Foundations of Experimental Economics

University of Kassel

Winter Term 2025/2026

Lecture 2: Designing (Laboratory) Experiments

Introduction

Phases of Experimental Research

1. **Design**: Define tasks, incentives, institutions and treatments.

2. **Preparation**: Set up and test software (and/or other materials).

3. **Data Collection**: Run the experiment.

4. **Analysis**: Clean and analyze data using appropriate statistical tools.

5. **Reporting**: Interpret results and write up findings.

Designing Experiments

- **The design phase is the foundation of any experimental study:** This is where the research question is translated into a clear, practical procedure.

- **There are many design choices to make**: Even (seemingly) small decisions can affect outcomes and threaten validity.

- **Flaws in design can't be fixed later (or only at high costs):** Even advanced statistical methods cannot correct poor designs once data is collected.

- **Design must anticipate data collection and analysis:** Planning should consider how data will be gathered and analyzed.

Goals for Today

- **Learn about** canonical **decision-making tasks** (e.g., economic games).
- **Understand** the role of **incentives** in shaping participant behavior and **explore** best practices for their effective implementation.

Recommended Readings

- Weimann, J., & Brosig-Koch, J. (2019). *Methods in experimental economics: An introduction*.
    - Chapter 2.2, p. 44-55

Decision-Making Tasks

Choice of Decision-Making Task

- The research question determines what kind of behavior needs to be observed and what decision-making task or game is appropriate.

- In the following, we will look at canonical tasks or games for the following topics:
    1. Individual Decision-Making
    2. Cognitive or Strategic Reasoning
    3. Social Preferences
    4. Social Dilemmas
    5. Coordination

1. Individual Decision-Making

- Focuses on how individuals make choices. This may include observing risk preferences, time preferences, or loss aversion.

- Important tasks:
  - **Risk Aversion Task** – *Holt & Laury (2002)*
  - **Honesty Task** – *Fischbacher & Föllmi-Heusi (2013)*
  - **Time Preference Task** – *Coller & Williams (1999)*
  - **Endowment Effect Task** – *Kahneman, Knetsch & Thaler (1990)*

2. Cognitive or Strategic Reasoning Tasks

- Focuses on how individuals predict, reason, or outguess others in strategic contexts. Captures depth of reasoning or bounded rationality.

- Important tasks:
  - **Beauty Contest** – *Nagel (1995)*
  - **Cognitive Reflection Test (CRT)** – *Frederick (2005)*

3. Social Preferences

- Focuses on how individuals make decisions that affect others, balancing self-interest with concerns for fairness, altruism, trust or reciprocity.

- Important games:
  - **Dictator Game** – *Forsythe et al. (1994)*
  - **Ultimatum Game** – *Güth, Schmittberger & Schwarze (1982)*
  - **Trust Game** – *Berg, Dickhaut & McCabe (1995)*
  - **Gift Exchange Game** – *Fehr, Kirchsteiger & Riedl (1993)*

4. Social Dilemmas (Cooperation)

- Focuses on situations where there is a conflict between individual self-interest and the collective well-being of a group or society (**cooperation**).

- Important games:
  - **Prisoner’s Dilemma** – *Rapoport & Chammah (1965)*
  - **Public Goods Game** – *Ledyard (1995)*
  - **Common Pool Resource Game** – *Ostrom, Gardner & Walker (1994)*

5. Coordination

- Focuses on how individuals or groups align their actions to achieve mutually beneficial outcomes in situations where individual self-interest and the collective well-being are not in conflict (**coordination**).

- Important games:
  - **Stag-Hunt Game –** *Battalio, Samuelson & Van Huyck (2001)*
  - **Battle of Sexes –** *Cooper et al. (1989)*
  - ***Chicken Game*** *– Rapoport & Chammah (1966)*
  - ***Threshold Public Goods Game*** *– Croson & Marks (2000)*

Individual Decision-Making

Risk Preferences (1/3)

Purpose

- Measure **risk aversion** in individuals.

Task

- Each participant in the experiment makes a series of choices between pairs of lotteries, where each lottery has a different risk profile.

Payoff

- Implementation of one randomly selected lottery.

Risk Preferences (2/3)

TABLE 1—THE TEN PAIRED LOTTERY-CHOICE DECISIONS WITH LOW PAYOFFS

Option A	Option B	Expected payoff difference
1/10 of $2.00, 9/10 of $1.60	1/10 of $3.85, 9/10 of $0.10	$1.17
2/10 of $2.00, 8/10 of $1.60	2/10 of $3.85, 8/10 of $0.10	$0.83
3/10 of $2.00, 7/10 of $1.60	3/10 of $3.85, 7/10 of $0.10	$0.50
4/10 of $2.00, 6/10 of $1.60	4/10 of $3.85, 6/10 of $0.10	$0.16
5/10 of $2.00, 5/10 of $1.60	5/10 of $3.85, 5/10 of $0.10	−$0.18
6/10 of $2.00, 4/10 of $1.60	6/10 of $3.85, 4/10 of $0.10	−$0.51
7/10 of $2.00, 3/10 of $1.60	7/10 of $3.85, 3/10 of $0.10	−$0.85
8/10 of $2.00, 2/10 of $1.60	8/10 of $3.85, 2/10 of $0.10	−$1.18
9/10 of $2.00, 1/10 of $1.60	9/10 of $3.85, 1/10 of $0.10	−$1.52
10/10 of $2.00, 0/10 of $1.60	10/10 of $3.85, 0/10 of $0.10	−$1.85

Source: Holt & Laury (2002, p. 1645)

Risk Preferences (3/3)

Dependent Variable

- Switch point from Option A to Option B.

(Dis-)Honesty (1/2)

Purpose

- Study **(dis-)honesty** in individuals.

Task

- Roll a six-sided die and report the number.

Payoff

- The payoff is determined by the reported number (\$1, \$2, \$3, \$4, or \$5) and zero if the reported number is 6.

(Dis-)Honesty (2/2)

Dependent Variable

- Distribution of reported numbers.

Cognitive or Strategic Reasoning

Beauty Contest (1/3)

Purpose

- Study strategic thinking and iterative reasoning.

Roles & Task

- Players: Each player chooses a number from a fixed range (e.g., 0 to 100) and must indicate 2/3 (or some other fraction) of the average of all chosen numbers.

Beauty Contest (2/3)

Game Structure & Payoffs

- Each player is asked to choose a number, and the average of all players’ chosen numbers is calculated.
- The winner is the player whose number is closest to 2/3 of the average.
- The winner receives a fixed amount independent of the chosen numbers; in case of a tie the amount is divided between all winners.

Beauty Contest (3/3)

Prediction

- Nash equilibrium predicts that **all players choose 0.**
  - Players will think that others will try to pick the best guess based on 2/3 of the average (e.g., starting at 50), and so on, leading them to guess **lower and lower numbers.**

Dependent Variable

- Chosen numbers.

Social Preferences

Dictator Game (1/2)

Purpose

- Measuring **altruism** and **fairness** preferences in a simple, non-strategic setting.

Roles & Task

- **Dictator:** Decides how to split an endowment (e.g., $10) between themselves and the recipient.
- **Recipient:** Passive without decision-making power.

Dictator Game (2/2)

Game Structure & Payoffs

- Dictator receives an endowment and chooses how much (if any) to transfer to recipient.
- No response or punishment by recipient possible. Dictator choice determines payoffs.

Dependent variable

- Amount transferred by the dictator.

Prediction

- The dictator keeps the **entire endowment**.

Ultimatum Game (1/3)

Purpose

- Measuring **fairness** preferences in a more complex, strategic setting.

Roles & Task

- **Proposer:** Decides how to split an endowment (e.g., $10) between themselves and the responder.
- **Responder:** Decides whether to accept or to reject the offer.

Ultimatum Game (2/3)

Game Structure & Payoffs

- **Proposer** makes an offer of how to split the endowment between themselves and the responder.
- **Respondent** accepts or rejects the offer:
  - Accept: The proposed split is implemented as offered by the proposer.
  - Reject: Both players receive $0.

Dependent Variables

- Offers by the proposers.
- Share of rejection by the responders conditional on size of offer.

Ultimatum Game (3/3)

Prediction

- Subgame perfect Nash equilibrium: Proposer offers **lowest possible positive amount.**
  - The responder should accept any positive amount as this is better than receiving nothing.
  - The proposer anticipates this (backwards induction) and offers lowest possible positive amount.

Trust Game (1/3)

Purpose

- Measuring **trust** and **trustworthiness**.

Roles & Task

- **Trustor:** Receives an endowment (e.g., $10) and decides how much to send to the trustee.
- **Trustee:** Receives the transfer from the trustor and decides how much (of the multiplied amount) to send back to the trustor.

Trust Game (2/3)

Game Structure & Payoffs

- **Trustor** decides how much of an endowment (= E) to send to the **trustee** (Amount = T).
- The amount sent to the **trustee** is tripled (or some other factor is applied).
- The **trustee** decides how much of the tripled amount (3T) to send back to the **trustor** (Amount = R).
- Payoffs: Trustor = E – T + R; Trustee = 3T – R

Trust Game (3/3)

Dependent Variables

- Amount sent by trustors.
- Amount sent back by trustees conditional on sent amount.

Prediction

- Truster sends **nothing** to the trustee.

5-Minute Exercise

- In your own words, briefly describe the key differences between the **Dictator Game** and the **Ultimatum Game**. Then explain how these differences affect the interpretation of giving in the two games.

Social Dilemmas

Prisoner‘s Dilemma (1/3)

Purpose

- Study cooperative behavior when there is a conflict between **individual rationality** and **collective welfare** in a two-player setting.

Roles & Task

- **Player 1:** Decides whether to cooperate or to defect with Player 2.
- **Player 2:** Decides whether to cooperate or to defect with Player 1.

Prisoner‘s Dilemma (2/3)

Game Structure & Payoffs

P2

		Cooperate	Defect
P1	**Cooperate**	40, 40	12, 60
	Defect	60, 12	25, 25

Dependent Variables

- Share of cooperative choices.

Prisoner‘s Dilemma (3/3)

Prediction

- Both players **defect,** as (Defect/Defect) is a Nash equilibrium in dominant strategies.
    - The social optimum (Cooperate/Cooperate) is not an equilibrium.

Public Goods Game (1/4)

Purpose

- Study cooperative behavior when there is a conflict between **individual rationality** and **collective welfare** in settings with n>2 players.

Roles & Task

- **Players:** Typically, n>2 players (e.g., 4-6), each with an initial endowment. Each players decides whether to contribute to a Public Good or not.

Public Goods Game (2/4)

Game Structure & Payoffs

- Each player is given an initial endowment (= E, e.g., $10).
- Each player decides how much to contribute (= C) to the **public good (fund)** without knowing others' choices.
- Contributions of all players are summed up and multiplied by a factor (greater than 1, such as 1.5 or 2) and then distributed equally among all players (regardless of their contribution).
- **Payoff** = (E - C) + (Share of public good)

Public Goods Game (3/4)

Example

Each of four players has an endowment of $10 and makes the following contribution:

- Player 1 contributes $10.
- Player 2 contributes $6.
- Player 3 contributes $4.
- Player 4 contributes $0.

- Total contribution by all players: $10 + $6 + $4 + $0 = $20
- Share of public good for each player: ($20 x 1.5)/4 = $7.5
- Each players receives: (E-C) + Share of public good:
  - Player 1 receives: ($10 - $10) + $7.5 = $7.5
  - Player 2 receives: ($10 - $6) + $7.5 = $11.5
  - Player 3 receives ($10 - $4) + $7.5 = $13.5
  - Player 4 receives: ($10 - $0) + $7.5 = $17.5

Public Goods Game (4/4)

Dependent Variable

- Contributions.

Prediction

- The Nash equilibrium is for all players to **contribute 0.**
  - A players earns most when contributing 0, regardless of what the others are contributing (dominant strategy).
  - The social optimum (all contribute the full endowment) is not an equilibrium.

Coordination

Stag-Hunt (1/3)

Purpose

- Study **coordination** in situations where there is a trade-off between payoffs and risk but no dominant strategy to defect.

Roles & Task

- **Player 1:** Decides whether to cooperate or to defect with Player 2.
- **Player 2:** Decides whether to cooperate or to defect with Player 1.

Stag-Hunt (2/3)

Game Structure & Payoffs

P2

P1		Cooperate	Defect
	Cooperate	50, 50	0, 20
	Defect	20, 0	10, 10

Dependent Variables

- Share of cooperative choices.

Stag-Hunt (3/3)

Prediction

- Two Nash equilibria (in pure strategies): (Cooperate/Cooperate) and (Defect/Defect).
    - (Cooperate/Cooperate) is **attractive in terms of payoffs** and aligns with the social optimum.
    - (Defect/Defect) is **attractive in terms of risk.**

Incentives

Why Use Real Money?

- **Simple explanation:** Participants are more likely to take tasks seriously and don't engage in **cheap talk** when real money is at stake.

- The **induced value method** (Smith 1976) provides a theoretically grounded reason for using monetary incentives.

The Induced Value Method (1/3)

- In standard economic theory, models are built around **preferences** and **utility**, not around money directly.
  - **Preferences**: Describe how much someone likes or values one thing over another. For example, a person might prefer coffee over tea, or a day off over working extra hours.
  - **Utility**: Numerical way of representing those preferences. Higher utility = higher preference.

- Experimental research replaces utility payoffs with monetary payoffs and thus induces a utility function.

- The **induced value method** assigns artificial preferences to participants by tying their choices to real monetary rewards.

The Induced Value Method (2/3)

- Smith (1976) argues that inducing preferences by money can only be achieved if three conditions are met:

1. The perceived utility from monetary income must increase with the size of the payoff. In other words, participants must **always prefer more money to less.**
2. The payoffs in the experiment must be **salient**, i.e., they must noticeably depend on the subject’s decisions.
3. The monetary rewards must **dominate** other possible motivations (like boredom, curiosity, or social approval).

The Induced Value Method (3/3)

Example for Public Goods Game

- A classic example for a “real” world public good is “better air quality.”

- Public Goods Game experiments in the lab do not involve clean air or any "real" public good—they use money as the medium of preference.

- Through monetary payoffs, researchers simulate the incentive structure of public goods to study cooperation and free-riding behavior.

Size of Payoffs (1/6)

- Do monetary incentives have an effect and if so, to what extent does it depend on the size of the payoffs?
  - ➢How high should payoffs be?

- There are two extreme positions:
  - It makes no difference at all whether monetary incentives are used or not.
  - Many effects (especially in the context of social preferences) vanish if payoffs are set at a sufficiently high level.

➢Both extreme positions are likely incorrect.

Size of Payoffs (2/6)

- Camerer and Hogarth (1999) analyzed 74 papers in which the effect of different payoff levels was investigated:
  - Monetary incentives are **not ineffective** (i.e., decisions should not be elicited hypothetically but provided with appropriate monetary consequences).
  - Deviations from the rational choice model **do not disappear** at higher payoffs.

- Further results show that effect of payoffs size depends on the context:
  - Size of payoffs matter much in tasks involving real effort.
  - Size of payoffs matter less when intrinsic motivations is high.
  - Proportion of allocations in Dictator Game gets smaller with increasing payoff size.

Size of Payoffs (3/6)

- Andersen et al. (2011) study the effects of the stake size in an Ultimatum Game in Indian villages.

- They vary the endowment of the proposer: 20/200/2,000/20,000 rupees:
  - At the time of the experiment, these amounts roughly corresponded to \$0.41, \$4.1, \$41, and \$410 or between 1.6 and 1,600 hours of work (daily wage: 100 rupees).

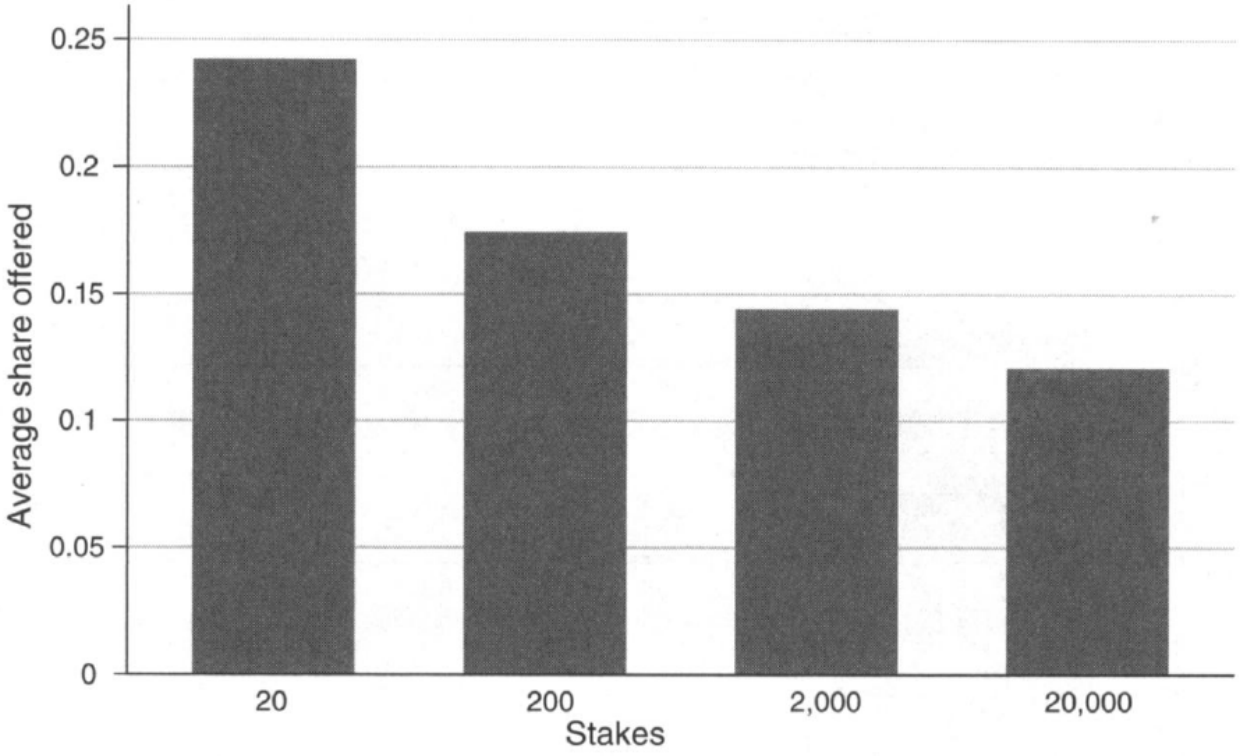

FIGURE 1. OFFER PROPORTION ACROSS STAKES

Notes: Figure shows average proportion of the stakes offered to the responder. Stakes represents our four stakes treatments of 20, 200, 2,000, and 20,000 rupees to be shared in the ultimatum game.

Source: Andersen et al. (2011, p. 3431)

TABLE 2—REJECTION RATES BY WEALTH AND STAKES (*percent*)

	Rs 20	Rs 200	Rs 2,000	Rs 20,000	All
Wealth	34.68 [60]	47.30 [35]	33.33 [21]	8.33 [1]	36.34 [117]
No Wealth	46.43 [13]	36.00 [18]	19.57 [9]	0 [0]	29.41 [40]
All	36.32 [73]	42.74 [53]	27.52 [30]	4.17 [1]	34.28 [157]

Notes: Figures in the table represent average rejection rates by treatment. Numbers in brackets are the number of actual offers rejected. Subjects in the "Wealth" treatment earned earnings in unrelated tasks before bargaining in the ultimatum game. Subjects in the "No Wealth" treatment participated in only the ultimatum game task. Rs 20, 200, 2,000, and 20,000 represent our four stakes treatments and denote the monetary amount to be bargained over in the ultimatum game.

Source: Andersen et al. (2011, p. 3433)

Size of Payoffs (6/6)

Commonly used rule of thumb

- Average total payoffs should be as high as the **opportunity costs** incurred by the subjects by participating in the experiment.
  - For students: The hourly rate that they would receive as student assistants for the duration of the experiment.

Take Money from Subjects? (1/5)

- In many economic contexts, decisions made by individuals can lead to losses.
  - For example, investing in the stock market.
- Experiments aiming to reflect this may require participants to incur losses—potentially even paying the experimenter.
- However, beyond ethical concerns, such designs can harm recruitment, as participants may be deterred by the risk of losing money.
- So how can we study losses in the lab?

Take Money from Subjects? (2/5)

Introduce losses only in parts of the experiment

- In Rydval and Ortmann (2005), subjects play five different versions of the Stag-Hunt Game.

- Only two involve potential losses, and only one game is randomly selected for payment.

- This keeps the possibility of losses real but minimizes their likelihood.

Take Money from Subjects? (3/5)

Introduce non-monetary losses

- In Kroll et al. (2014), losses are implemented as **waiting times**—participants wait longer to receive their payoffs, rather than receiving less money.

- This avoids financial loss but raises concerns about **unequal opportunity costs of time**, which may affect behavior.

Take Money from Subjects? (4/5)

Introduce a show-up fee

- Participants receive a **fixed payment** simply for showing up, regardless of their decisions.
  - Ensures they don't leave with negative earnings, even if losses occur during the experiment.

- However, the fee should be modest—too high, and it may **undermine incentives** tied to performance.

Take Money from Subjects? (5/5)

Introduce an earnings stage

- Participants first complete an initial task to **earn money**, which is then used in the main experiment—where losses may occur.

- To be effective, there should be a **time gap** between the two stages, so the earned money feels psychologically separate from the experiment setup.

House Money Effect

- People often treat endowed money differently from earned money, this is refereed to as **house money effect**.

- This behavior is inconsistent with rational choice theory but consistent with findings in behavioral economics (e.g., mental accounting).
  - Strong house money effects have been observed in Dictator Games.
  - Effects appear weaker in Public Goods Game experiments.

- To minimize house money effects, it is recommended to have participants earn their stakes through a preliminary task.

Questions

Exam Objectives

In the exam, you should be able to:

- **Describe** the Die-Rolling Task, the Dictator Game, the Ultimatum Game the Trust Game and the Public Goods Game (Roles, Tasks, Game Structure, Payoffs, Dependent Variables).
- **Describe** the difference between cooperation and coordination by using the Prisoner’s Dilemma and the Stag-Hunt Game as examples.
- **Explain** the three conditions that must be met to induce preferences by money according to Smith (1976).
- **Explain** the house money effect.

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Image Sources

- All images sourced as indicated on the slide or generated by AI.