

M.Sc. Seminar: Decision and Game Theory

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These notes may be updated from time to time.

Contact

- Use this and only this email address: `office.alos-ferrer@wiso.uni-koeln.de`
- This is not the only course we teach. Always write in your email which course it is about, in this case “Seminar Decision and Game Theory”.

Topic

The topic this year is **Belief, Rationality, and its Limits in Games**. A standard assumption in game theory is that all players are rational, that everyone believes this, that everyone believes that everyone believes this, and so on. There are no bounds to the depth of reasoning of players. Often, one just assumes that players play a Nash equilibrium. But such strong assumptions can not literally be true in every situation. There would be no chess tournaments if everyone could reason through all possible plays. At the same time, it is clear that people often try to reason through games, even when there are limits as to how far they can do so.

In order to learn to what degree players can reason through a game, we need to have clear theoretical ideas about what rationality and belief actually mean. How can the behavior of a rational player differ from a player that is rational and believes everyone else is rational too? Will players who have no limitations on how far they can reason through a game always play a Nash equilibrium? What are the implications of reasoning that are principally observable in a laboratory setting?

Questions like these will occupy us in this seminar. It has only been very recently that the approaches economic theorists have developed to study such questions under the umbrella term “epistemic game theory” since the late 80s had an impact on economic experiments and some of the papers below are extremely recent and part of an active research area.

A good, purely theoretical, foundation for these topics is given in the following survey paper, and I will present selected parts in the first session.

- Brandenburger, Adam. “Knowledge and equilibrium in games.” *The Journal of Economic Perspectives* 6.4 (1992): 83-101.

Schedule for WS 16/17

Group Meetings take place on certain **Wednesdays, 14:00 - 15:30, Philosophikum - Room S 55**. A good part of the course is based on your own work and face-to-face meetings to discuss it. The course has three phases.

Phase 1: Introduction

In this phase I will introduce the seminar topic, and discuss what should be in the presentation and in the written report. The date for this is:

- **October 19th, 2016:** General information on the seminar

Phase 2: Preparing Your Presentation

In this phase you have to choose your topic (paper) from the list of **References** at the end of this document, get a date for your presentation, and prepare your slides and your written report. *There are no group meetings in this phase.* If you want to present a related paper not listed, discuss it with me first. Important notes:

- The deadline for choosing a topic and a preferred date for your presentation (see below) is **November 2nd**. Write an email before that date. Please note that we operate on a “first-come, first-served” basis, so if you are late you might not get your topic or your preferred slot. Also, please note that some papers need to be presented before other ones, so this might condition the slot you get.
- If you encounter difficulties preparing your presentation / report, make an appointment with me. Please note that office hour slots go fast! You need to make an appointment with several weeks in advance. Ask for an appointment at the email address above.
- Even if you do not make an appointment, it is recommended that you send a preliminary version of your slides (PDF only!) to the email address above. To get feedback on the slides, you need to send them at least two weeks before your scheduled talk.

Phase 3: Student Presentations

We will have student presentations in the dates below. We may not need all these dates, depending on the number of presentations. You need to get a slot for one of these dates.

- January 11th, 2017
- January 18th, 2017
- January 25th, 2017
- February 1st, 2017

You are required to give a presentation to pass. We have chosen as many dates as needed given the number of registered students. If students drop out, we might reallocate some talks.

Is attendance required? Except for your presentation, NO. But it is highly recommended. Please check “Seminar Attendance and the New University Law” in the Brain Gain blog. There are other entries on seminars and studies in that blog that you might want to have a look at.

In addition to your presentation, you need to deliver a written report.

The deadline for the written report is February 8th, 2017, 24:00

General Observations

1. **The language is English.** English has established itself as the language of Economic Theory. The literature you will work with will be in English, and it is expected that you write your slides and your written report in English.
2. **The format is PDF.** It is *recommended* to write in L^AT_EX, but you are free to use whatever software you are familiar with to produce your presentation slides and your written report. However, **YOU MUST GENERATE (searchable) PDF FILES** which work across platforms (our group is Windows-free). No other format is accepted. In particular, do *not* come to your presentation with a “PowerPoint” file.
3. **Plan in advance.** You can make an appointment to discuss your presentation and report. However, you need to make the appointment several weeks in advance. Do not count on getting an appointment if you ask just a week in advance—slots go fast! You can also send a preliminary version of your slides before your presentation. You will get feedback, but only if you send them at least two weeks before your presentation.

The Presentation

4. You should prepare a slides utilizing presentation based on the research paper you have been assigned. Great advice on giving presentations can be found in Unit 4 of
 - Jean-luc Doumonts, *English Communication for Scientists*. Cambridge, MA: NPG Education, 2010
Cambridge: Cambridge University Press, 2013.
www.nature.com/scitable/ebooks/english-communication-for-scientists-14053993
5. Your talk should take no more than 25 minutes, and no less than 20. Practice privately in advance. Several times. As a rule of thumb, this means 10 to 15 slides. Often, you will have to make a decision which part of the paper is important and which part can be ignored for the presentation. Don't aim for presenting everything if the paper is long.
6. Slides have to be easily readable. Use a large type font (if you use L^AT_EX simply use a slide style as *Beamer* or *PowerDot*). Do not pack too much in your slides. The less clutter a theme has, the better.
7. What belongs in the slides?
 - Introduction: what the paper is about, previous literature.
 - For theoretical papers: Detailed set-up of the model and the results you chose to present.
 - Detailed presentation of the results. Include intuition on them.
 - Graphical illustrations. It is fine to copy-paste pictures from the paper (this is a closed-door presentation), but indicate it clearly in the slide.
 - Discussion, including literature appeared *after* the paper.
8. What should *not* be in the slides?
 - Long, detailed proofs (but intuition, sketches, and/or examples are welcome). Check your timing.
 - Unsubstantiated opinions.
9. These things *could* be in the slides (but need not be).
 - Short (1 slide) discussions of related papers.
 - Short presentations of examples or other original contributions on your part (see below).
 - Self-generated pictures illustrating aspects of the paper.

The Written Report

11. The written report is due at the end of the semester, and can contain elements which appeared in the discussion of your presentation.
12. The written report should be 12 to 16 A4 pages written single-spaced with reasonable margins (not too large, not too small) and a 12pt type font. Avoid fluff. The bibliography at the end does *not* count towards page count.
13. **Content.** The written report is made out of the following parts.
 - *Introduction*. Where you explain what is the topic and why it is interesting for economists.
 - *Related Literature Review*. Where you briefly explain which other articles are relevant for the issue(s) at hand, and put the paper in a broader context.
 - *Model*, where the setup of the paper is presented.

- *Results*, where the results of the paper are presented and discussed. As in the presentation, avoid repeating proofs (we can read those in the original paper), but make sure you understand them and give intuitions, illustrations, or summaries of the main arguments instead.
- *A Small but Original Contribution*, related to the paper but not taken from it. What is feasible of course depends on the paper, but examples of original contributions are:
 - A worked-out **numerical example** where you can illustrate the results of the paper, ideally giving rise to a graphical illustration.
 - A **computer simulation** which illustrates aspects of the model in the paper which have not been or can not be showed analytically.
 - A worked-out **small variant** or **simplification** of the paper's model in the literature review (e.g. take a model which has been analyzed with linear costs and solve it with quadratic costs; find additional equilibria after one assumption has been dropped/weakened; recompute the results of a duopoly model for three firms; etc).
 - A **comparison** of the results in the paper to later, related papers (of course, this does not count as contribution if the comparison is made in those later papers).
- *Related Work*. Where you briefly summarize related papers which appeared after the one you have been assigned. Conduct an inverse search (through academic databases or at least Google Scholar) to see who has quoted the papers you are working on and why. Find out what has been done on the topic after the papers you review were written.
- *Conclusion*. Where you summarize the report and its message (1 page; not more, not less).

Mistakes

The following are examples of severe mistakes leading to bad grades. They are all taken from actual student behavior in past seminars. Learn from their mistakes!

- *Mistake: using the wrong version of your paper*. Do not just "google" your paper. Go to the journal's web page through the Library's database or the links provided below and download the published version. Using a VPN-client, you can also do this from home. There might be preliminary versions of the paper on the Internet, which might differ from the published version or even contain mistakes. As a student at the University of Cologne, you have access to the journals. Use it! If you have problems accessing a paper, write to me.
- *Mistake: looking only at your paper*. There are several "general papers" which you should read. You should also read the papers which are going to be presented by other participants. You might be asked to discuss the relations among them. Be prepared!
- *Mistake: misquoting*. If a paper is by Smith, Jones, and Gordon (1985), you *cannot* quote it as Smith (1985). How would you feel if you worked hard on a paper and it was attributed to somebody else? Learn how to quote properly, and make sure you do not mix up the authors' names. Misquoting will automatically reduce your grade.
- *Mistake: textbook literature*. This is not the place to review textbook knowledge from your basic courses. Don't review what is a utility function or a subgame perfect Nash equilibrium. Don't write the n -th summary on the basics of Principal-Agent models. Don't reproduce a detailed definition of repeated games.
- *Mistake: nonacademic sources*. Wikipedia is not a peer-reviewed, academic source. It's fine to use it to find the real sources, but do not mistake it with an academic document. Likewise, not everything you find on Google is an acceptable reference (hint: use the academic databases available within the UoC net, e.g. EconLit, or at least start your searches with Google Scholar).

- *Mistake: coming to your presentation without a working PDF file.* If you show up with a file in the wrong format (e.g. Powerpoint slides), you will not be able to present. This means you will fail the course.
- *Mistake: reading from your notes while presenting.* Your presentation should be hands-free. Do not prepare a text to read. That shows that you are unfamiliar with the paper and are trying to cover up lack of preparation. It's fine to have a couple of notes handy "just in case", but reading out loud from them is not. Note that slides are not your presentation notes, they are only for things that the audience should see.
- *Very Bad Mistake: plagiarism.* Plagiarizing is worse than a mistake. It is dishonest behavior. As a first step, it will immediately lead to a "fail" grade. Additionally, we will report it to the administration and that might lead to expulsion from University. We're not kidding. By the way, there is automatic web-searching software to check for plagiarism. So we'll find out. And yes, copying from other students' written reports is also plagiarism.

References

- Alaoui, Larbi, and Antonio Penta. "Endogenous depth of reasoning." *The Review of Economic Studies* (2015): rdv052. doi: [10.1093/restud/rdv052](https://doi.org/10.1093/restud/rdv052)

The authors assume there is a cost to deeper reasoning in games and players have to decide on how deep to go. They also test their theory in the lab. Note that there exists two published versions, the second one is rdv052.

- Aumann, Robert J. "Correlated Equilibrium as an Expression of Bayesian Rationality." *Econometrica* 55.1 (1987): 1-18. doi: [10.2307/1911154](https://doi.org/10.2307/1911154)

Much of economics does not just assume that players have unbounded depth of reasoning, but that all players have, at least a priori, the same beliefs. This paper shows what the consequences of this assumption are.

- Aumann, Robert J., and Adam Brandenburger. "Epistemic Conditions for Nash Equilibrium." *Econometrica* (1995): 1161-1180. doi: [10.2307/2171725](https://doi.org/10.2307/2171725)

A classic paper that clarifies what one needs to assume about the reasoning of players to justify Nash equilibrium. Somewhat technical.

- Aumann, Robert J., and Jacques H. Dreze. "Assessing strategic risk." *American Economic Journal: Microeconomics* 1.1 (2009): 1-16. doi: [10.1257/mic.1.1.1](https://doi.org/10.1257/mic.1.1.1)

In order to judge whether players are rational in a game, we need to be able to elicit their preferences. In a strategic setting, this is a subtle issue addressed in this paper.

- Brandenburger, Adam, and Eddie Dekel. "Rationalizability and correlated equilibria." *Econometrica* (1987): 1391-1402. doi: [10.2307/1913562](https://doi.org/10.2307/1913562)

The most readable (but still technical) early paper that studies assumption on reasoning behind various solution concepts.

- Friedenber, Amanda, Willemien Kets, and Terri Kneeland. "Bounded Reasoning: Rationality or Cognition." (2016) unpublished. <http://www.public.asu.edu/~afrieden/car.pdf>

The authors use the data from Kneeland (2015) to disentangle the reasoning process of players further. Since this paper is not yet published, the online version might be subject to change. If you want to present this paper, ask me and I will send you a version you can take to be definite for the purpose of your presentation and your writeup.

- Stuart, Harborne W. "Common belief of rationality in the finitely repeated Prisoners' Dilemma." *Games and Economic Behavior* 19.1 (1997): 133-143. doi: [10.1006/game.1997.0549](https://doi.org/10.1006/game.1997.0549)

What does unlimited depth of reasoning imply in the finitely repeated prisoners dilemma?

- Kneeland, Terri. "Identifying HigherOrder Rationality." *Econometrica* 83.5 (2015): 2065-2079. doi: [10.3982/ECTA11983](https://doi.org/10.3982/ECTA11983)

A clean experiment for studying depth of reasoning.

- Reny, Philip J. "Common knowledge and games with perfect information." *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association*. Philosophy of Science Association, 1988. <http://www.jstor.org/stable/192897>

What does rationality, belief in everyones rationality, and so on imply in extensive form games? The topic is still somewhat controversial and this was one of the first papers pointing out difficulties with backward induction.

- Rubinstein, Ariel. "The Electronic Mail Game: Strategic Behavior Under" Almost Common Knowledge". *The American Economic Review* (1989): 385-391. <http://www.jstor.org/stable/1806851>

This influential paper shows that in games of incomplete information, the idea that every knows that everyone knows that everyone knows...of unbounded depth can dramatically differ from having such interactive knowledge to a high but finite depth.