Designing and Running Experiments

Methods, Examples, Techniques and Advices

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What is a good experiment?
Seven questions by Shyam Sunder

1. What is the question that you would like to have answered after the experiment? (Your answer should be a single sentence with a question mark at the end.)
2. What do you know already about the possible answers to the question you have stated above? → **Literature research**
3. What are the various possible ways of finding an answer to the question you have stated above? Include both experimental as well as any other methods you know.
4. What are the advantages and disadvantages of using an experiment to find an answer?
5. What are the chances that the answer you get from the experiment will surprise you or others? What are the chances that it will change someone's mind? **[NOTE: Confirming previous results also important!]**
6. How would you conduct the experiment? (Write down a design and instructions.)
7. Is your experimental design the simplest possible design to help answer the question you have stated?

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I. How to arrive at your

Research Question?

Motivation for Research Question

1. Testing theories
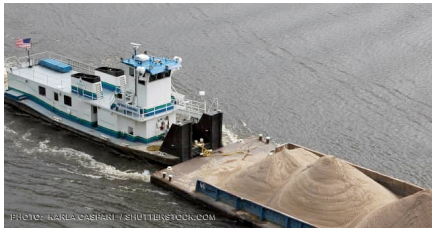
Motivation of Research Question

1. Testing theories
2. „Real world" problems

2. „Real world" problems

- „*Whispering in the ears of princes*"   (Roth 1986)
  - advice based on experiments calibrated to specific questions, e.g., raised by policy institutions

Policy experiments

- **Market organization rules**
    - Rate filing policies for U.S. inland water transportation by US Interstate Commerce Commission (Hong and Plott, Bell Journal Economics 1982)
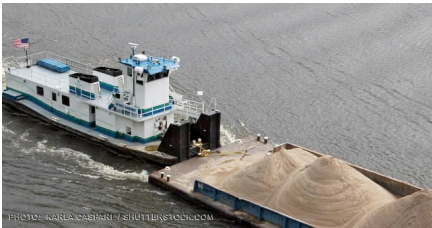
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Policy experiments

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  - UMTS spectrum auctions in UK and Germany
    - advising the British Radiocommunications Agency (Binmore and Klemperer, EJ, 2002)
    - BonnEconLab supported bidders' behavior in
      - UK (Abbink et al. EER, 2005)
      - Germany (Abbink et al. CESifo Economic Studies, 2002)

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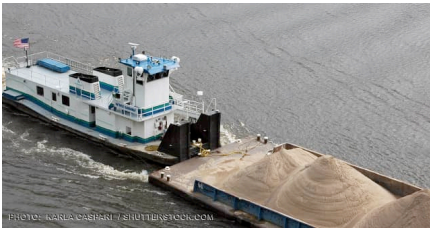# Policy experiments

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- **Health care** (Hennig-Schmidt, Selten, Wiesen, JHE 2011)
  - payment systems for medical doctors supported by German Doctors' Association

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Motivation of Research Question

1. Testing theories
2. „Real world" problems
3. Explorative studies to establish behavioral regularities

3. Explorative studies

- "Searching for facts" as a basis for new theories of **rational** behavior (Roth 1986)

- Establishing empirical regularities → theories of **boundedly rational behavior** (Selten et al, Econometrica 1997)

  - Both approaches direct theorist's effort
    → look for regularities in existing data → build a formal model → test the new model by new experiments
  - Selten's approach (1987)
    - **limited rationality of human decision behavior must be taken seriously.**
    - Are basic assumptions of SUT adequate to real behavior?
      - Maximization?
      - Aspirations, equity?

3. Explorative studies

Roth (1986)

- "Demands on theory made by experimental data can be quite different from those imposed by traditional deductive considerations. In this respect, **Selten conducts something of a dialogue with himself.**

- As a theorist, he is well-known for his seminal work on perfect equilibria, which forms the basis for much of the current theoretical work on rational and "hyperrational" behavior."

- For this work he was awarded the **Nobel Prize in Economics in 1994** together with John Nash and John Harsanyi.

- "But on the basis of his reading of the experimental data he finds himself constructing a theory of a radically different sort. Indeed, he observes:"

- "The success of [my] theory […..] confirms the methodological point of view that the limited rationality of human decision behavior must be taken seriously." **"The optimization approach fails to do justice to the structure of human decision processes**" (Selten, 1987).

Motivation of Research Question

1. Testing theories
2. „Real world" problems
3. Explorative studies to establish behavioral regularities
4. **Open questions from literature: Findings from previous experiments require clarification**

4. Open questions from literature

- Camerer (2003): Top Ten Open Research Questions

  1. How do people value the payoff of others?
  2. How do people learn?
  3. How do social preferences vary across people and environment (e.g. cultures)?
  4. What happens when people are confronted with "new" games?
  5. How exactly are people thinking in games?
  6. What game people think they are playing?
  7. Can experiments sharpen the design of new institutions?
  8. How do teams, groups and firms play games?
  9. How do people behave in very complex games?
  10. How do socio-cognitive dimensions influence behavior in games?

Motivation of Research Question

1. Testing theories
2. „Real world" problems
3. Explorative studies to establish behavioral regularities
4. Open questions from literature: Findings from previous experiments require clarification
5. **„New" tools available**
6. ……..

5. „New" tools

- Field experiments (Harrison and List 2004)
- Combining survey and experimental data
  (Dohmen, Falk, Huffman, Sunde, Schupp, and Wagner JEEA, 2011)
- Personality questionnaires (Bartling, Weber, Yao QJE, 2015)
- Skin-conductance
  (Ben-Shakhar, Bornstein, Hopfensitz & van Winden, JOEP, 2007)
- Neuro-economics
  (Nagel and Corricelly, PNAS, 2009, Camerer and Yoon 2015 – SI JMR)
- Eye-tracking (Fehr, recent presentations)
- ......

II. Transfer the RQ into an experiment

1. Design

- Experience
  - Learn from experiments in the literature
    - Is existing design adequate to your RQ?
    - How to adapt it?
    - New design?

  - *Check whether your wonderful new design has already been invented by someone else!*

1. Design

- *Economic Science Association* *https://www.economicscience.org/*
  - esa-discuss@googlegroups.com

Oliver Kirchkamp
An: ESA Experimental Methods Discussion
Antwort an: oliver@kirchkamp.de
Aw: [ESA-discuss] Re: statistics on multiple independent tasks on the same subjects

2. Which kind of experiments?

- Labexperiments → control

  - Paper and pencil
  - Computer
    - within one Lab
    - between several Labs (Connection via Internet)
    - Online
  - Video

Lab: Paper-and-pencil experiments

Lab: Paper-and-pencil experiments

Participant #: 1   Session: 5

Decision sheet for RESPONDER

INITIAL ENDOW- MENT SENDER	RESPONDER RECEIVES	SENDER- KEEPS	TICK HERE IF YOU ACCEPT	TICK HERE IF YOU REJECT
20	0	20		✔
20	1	19		✔
20	2	18		✔
20	3	17		✔
20	4	16		✔
20	5	15		✔
20	6	14		✔
20	7	13		✔
20	8	12	✔	
20	9	11	✔	
20	10	10	✔	
20	11	9	✔	
20	12	8	✔	
20	13	7	✔	
20	14	6	✔	
20	15	5	✔	
20	16	4	✔	
20	17	3	✔	
20	18	2	✔	
20	19	1	✔	
20	20	0	✔	

- Relatively low start up costs
- Flexibility (quickly develop new treatments)

- Procedures more visible and credible
  - e.g., instead of random device on the computer throw a dice in front of people
- Prone to mistakes in transmitting decisons
- Matching of subjects is easily figured out
  → experimenter walking around
- Data have to be entered manually

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Computer experiments

- – Better control
  - no communication among subjects
  - less interaction with experimenter

- Running experiment much simpler (e.g. complex interactions, markets)
- Automatic data collection
- Fewer mistakes
- Higher start-up costs: programming, testing

Computer experiments

Connecting several Labs

- One large lab: Public good game
  100 participants simultaneously
  (Weimann et al. 2019 EER)

Computer experiments
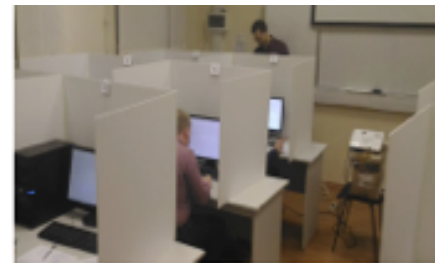
Connecting several Labs

- One large lab: Public good game
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- Intercultural online-experiment
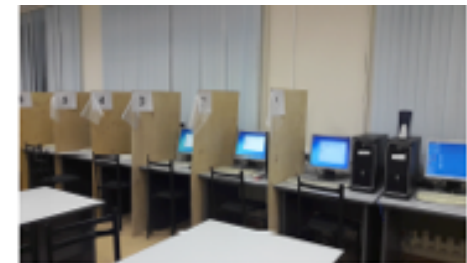 Russia/Germany (WP, Grimalda et al. 2019)

Kiel Laboratory   BonnEconLab   Moscow Lab   Tomsk Lab

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Video experiments

- How do people make their decisions?
  - interest in decision processes
- Group decision making
- Discussions are video recorded

- Conventional experimental methods
  - most often record decisions only,
- Questionnaires and interviews cannot document decision processes.
- Content analysis of text protocols

More kinds of experiments

- Internet experiments → loss of control
  - larger number of participants
- Field experiments
  - closer to „reality"
- Combination of methods
  - Survey and experiment, experiment and questionnaires
- …..

3. Instructions

- **Take your time** to formulate the instructions!!
- Instructions should be **clear** and **easy to understand for the participants**
  - check in a **pilot**
- Instructions must be clear about
  - all participants' **decision options**
  - the **consequences** of their decisions for **themselves** and **others**
  - in particular the **financial** consequences
- **Terms** on **screens** are to be **identical** to instructions
- **Back-translation** in inter-/cross cultural experiments to check for *differences in meaning*

No deception!!!

- **Never cheat on subjects**, even though it might be tempting from a scientific point of view.

  – You need not tell all details to the subjects.
  – But what you tell them has to be true.
  – Make sure that when you do not tell details you do not deceive.

  – There exists a moral code among economic experimentalists not to cheat.
  – **Keeping a subject pool trusting is a public good!**
  – You will lose your reputation towards your subjects:
    - If you lie once they will never believe you in the future. This blurs all incentives.

  and
  – You will not publish a paper in an economic journal as that would provide wrong incentives to other researchers.
  – Different view in psychology.

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4. Procedure

Document in a

- **to-do-list** what has to be prepared before the experiment
- **script** the procedure how to prepare and run the total experiment
  - in order to run it **always same way**, also when several people are involved!
- Make sure participants **don't communicate and do not use their mobile phone** during the experiment.
- Having participants **read instructions in private**/ reading the instructions **loudly** to the participants
  - common knowledge
- Participants **ALWAYS** have to answer **comprehension questions**.
- **Answers** are controlled by experimenter/program.
- The experiments only starts after all subjects have answered **all comprehension questions correctly**.
  - → may take time!!!

5. Programming

- **oTree-Software** https://www.otree.org/

    An open-source platform for behavioral research,

    – Chen et al.: oTree – An open-source platform for laboratory, online, and field experiments, *Journal of Behavioral and Experimental Finance,* 9, 88-97.

- **zTree** https://www.ztree.uzh.ch/en.html

    Zurich Toolbox for Readymade Economic Experiments

    – Fischbacher, Urs (2007): z-Tree, Toolbox for Readymade Economic Experiments, *Experimental Economics*, 10, 171–178.

- Others

- Available in different languages and characters (fonts), e.g., Chinese, Cyrillic .....

Test the program extensively!!!

- Extremely **important**!!!
- Test
    - **local** on your computer
    - **But finally with all clients on the server**
    - by a **pre-designed** test
    - to **exclude problems** during the experiment
    - to **avoid** losing
        - money
        - reputation

6. Inviting participants

- **Announcement on campus**

  "Participate in economics experiments and earn money"

- **email**,

- **by ….**

- **Online recruiting system**

  ORSEE: Online Recruitment System for Economic Experiments Software http://www.orsee.org/web

  - Greiner, B. (2015): Subject pool recruitment procedures: organizing experiments with ORSEE," *Journal of the Economic Science Association,* 1, 114-125.

  hroot: Hamburg Registration and Organization Online Tool https://hroot.wiso.uni-hamburg.de/

  - Bock, O., I. Baetge, and A. Nicklisch (2014): hroot: Hamburg Registration and Organization Online Tool," *European Economic Review*, 71, 117 -120.

Inviting participants

- Provide all information you need for inviting participants properly
  - Date, time, duration of sessions
  - # of participants per session, extra candidates per session

  - Characteristics of the invitees
    - Gender, major, # of previous participations in experiments, no-show ups
    - Which previous experiments they are *not* allowed to have participated in?

7. Running the experiment

- Proceed according to pre-specified **script**

- **Identify** each arriving participants by his/her ID

- **Assign** participants **randomly** to work stations

8. Paying participants

- **Show-up fee**
  plus
- **Adequate payment** per hour
  - student assistant wage
- Pay **all** people
  - But, pay only **some participants** if you do not have enough money (e.g., by random draw)
  - Pay only **some randomly drawn decisions** of **each** participant (to avoid income effects).
- Usually, subjects are paid
  - **directly after** the experiment (cash, transfer to account)
- Pay **in private**
  - **double blind** (experimenter cannot assign any decision to any subject) if essential for experiment

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