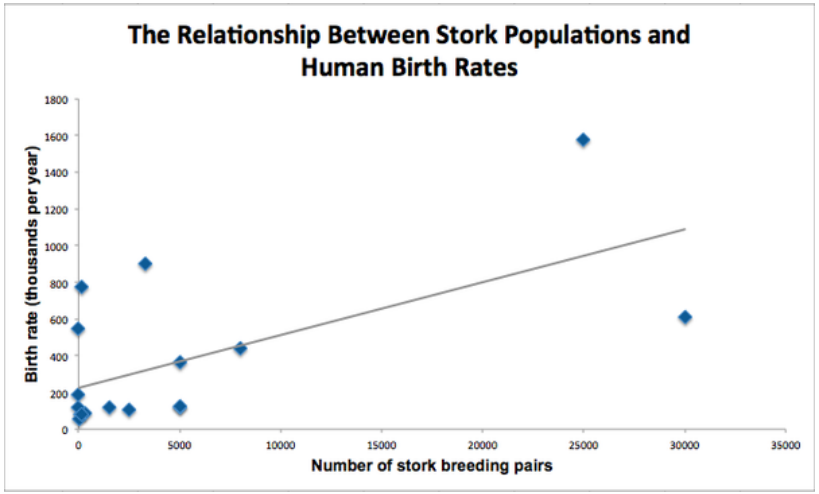


Variable	Model 1	Model 2
Number storks	0,029 ***	-0,006
	(0,009)	(0,006)
Size in km2		0,0015 ***
		(0,0002)
Constant	225,03	-7,411
	(93,56)	(56,702)
p-Wert F-Test	0,0079	0,0000
R^2	0,3847	0,8622

* p<0.1, ** p<0.05, *** p<0.01, Standardfehler in Klammern

Werte des Beispiels aus Robert Matthews (Teaching Statistics, 22(2), 2000)

Tabelle 7.9: Lineare Regression Anzahl Geburten pro Jahr

There are confounding factors. But what if we do not know all possible confounding variables?

Matthews, R. (2000). Storks deliver babies (p= 0.008). *Teaching Statistics*, 22(2), 36-38.

Why Conduct an Experiment?

- Correlation DOES NOT imply causation
- Confounding factors that we do not (or cannot) control threaten internal validity of our conclusions
- In this case the size of a country positively correlates with both the dependent variable (birth rate) and independent variable (stork population)
- A more plausible explanation is that larger countries tend to have higher populations that tend to produce more babies
- If we don’t want to rely on common sense:
  - Pick two villages with similar demographics. Resettle some storks in village A (treatment) and compare birth rates over coming years with village B (control).
  - This is what we would call: an experiment

What are Experiments?

*"A scientific test in which you **perform** a series of **actions** and carefully **observe** their **effects** in order to learn about something."*

Merriam-Webster

*“A method of investigating **causal relationships** among variables.”*

wikipedia.com

*"A test under **controlled conditions** that is made to demonstrate a known truth, examine the validity of a **hypothesis**, or determine the efficacy of something previously untried.“*

Shadish et al. (2002)

Shadish, William R., Thomas D. Cook, and Donald Thomas Campbell. *Experimental and quasi-experimental designs for generalized causal inference/William R. Shedish, Thomas D. Cook, Donald T. Campbell.* Boston: Houghton Mifflin,, 2002.

A simple Example

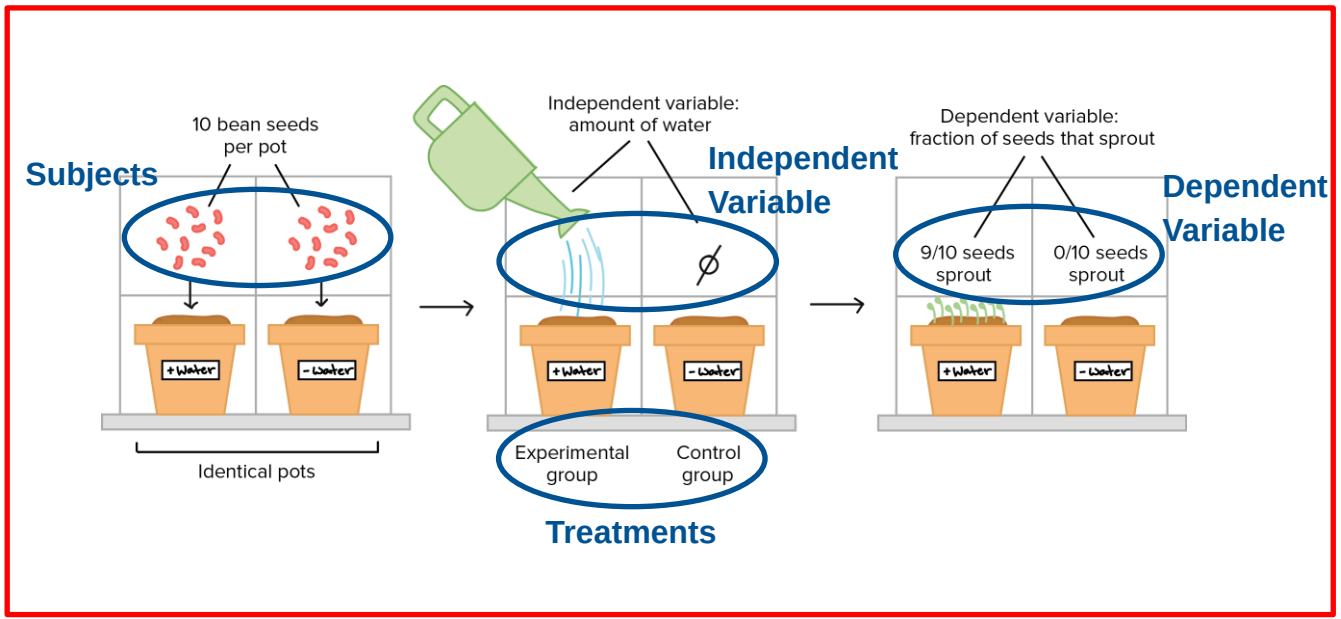
- Imagine you want to grow beans. You put seeds in a pot of soil and wait for them to grow.
- However, after several weeks, you have no sprouts. Why not?
- You hypothesize that the seeds didn’t grow due to lack of water (you forgot to water them).
- You want to test your hypothesis using a controlled experiment:

Some Jargon

- **Subjects:** Participants in an experiment
- **Treatment:** Variation in the conditions of the experiment and also the condition itself
- **Treatment group:** Group who receives the experimental treatment
- **Control group:** Group who receives either no treatment or a standard treatment
- **Dependent variable:** Variable being tested and measured in an experiment, and is 'dependent' on the independent variable
- **Independent variable:** Variable the experimenter changes or controls and is assumed to have a direct effect on the dependent variable
- **Manipulation:** Variation of an independent variable by the experimenter
- **Session:** One group of people participating in the experiment at the same place and time

A simple Example

Session



https://www.khanacademy.org/science/high-school-biology/hs-biology-foundations/hs-biology-and-the-scientific-method/a/experiments-and-observations

II. How to conduct an Experiment (in Economics)

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1. Identify your research question
2. Identify your hypotheses
3. Choose a type of experiment
4. Choose an experimental game/task
5. Define control and treatment conditions
6. Specify experimental protocols
7. Write the Experimental instructions
8. Design a questionnaire
9. Get ethical approval (IRB)
10. Pre-register hypotheses and details of experiment
11. Run the experiment
12. Analyse your data

II. Today‘s goals

- Be able to give a brief overview of the history of Experimental Economics
- Know the basic methodology of Experimental Economics
- Be able to design a simple experiment
- Be able to describe the experimental design and protocols of famous experiments

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Good practices when choosing the Research Question (RQ)

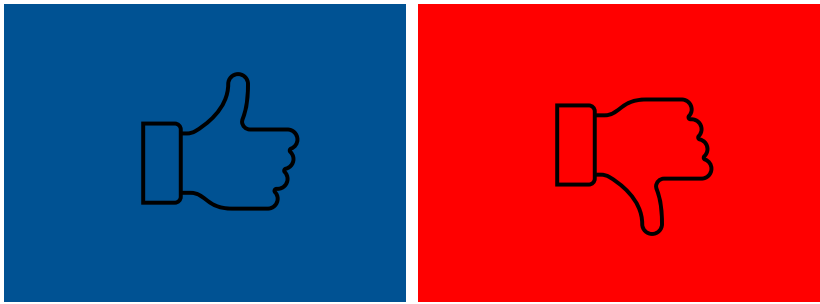
- Answering the RQ is **feasible**.
  What would it take in terms of resources (time, money, skills, etc.)?
- The RQ is **clear**.
  What is your dependent and independent variable?
- The RQ is **significant**.
  What research has been done already and how would answering this question benefit society or advance our knowledge?
- Answering the RQ is **ethical**.
  Would the ethical board allow you to conduct the research?

A good research question is: **Novel** – **interesting** – **relevant**

Individual decision making: e.g. incentives & performance

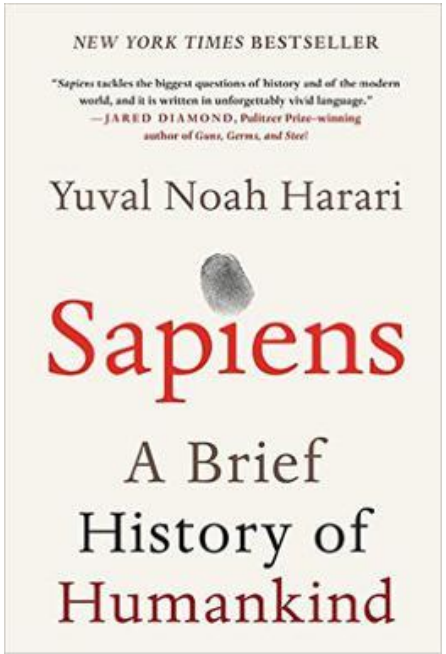
- How does behavior respond to monetary incentives?
- Does effort increase when incentives are improved?
- Can rewards have detrimental effects on performance?
- Can fines encourage ‘bad’ behavior?
- Does it depend on the size of the incentive: Low vs. high?

The pros and cons of increasing minimum wage



Behavioral Game Theory: e.g. cooperation

- Do people cooperate even when it is costly for their own payoff?
- Do people cooperate even with complete strangers?
- Does cooperation decline over time?
- Can punishment help sustain higher levels of cooperation?
- …



Markets

- What type of auction maximizes revenue for auctioneer?
- What is the best way to design a dating market?
- What are the reasons behind the “winner’s curse”?
- …

Examples

Research Question 1: What is the relation between high-stakes and performance?

- Individual decision making

Research Question 2: How can costly cooperation be sustained?

- Behavioural Game Theory

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Identify your hypothesis/ hypotheses

- Hypothesis-testing is an integral component of modern scientific research
- A hypothesis is a (well-informed) prediction of relationship between (typically) two variables: the **dependent** and the **independent** variable.
  - Null hypothesis (H0): there is no relation between the two variables.
  - Alternative hypothesis (H1): there is (non-random) relation between the two variables.
- Hypotheses can be derived from theory, previous observations, common sense, etc.

A hypothesis should be…

- **Falsifiable:** We reject or fail to reject the null hypothesis.
- **Novel:** Advance the current body of knowledge by testing something new.
- **Suggesting a direction:** E.g. “High stakes harm performance”, “Punishment helps sustain cooperation”
  - Though sometimes, when the phenomenon is new or because they are conflicting forces, it is OK to have an undirected hypothesis (exploratory analysis: some relation between dependent and independent variable but uncertain about direction).
- **Interesting:** Focus on hypotheses that are non-obvious or non-trivial.
- **Generalizable:** E.g. introduction of minimum wage increases unemployment.

RQ and hypotheses (example 1)

Individual decision making

- RQ (specific): Can certain rewards harm performance?
  - Hypothesis: **High stakes** can back-fire and harm **performance** (“choking under pressure”). H0: No effect vs. H1: Negative effect
- Notice, that often, certain things are implied.
  - In this case, that low and medium stakes are generally improving performance.
  - Research and knowledge builds on previous findings
  - Nonetheless, it is ideal to replicate key findings before building on them

Dependent variable

Independent variable

Relation between RQ and hypotheses (example 2)

Behavioral game theory

- RQ: Can costly cooperation be sustained?
- Hypothesis 1: **Punishment** helps sustain **cooperation**. H0: No effect. H1: Positive effect
- Notice what is implied:
  - People cooperate even when this is costly to their own payoff
  - Repetition reduces level of cooperation

Dependent variable

Independent variable

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Types of Experiments

Harrison and List (2004) distinguish four types of experiments:

1 Conventional lab experiment

Mostly student subjects, abstract framing, and experimenter intervention

2 Artefactual field experiment

Non-student subjects, abstract framing, and experimenter intervention

3 Framed field experiment

Non-student subjects, contextual framing, and experimenter intervention

4 Natural field experiment

Non-student subjects, contextual framing, and experimenter intervention, but subjects unaware

Internal and External validity

- **Internal validity:** refers to the degree of confidence that the causal relationship being tested is **trustworthy** and not influenced by other factors or variables.
  - There are formal tests for internal validity – **objective** assessment
  - Without internal validity, we cannot identify causal relationships
- Important threat to internal validity: presence of confounding factors that are not controlled.

Internal and External validity

- Example of internal validity failure: assume you want to test whether drinking coffee improves short-term memory. You design an experiment with two conditions: the water and the coffee condition.
- Coffee condition: 20 college students come to the lab in the morning. They drink coffee and take a memory test.
- Water condition: 20 college students come to the lab in the evening. They drink water and then take the same memory test.
- Finding: the coffee group performed on average better than the water group.
- Can we conclude that coffee is better than water for short-term memory?
- No!
- Confounding factor: systematic differences between time of the day. Water group might be more tired as subjects always took the test in the evening.

Internal and External validity

- **External validity:** refers to the extent to which results from a study can be applied (generalized) to other situations, groups or events.
  - No formal tests for external validity – more an act of persuasion
  - Desirable to have to a high degree but often **subjective**
- Often, there is a tension between internal and external validity: the more one controls for extraneous factors the less generalizable the findings
  - Lab experiments: easier to achieve internal – harder to convince about external validity
  - Natural field experiments: harder to achieve internal – easier to convince about external validity

EXPERIMENTUM

This is how a physical lab usually looks like…

1 Pros and Cons of the physical lab

Pros

- Internal validity
  - Participants focus on a specific task and **not to be distracted** by other factors.
  - **Control** over participants‘ **time** or **timing**.
  - **Control** over the available **information.**
- Easy to have participants **interact with each other** in real time.

Cons

- External validity
  - Subject pool **demographics not** very **diverse** (usually students in WEIRD countries)
  - Environment artificial
- **Hard to** always get **access** to a physical lab (not too many of those available)

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The advent of online recruitment platforms (e.g. Amazon’s Mtruk, Prolific) and online labs (e.g. LionessLab, oTree) offer a different trade-off between those pros and cons

2 Artefactual Field Experiment

Artefactual Field Experiment:

Non-student subjects, abstract framing, and experimenter intervention

- **Advantage**: Subject pool closer to the characteristics of study-focus.
- **Disadvantages**: Recruitment of subjects is more difficult and subjects do not always understand the rules.
- **Example:** Ariely, Gneezy, Loewenstein and Mazar “Large Stakes and Big Mistakes.” (ReStud 2008)

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3 Framed Field Experiment

Framed field experiment:

Non-student subjects, contextual framing, and experimenter intervention

- Field context in either the commodity, task, or information set that the subjects use.
- Subjects know they are a part of an experiment.

4 Natural Field Experiments

Natural field experiment:

Non-student subjects, contextual framing, and imposed rules, experimenter intervention but subjects unaware

- Natural field experiments are experiments with a relevant subject pool, who is not aware of being part of an experiment (e.g., workers at a company, students in a class).
- Difference between natural field experiments and natural experiments is that in the first the experimenter implements a manipulations, while in the natural experiment some other form of exogenous change happens

Example 1

- **Research Question**: Are there negative effects of large incentives?
- **Hypothesis**: “increasing incentives past an optimal level can be detrimental to performance”
- What is the best **type of experiment** to test this hypothesis?
  - Notice that the question is general (so abstract framing might be more appropriate
  - Notice that high stakes are hard to implement in countries with high GDP per capita…

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  - High stakes are hard to implement in countries with high GDP per capita…
    - **Artefactual field experiment** in rural India: 87 people *randomly* assigned to EITHER 4, 40 OR 400 rupies condition (3 conditions – Experiment 1).
      - Ariely, Gneezy, Loewenstein and Mazar “Large Stakes and Big Mistakes.” (ReStud 2008)
      - Average monthly expenditure ~ 500 rupies (~$10). Possible earnings up to 6 months consumption!

Example 2

- **Research Question** : Can costly cooperation be sustained?
- **Hypothesis**: Punishment can sustain high levels of cooperation in repeated interactions.
- What is the best **type of experiment**? Notice:
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  - Real-time interaction (nature of cooperation) within groups over multiple rounds
  - Instructions not as straight forward as in a real effort task

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- **Conventional Lab Experiment** in University of Zurich. 18 groups of size n=4 students.
  - E Fehr, S Gächter – (AER 2000)

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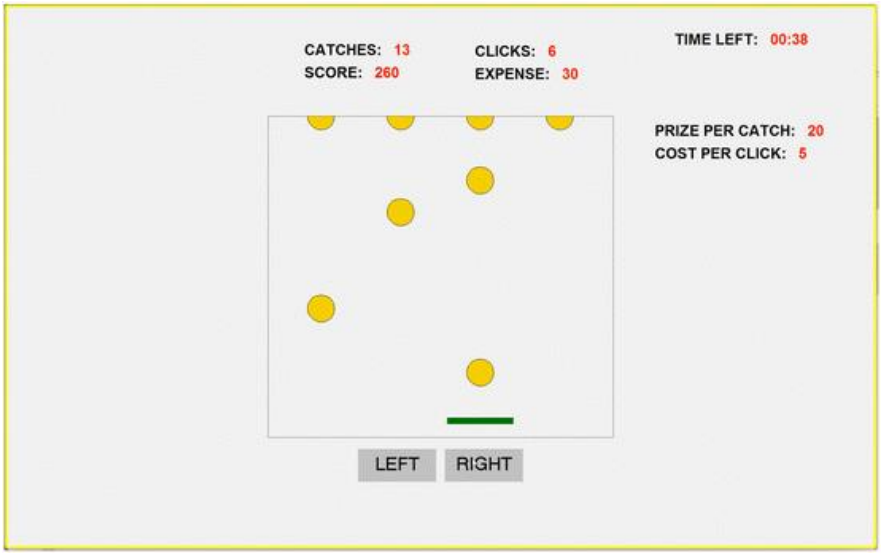
Individual Decision Making

- Risk preference elicitation : choices between “gambles”
  - Paired gambles
  - Multiple choice list
  - Certainty equivalence method
- Real effort tasks
  - Solve math problems (Mazar et al., 2008)
  - Solve mazes (Gneezy et al., 2003)
  - Slider task (Gill and Prowse, 2011, Goerg, Kube, and Radbruch, 2019)
- Honesty: report result of a die roll
- …

Real effort tasks

Matrix task

5.64	2.85	9.48	1.63	2.32	7.93	7.87	3.62	9.41	8.18	9.01	3.97
1.68	9.52	2.15	4.92	6.1	5.83	5.72	7.4	5.84	5.2	4.56	9.12
6.71	4.36	1.67	2.81	6.78	7.19	2.49	9.59	6.62	0.28	2.92	6.59
8.1	5.48	8.91	8.46	5.67	7.57	4.16	5.61	0.49	1.12	6.93	9.72
1.43	2.11	5.36	3.99	3.91	4.34	4.74	4.23	1.34	6.58	8.97	3.21
7.45	8.57	9.3	8.39	2.72	0.51	2.1	5.49	4.21	3.85	3.87	5.82
5.39	2.29	0.42	9.61	3.57	2.36	6.26	7.86	9.78	4.14	9.46	6.15
3.28	4.43	2.6	6.09	4.56	1.58	0.89	2.14	6.71	9.12	4.2	6.83
4.91	6.86	7.76	5.47	2.49	6.28	9.83	0.65	2.23	6.09	8.66	7.37
8.96	2.29	5.99	3.82	4.21	7.91	6.52	5.1	9.28	3.51	2.9	1.34
7.71	2.94	4.25	2.65	4.17	4.53	3.91	1.42	4.42	2.02	5.06	2.89
2.01	1.28	5.12	7.49	0.55	6.39	3.48	6.95	4.87	8.1	7.61	8.84
3.53	5.94	4.16	0.74	4.55	3.19	1.08	5.19	6.6	0.17	7.13	7.2
6.15	2.97	2.32	8.17	7.91	1.83	6.56	3.06	2.72	2.54	5.16	5.49
1.9	9.3	7.68	5.62	0.81	2.15	8.98	9.22	3.39	9.48	8.5	9.71
3.55	4.72	2.32	3.75	3.72	2.09	0.71	3.44	4.48	2.87	6.86	1.23
2.32	4.51	6.13	8.19	6.46	1.62	9.43	6.57	8.33	3.47	2.6	4.11
9.35	8.05	4.96	8.29	2.91	2.03	1.58	8.55	0.67	6.63	8.89	2.36
1.02	6.34	1.95	2.73	7.89	9.86	9.33	3.5	3.72	1.32	9.84	4.9
8.82	7.2	2.14	6.21	3.54	3.18	3.46	2.36	2.66	7.4	1.65	2.09



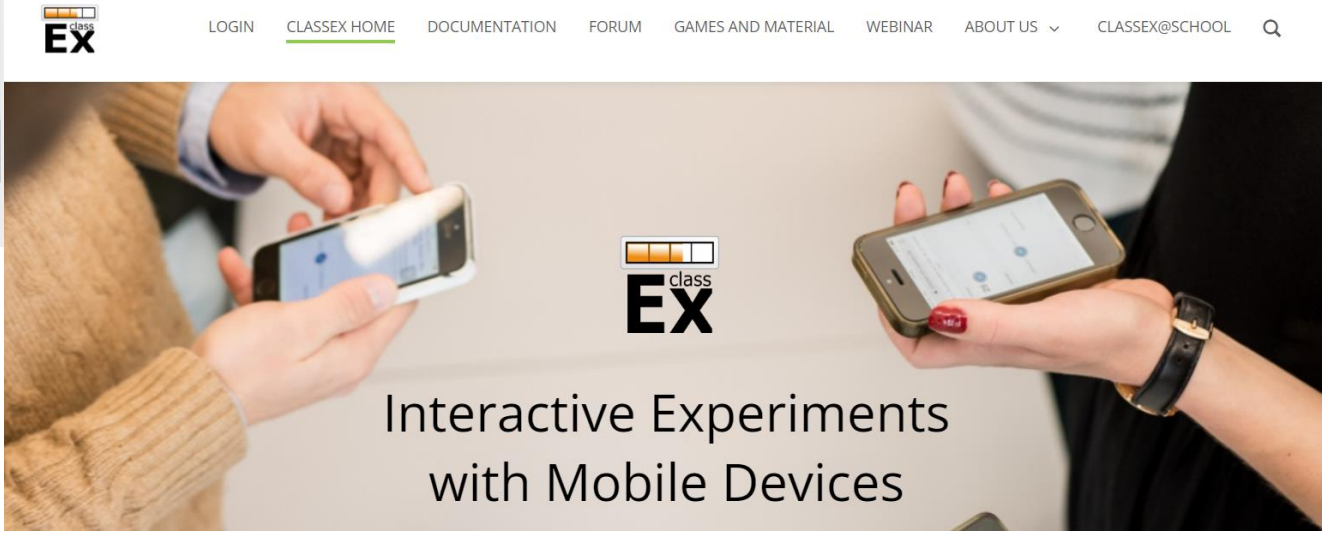
Behavioral Game Theory

- Prisoners' Dilemma game
- Public Goods game
- Ultimatum game
- Dictator game
- Trust game
- Gift Exchange game
- Third Party Punishment game

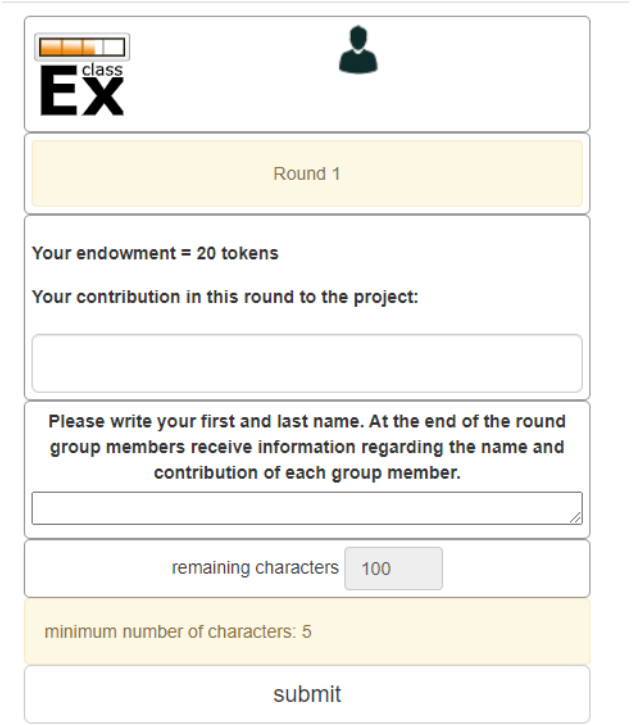
An example through classEx

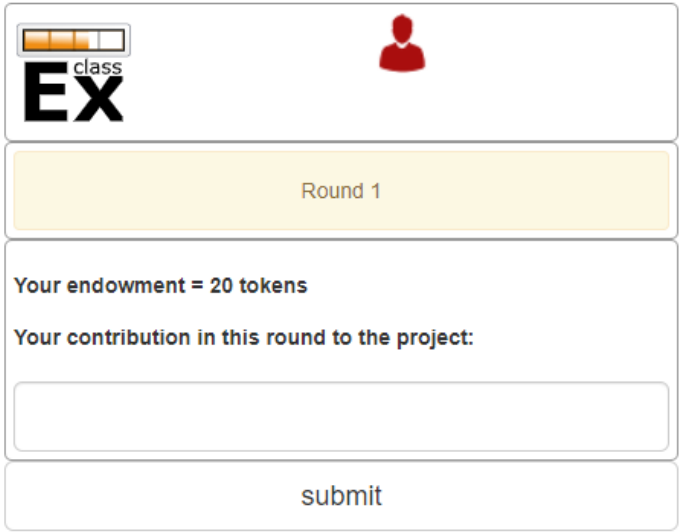
Marcus Giamattei

Germany/Italy
Habilitation in Economics
University of Passau, Germany

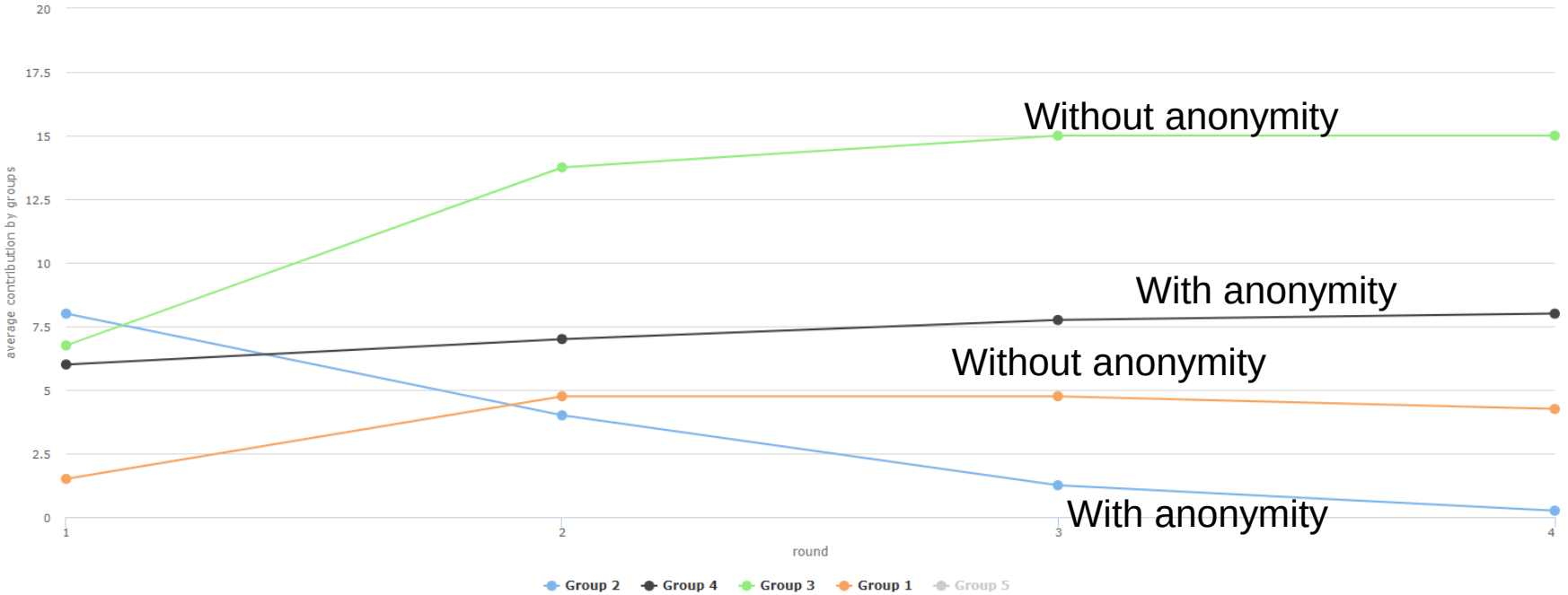


Public Good Game with/ without anonymity

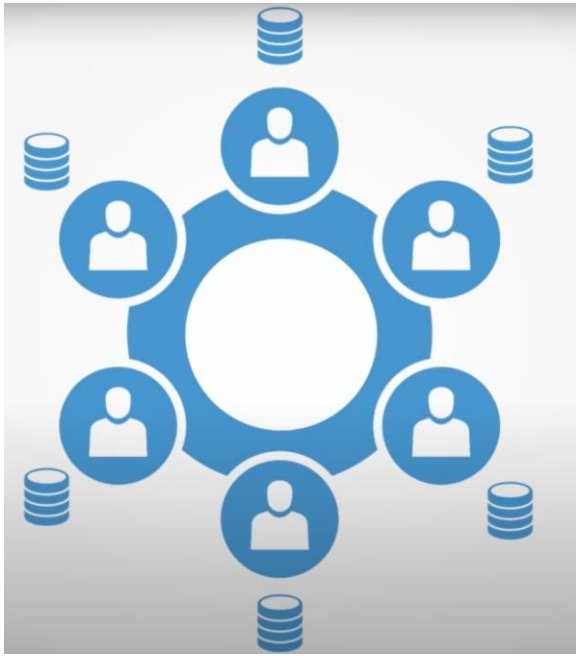




Results


20
17.5
15
12.5
10
7.5
5
2.5
0
average contribution by groups
1
2
3
4
round
Without anonymity
With anonymity
Without anonymity
With anonymity
Group 2
Group 4
Group 3
Group 1
Group 5

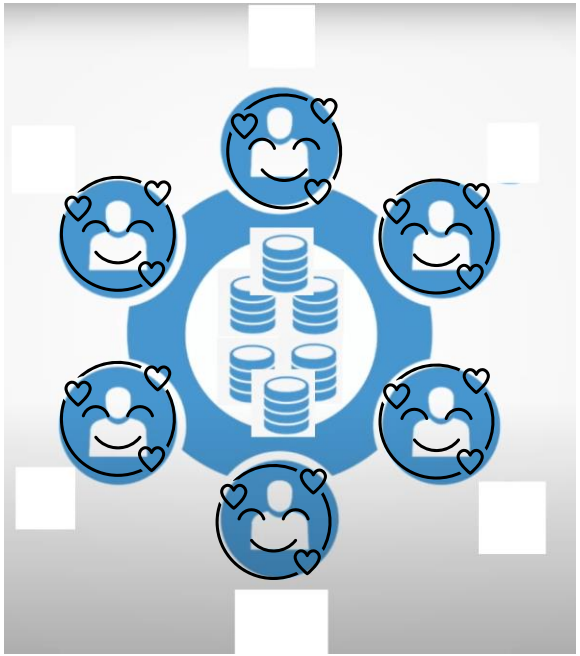
Public Goods game



- You are in a group with n=6 players.
- At the beginning of every round you are given: y= €10
- Every group member i must decide how much to contribute (c_i) to the common pool.
- Individual contributions are multiplied by a factor of m=2 and then divided across all group members
- In this case, every member's final payoff is:

$$\pi_i = 10 - c_i + \frac{2 * \Sigma c_i}{6}$$

Public Goods game: Scenario 1

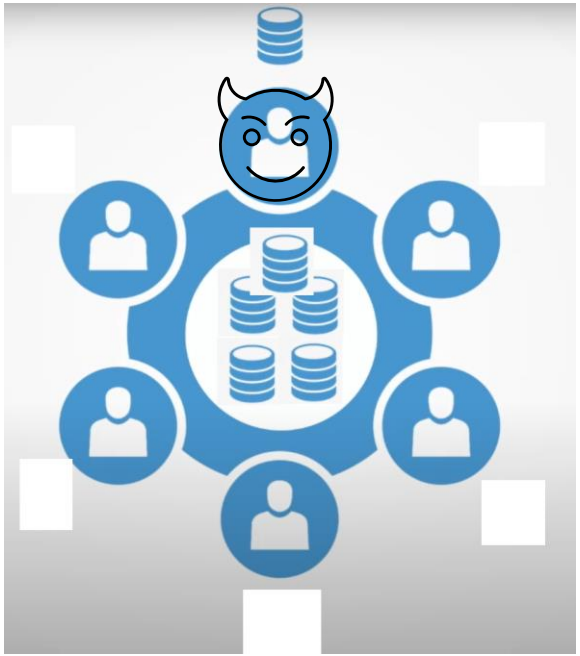


Everyone contributes their entire endowment

Final payoff for everyone:

$$\pi = 10 - 10 + \frac{2 * 60}{6} = 20$$

Public Goods game: Scenario 2



Everyone contributes their entire endowment

Final payoff for free rider (f):

$$\pi_f = 10 - 0 + \frac{2 * 50}{6} = 26.6$$

Final payoff for everyone else:

$$\pi_i = 0 + \frac{2 * 50}{6} = 16.6$$

Public Goods game

Definition	n players simultaneously decide about their contribution c_i. ($0 \leq c_i \leq y$) where y is players' endowment; each player i earns $\pi_i = y - c_i + mG$ where G is the sum of all contributions and $m/n<1<m$.
Real life example	Team compensation, tax,cooperative production in simple societies, overuse of common resources (e.g., water, fishing grounds).
Predictions with rational and selfish players	Each player contributes nothing, i.e. $c_i = 0$.
Experimental regularities	Players contribute 50% of y in the one-shot game (public good and prisoner's dilemma game are essentially a very similar problem). Contributions unravel over time. Majority chooses $c_i=0$ in final period. Communication strongly increases cooperation. Individual punishment opportunities greatly increase contributions.
Interpretation	Reciprocate expected cooperation

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Treatments

Treatments are a variation in the conditions of the experiment and also the condition itself

- **Treatment group:** Group who receives the experimental treatment.
- **Control group:** Group who receives either no treatment or a standard treatment.

Treatments: good practices

- If your research builds upon another study, it is common practice to include the study‘s treatments to see if you can replicate the results and then extend it by adding your additional treatments.
- Design the treatment so that comparing behavior between control and treatment ISOLATES the causal relation (clear to attribute change in behavior if only one thing changes)
- Assignment to the different treatments should be:
  - random (e.g. roll a dice, toss a coin, draw a number, computer)
  - If possible within sessions (controls for session effects)

Example 1

- **Research Question** : Are there negative effects of large incentives?
- **Hypothesis**: “increasing incentives past an optimal level can be detrimental to performance”
- **Type of experiment**: Artefactual field experiment
- **Experimental Task**: Individual real effort tasks (performed by every subject in *random* order)
- **Treatments**:
  - Baseline: Low reward (4 rupies for high performance per task)
  - Treatment 1: Medium reward (40 rupies for high performance per task)
  - Treatment 2: High Reward (400 rupies for high performance per task)

Example 2

- **Research Question** : Can costly cooperation be sustained?
- **Hypothesis**: Punishment can sustain high levels of cooperation in repeated interactions.
- **Type of experiment**? Notice:
- **Experimental Task**: Public good game, y=20, n=4, m=1.6, 10 rounds
- **Treatments**:
  - Control: No Punishment
  - Treatment: With Punishment

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Fundamental Protocols

- Between-subjects vs. within-subjects design
- One-shot vs. repeated game
- (Re-)matching of participants: Strangers vs. Partners matching
- Stated vs. revealed preferences
- Paper and pencil vs. computer

Between-subjects vs. within-subjects design

Between-subject design

- Each subject participates in only one treatment.

Within-subject design

- Each subject participates in all/several treatments.
- Advantage:
  - More statistical power
- Concerns:
  - Order effects
  - Time constraints if several treatments

One-shot vs. repeated game

One-shot game

- One subject, one decision.
- No learning, wealth, or strategic effects.
- Subjects cannot reward or punish others.
- Check carefully if subjects understood task.
- Easy to implement and quick to conduct.

Repeated game

- Subjects repeat the same decision
- A game may extend over several rounds or each round may be a new game.
- Subjects can change their behavior (e.g. convergence to equilibrium).
- They can also respond to others‘ behavior in prior rounds.
- One session produces many (dependent) observations.

(Re-)matching of participants

Partner matching

- The same subjects interact during several rounds.

Stranger matching

- The subjects are re-machted before each round.

Stated vs. revealed preferences

Stated preferences

- Survey-based technique for establishing preferences
- “Cheap talk“
- Mostly used in questionnaires – not in the main task.

Revealed preferences

- Studying actual decisions
- Incentivized
  - To avoid wealth effects, often one task/ answer is chosen for payoff randomly
    - In Decisions Under Risk: Random Lottery Incentive (see Starmer and Sugden, 1991)
    - In games: Strategy method (see Selten, 1967)
- Generally preferred in Economics

Paper and pencil vs. computer

Paper and pencil

- Easy to implement and adjust
- Low set-up cost
- Can be done without or outside the lab

Computer

- Allows complex designs
- Less prone to errors in implementation and data collection
- Little experimenter-subject interaction
- Controlled communication between subjects

Most lab experiments are now performed on the computer.

Software

Software:

- oTree (http://www.otree.org/)
- zTree (http://www.ztree.uzh.ch/en.html)
- MultiStage (http://www.ssel.caltech.edu/software.html)
- jMarkets (http://www.ssel.caltech.edu/software.html)
- Willow (http://econwillow.sourceforge.net/)
- BoXS (http://boxs.uni-bonn.de/)
- SoPHIE (https://www.sophie.uni-osnabrueck.de/)
- LIONESS (https://lioness-lab.org/)

Online platforms to run your software:

- Mturk (https://www.mturk.com/mturk/welcome)
- Upwork (https://www.upwork.com/)
- Applause (https://www.applause.com/)
- Guru (https://www.guru.com/)
- CrowdFlower (https://www.crowdflower.com/)
- Prolific (https://www.prolific.co/)

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- **Protocols:**
  - Between subjects, revealed preferences, one-shot, not computerised

Example 2

- **Research Question** : Can costly cooperation be sustained?
- **Hypothesis**: Punishment can sustain high levels of cooperation in repeated interactions.
- **Type of experiment**? Notice:
- **Experimental Task**: Public good game, y=20, n=4, m=2, 10 rounds
- **Treatments**:
  - Control: No Punishment
  - Treatment: With Punishment
- **Protocols:**
  - Experiment 1: within subjects, revealed preferences, repeated game, strangers matching
  - Experiment 2: within subjects, revealed preferences, repeated game, partners matching
    - Comparison between Exp1 and Exp2: between subjects

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Writing the experimental instructions

- The instructions should explain the rules of the game to the participants.
- They need to be:
  - Clear
  - Concise
  - In neutral language (except the framing is part of the reseach question)
- No deception, which includes no misleading of subjects

In the lab:

- Reading instructions loud out to all participants generates common and full information. Everybody knows that they have the same instructions
- Use a neutral tone and body language

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Design a questionnaire

- Often experiments end with questionnaires
- Include basic demographic information to describe the sample (e.g. age, gender, study)
- But it is possible to include more detailed questionnaires/measures like
  - Risk-preferences
  - Cognitive ability
  - Personality traits
  - General questions about the investigated topic
- Typically, non-incentivized (stated).
- Data typically used for exploratory analysis.

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Getting it approved: Ethics approval

- In the US and other countries any kind of study involving human participants needs IRB (Institutional Review Board) / Ethics Board approval.
- In Germany, approval from an ethic board is only necessary if private and/or potentially damaging information is handled or some kind of risk might emerge (e.g., access to criminal records, medical trials).
- However, more and more journals require some form of IRB approval. In Germany, the German Society for Experimental Economics (GfEW) provides such an approval process. https://gfew.de/ethik
- This is a different topic then privacy protection! You need to ask subjects whether you can save their information!

Getting it approved: Don’t use deception!

- Instructions of the experiment should always correspond to the tasks.
- Unlike other experimental disciplines, Economists (almost**) always avoid deception**.
- Reason: subject pool “contamination”. Why would participants ever trust again that instructions are true?
- Even if IRB approval is obtained – almost impossible to publish in Economics if use of deception!

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Pre-registration: How to do it

- Pre-registration sites:
  - https://osf.io/prereg/
  - https://www.aspredicted.org/
- State clearly the research question, hypotheses and experimental protocols.
- Calculate and report statistical power: how many observations required to detect an effect of a given size with a given degree of confidence.
  - When evaluating the veracity of hypothesis, we test whether we can reject the H0 in favour of the H1.
  - Typically, we choose a 5% significance level (i.e. 5% probability of finding an effect that is not there).
  - This requires to pre-determine statistical tests: parametric vs. non-parametric tests

Pre-registration: Why do it?

- The scientific community can observe studies that authors would otherwise choose not to make public after seeing the results (“file-drawer” problem)
  - Publication bias
- Replicability of the study:
  - In the past, hypotheses (and sometimes even research questions) were formulated only after the results were in. Usually, according to what was found to be statistically significant ex-post. This increases the chance of a result being significant by chance.
- Transparency: easy for following projects that want to replicate your results
- Self-imposed discipline and structure for the researcher

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Run the experiment

- During experiment:
  - Randomise subjects' treatment allocation and seating (pull a number from a bag that corresponds to a pre-numbered seat. Each seat has instructions and a Computer with the corresponding treatment software)
  - No talking (participants or experimenters): If a subject has questions, it should raise the arm and you will talk in privat (prevents influence on other subjects)
- Good practice:
  - prepare a step-by-step log of what to do and in which order
  - ask a colleague to help
  - carry out the payments in private

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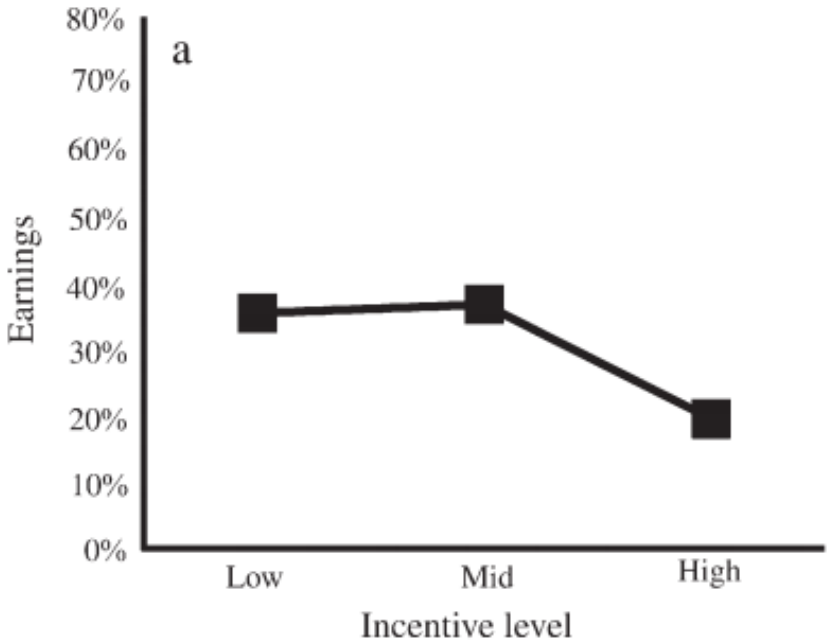
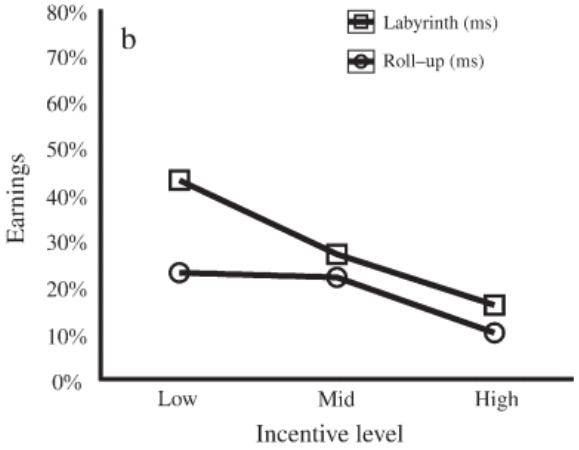
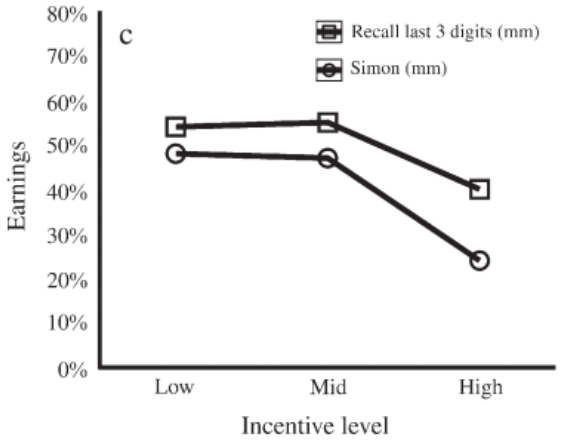
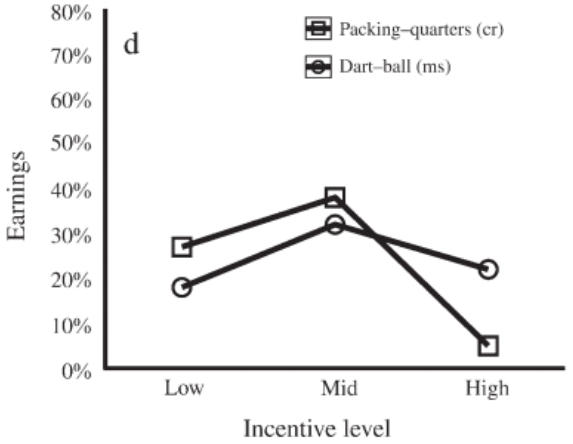
Results: performance - incentives experiment (example 1)



Results: performance - incentives experiment (example 1)







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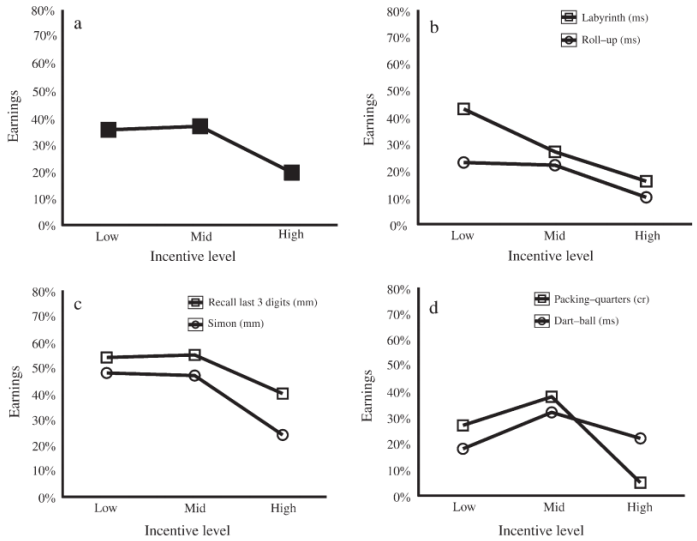


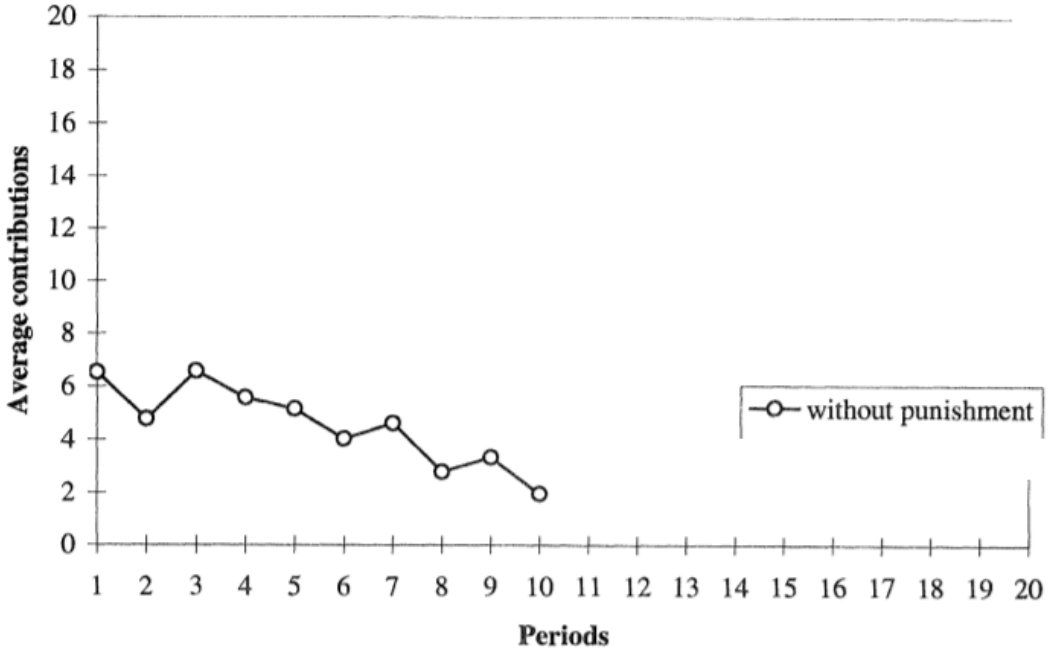
FIGURE 1

Means of the share of earnings relative to the maximum possible earnings for the three payment levels. For all six games combined (a), and plotted separately by game (b–d). Games are indicated by their category: motor skills (ms), memory (mm), and creativity (cr)

Conclusions

- Too low may have a detrimental effects
- Too high may cause choking
- Type of task seems to matter

Results: cooperation - punishment experiment (example 2)



AVERAGE CONTRIBUTIONS OVER TIME IN THE STRANGER-TREATMENT (SESSION 3)

Punishment increases & sustains cooperation

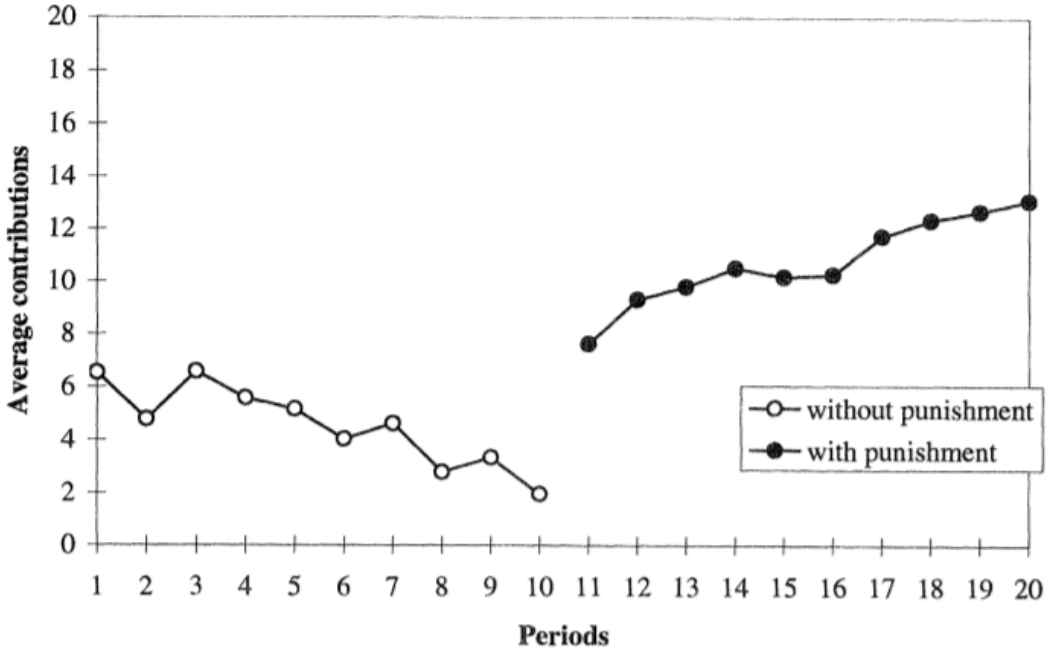
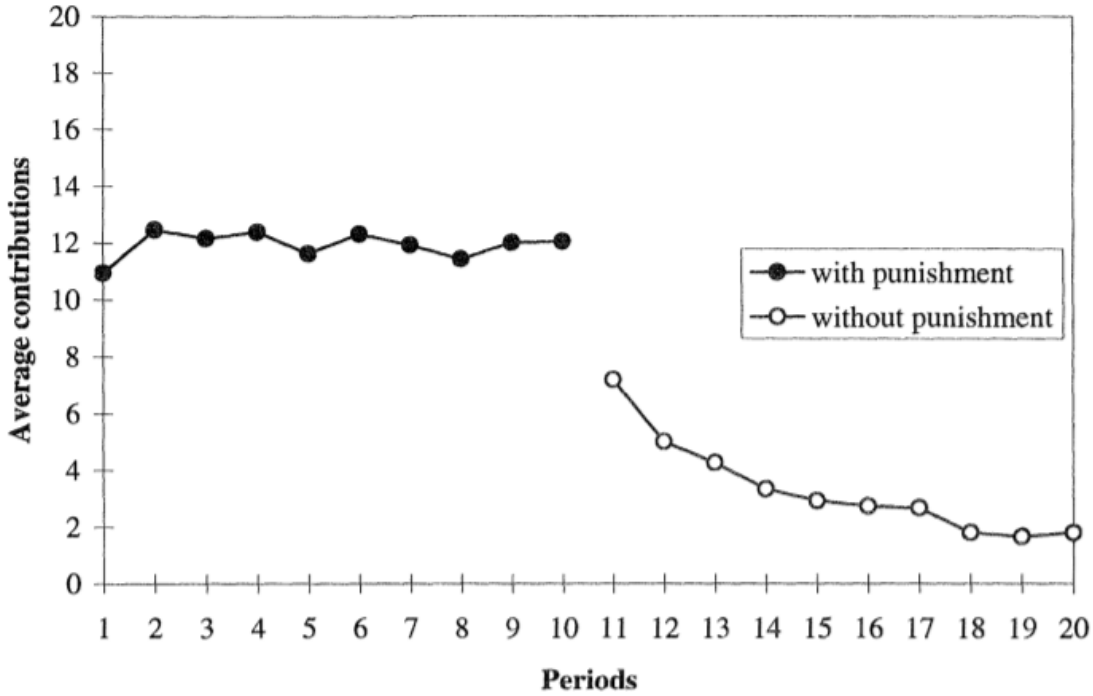
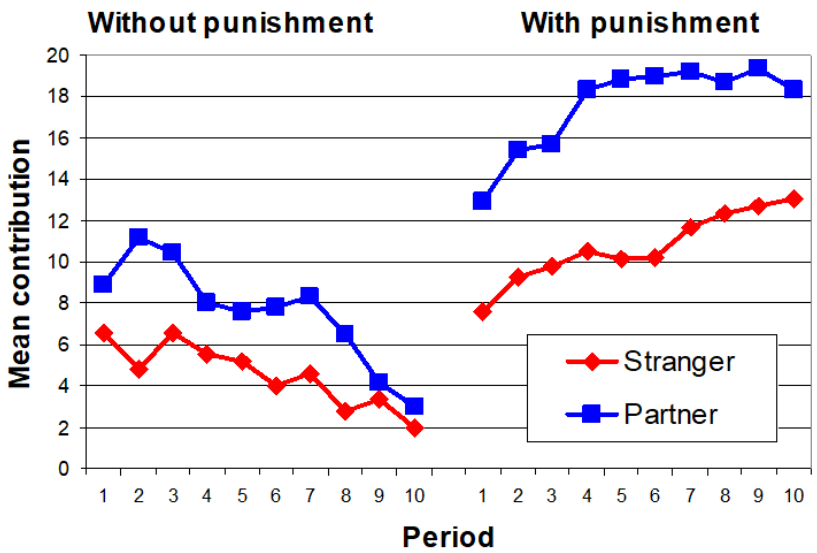


FIGURE 1B. AVERAGE CONTRIBUTIONS OVER TIME IN THE STRANGER-TREATMENT (SESSION 3)

Order of treatment does not change conclusion



Conclusions – Cooperation with punishment (Example 2)



Conclusions:

- Verify that people cooperate even when costly
- Verify that cooperation declines over time
- Verify that partners cooperate more than strangers
- Novel: punishment increases levels of cooperation
- Novel: punishment can sustain high levels of cooperation over time