Term Year – Course Number, Section

Evolutionary Explanations of Communication

Class Number: ####, Delivery Method: In Person

Course Information

Course Times + Location	Exam Times + Location
Date and Time	Date and Time
Building and Room Number	Building and Room Number

Contact Information	Office Hours
Instructor: Travis LaCroix	Date and Time
✉ tlacroix@uci.edu	Building and Office Number

Calendar Description

This course is an advanced study of a central problem in recent philosophy of language.

Prerequisites

12 credits in Philosophy or permission of the Department.

Some background in formal philosophy, especially game theory, will be valuable but is not strictly required.

Learning Outcomes

Upon successful completion of this course, students should be able to:

- Understand some recent conceptual issues in the evolution of signalling and simple communication;
- Articulate some philosophical dimensions of those issues; and
- Accomplish some evaluation and adjudication of those issues.

Detailed Course Description

Note: This course was designed as a senior undergraduate, graduate lecture in a seminar-type format. It may be run on a schedule of 3 hours, once per week (with two topics per section); or 1.5 hours, twice per week (with one topic per section). It could also be run as an undergrad (or grad) only lecture (or seminar).

Grading

The final grade will derive primarily from a research paper, due at the end of the semester. Given this course may be cross-listed with a graduate section, the requirements for the undergraduates and the graduate students will vary somewhat.

Details of how each section will be graded are given below. The main difference is that (1) Graduate students will choose a topic from the schedule and present one of the readings from that week; (2) the graduate student paper is expected to be somewhat longer.

I will discuss the papers further at the first meeting.

Undergraduates

Participation	10%
Weekly Response Paper	20%
Final Paper (according to the following scheme:)	70%

Proposal (500 words)	10%
First Draft (3-4k words)	20%
Peer Feedback	10%
Abstract of the Paper ($<$ 500 words)	5%
Revised Final Draft ($<$ 6k words)	25%

Graduates

Participation	10%
Presentation	20%
Final Paper (according to the following scheme:)	70%

Proposal (500 words)	10%
First Draft (4-5k words)	20%
Peer Feedback	10%
Abstract of the Paper ($<$ 500 words)	5%
Revised Final Draft ($<$ 8k words)	25%

Required Readings

We will be going through two books, plus associated articles.

All of the readings will be available as .pdf files on the course webpage; however, neither of the books are too costly if you want to pick up a hard copy.

They are

- David Lewis (2002/1969). *Convention: A Philosophical Study*. Oxford: Blackwell.
- Brian Skyrms (2010). *Signals: Evolution, Learning, and Information*. Oxford: Oxford University Press.

(Note, if you are auditing or on the waitlist and do not have access to the course web-page, please email me.)

All of these will be required material, unless specifically noted. We will generally not go in detail through every single one of the readings, but it will be important that you have read them, since the lecture will not merely summarise that week's reading.

Policies

For general university-wide policies, see here: [Insert Link to University Policies].

Policies specific to this course are detailed below.

Use of Technology in Class

Laptops, tablets, etc **are** allowed in class; however, please be mindful that what is on your screen may be distracting to those around you.

In case you miss something from the lecture, the slides for the day's lecture, when applicable, will be posted after the lecture on the course web-page.

Missing or Late Assignments

I will adopt the following policy regarding late assignments: For the (very short) weekly paper, no late assignments will be accepted. The purpose of this exercise is to encourage you to come to class prepared, and having read the assigned reading.

With respect to the final paper, each component, except for the peer feedback, will be penalised by **one full letter grade** per 24 hours past the deadline. (Note that this includes weekends and holidays.) Letter grades are given by A+, A, A-, B+, B, B-, C+, C, C-, D, F.

So, for example, if you wrote an A+ paper, and you hand it in 10 days late, you get an F! If you hand in a B- paper two days late, it gets a C, etc.

That being said, I am willing to grant some leeway (within reason), for **valid** excuses with documentation.

If you have any concerns at any point throughout the course, I encourage you to email me or come to my office hours to discuss. In general, if a special condition or circumstance in your life may affect your performance, please let me know about it as soon as possible. It will be treated with the strictest confidence. *Do not wait until the condition or circumstance is impending or has already happened before telling me about its impact on you.*

If something unanticipated occurs, bring it to my attention and we will work out a way of dealing with it.

Academic Integrity

Any form of academic misconduct that is shown on an assignment, exam, essay, etc. is sufficient for a failing grade on that assignment.

Demonstrable repetition of academic misconduct is sufficient for a failing grade in the course.

Depending on the severity of the misconduct, a letter recording the violation may be sent to the Dean.

[Refer to the university's policies concerning academic integrity.]

Detailed Schedule

Note:
This syllabus will be updated throughout the course with more detailed / accurate descriptions of the later weeks; I will send a notification via email and make an announcement in class whenever the syllabus is changed.

Prologue

W1. **Introduction to Course**

Optional Reading

W. V. Quine. Foreword to David Lewis (2002/1969). *Convention: A Philosophical Study*. Oxford: Blackwell.

David Lewis (2002/1969). Introduction, in *Convention: A Philosophical Study*. Oxford: Blackwell. 1–4.

I will go over the syllabus, and provide a general introduction to the theme and problems upon which we will focus in this course.

Part I: Classical Game Theory and the Lewis Signalling Game

W2. **Coordination and Convention**

Required Reading:

David Lewis (2002/1969). Coordination and Convention, in *Convention: A Philosophical Study* (Chapter I). Oxford: Blackwell. 5–51.

David Lewis (2002/1969). Convention Refined, in *Convention: A Philosophical Study* (Chapter II). Oxford: Blackwell. 52–82.

This week we will be discussing the first two chapters of David Lewis' *Convention*. You will be introduced to the notion of a coordination problem, in addition to ways of solving coordination problems. Lewis highlights his formal definition of convention in Chapter 2 (page 78).

Note:
You can skim quickly over the discussion of "higher-order expectations", so long as you understand the concept—the exposition itself is lengthy.

While you are reading, you might consider the following questions to help you focus on what is important in this section.

- What does Lewis mean by "coordination problem"? What are some examples of a coordination problem (in a non-formal sense)? What does this have to do with communication?
- What are "equilibrium solutions"? Why might such solution be or not be helpful for solving a (symmetric) coordination problem?
- What is the difference between a game of "pure cooperation" and one of "pure conflict"? Where on the spectrum between these two does Lewis think communication lies?
- What are the three main ways that Lewis thinks coordination problems can be solved? How might each of these come to bear on questions concerning *communication* as it is understood as a coordination problem?
- What role is "common knowledge" playing in Lewis' definition of convention? Why is it important?

W3. **Conventions and Communication**

David Lewis (2002/1969). Convention Contrasted, in *Convention: A Philosophical Study* (Chapter III). Oxford: Blackwell. 83–121.

David Lewis (2002/1969). Convention and Communication, in *Convention: A Philosophical Study* (Chapter IV). Oxford: Blackwell. 122–159.

This week we will be discussing chapters 3 and 4 of David Lewis' *Convention*. Lewis contrasts his account of convention with other closely related social phenomena, including norms, social contracts, etc.

Most importantly, in Chapter IV, Lewis shows how his definition of conventions can help us to understand signalling via specifically communicative conventions.

Note:
You can skim quickly over the discussion of chapter III. There are some philosophically interesting things there, but we will primarily focus on chapter IV.
The formalism is a bit tedious, but we will go over the key notions in class.

While you are reading, you might consider the following questions to help you focus on what is important in this section.

- What are some key differences, as Lewis sees it, between *conventions* and *social contracts*? *norms*? *rules*? *imitation*?

- What is the distinction that Lewis makes between *two-sided* and *one-sided* signalling. Can you think of other example of each of these (i.e., in nature).
- Lewis suggests that two actions are *ideally* suited to be signals. Are these exhaustive? Are there other things that might be ideal signals?
- On Lewis' account, meaning is *conventional*. What does he mean by this?
- What is the distinction that Lewis highlights between natural and non-natural meaning? Why is this important?

Part II: Evolutionary Game Theory and the Lewis-Skyrms Signalling Game

W4. **Evolutionary Game Theory and Signalling Games**

Brian Skyrms (2010). Signals, in *Signals: Evolution, Learning, and Information* (Chapter 1). Oxford: Oxford University Press. 5–19.

Brian Skyrms (2010). Evolution, in *Signals: Evolution, Learning, and Information* (Chapter 4). Oxford: Oxford University Press. 48–62.

Brian Skyrms (2010). Evolution in Lewis Signalling Games, in *Signals: Evolution, Learning, and Information* (Chapter 5). Oxford: Oxford University Press. 63–72.

This week we introduce Skyrms' evolutionary account of Lewis' signalling game. Chapter 1 presents an overview of the topics that we will be discussing over the course of the next several weeks. Chapters 4 and 5 discuss evolutionary game theory and evolutionary accounts of signalling.

> **Note**:
> You can skim quickly over the discussion of chapter 1, since this is an overview of topics that we will look at in more detail.

While you are reading, you might consider the following questions to help you focus on what is important in this section.

- What is the intuitive idea behind an *evolutionarily stable strategy*?
- How does differential fitness (e.g., the replicator dynamic) extend this notion?
- Under a particular set of starting assumptions, signalling systems are guaranteed. What are these assumptions? How do the outcomes change if we alter these assumptions?
- What are partial-pooling equilibria in the context of a signalling game? What two mechanisms does Skyrms highlight that destabilise pooling equilibria?

W5. **Learning How To Signal**

Brian Skyrms (2010). Learning, in *Signals: Evolution, Learning, and Information* (Chapter 7). Oxford: Oxford University Press. 83–92.

Brian Skyrms (2010). Learning in Lewis Signalling Games, in *Signals: Evolution, Learning, and Information* (Chapter 8). Oxford: Oxford University Press. 93–105.

This week we discuss learning dynamics, and how they can be applied to signalling games. Chapter 7 presents several different learning dynamics at a high level. Chapter 8 applies these dynamics to the signalling game.

While you are reading, you might consider the following questions to help you focus on what is important in this section.

- What is the *law of effect*?
- What is the main difference between Roth-Erev reinforcement learning and Bush-Mosteller Reinforcement?
- In what way are learning dynamics related to evolutionary dynamics?
- Roth-Erev reinforcement can be usefully modelled by a simple urn learning procedure. What sort of assumptions are being made about the players (e.g., their cognitive capacities, components of the game to which they have epistemic access, etc.)?

W6. **Signals in Nature**

Brian Skyrms (2010). Signals in Nature, in *Signals: Evolution, Learning, and Information* (Chapter 2). Oxford: Oxford University Press. 20–32.

Brian Skyrms (2010). Deception, in *Signals: Evolution, Learning, and Information* (Chapter 6). Oxford: Oxford University Press. 73–82.

Hockett's (1960, 1963) "design features" of language. [Handout to be made available on course webpage]

This week we briefly discuss some features of animal communication systems, with signalling in mind.

While you are reading, you might consider the following questions to help you focus on what is important in this section.

- Skyrms gives several example of communication systems in nature. Which of these are best modelled by the (simple) signalling game framework?
- Hockett's 'design features' were meant to help distinguish between animal communication and language; however, many animal communication systems possess many of these features. Give an example.
- Why does deception cause difficulties for understanding communication with respect to signalling?

W7. **Generalisations**

Brian Skyrms (2010). Generalising Signalling Games: Synonyms, Bottlenecks, Category Formation, in *Signals: Evolution, Learning, and Information* (Chapter 9). Oxford: Oxford University Press. 106–117.

Brian Skyrms (2010). Inventing New Signals, in *Signals: Evolution, Learning, and Information* (Chapter 10). Oxford: Oxford University Press. 118–135.

Part III: Complex Signals

W8. **Information and Propositional Content**

Brian Skyrms (2010). Information, in *Signals: Evolution, Learning, and Information* (Chapter 3). Oxford: Oxford University Press. 33–47.

Nicholas Shea, Peter Godfrey-Smith and Rosa Cao (2017). Content in Simple Signalling Systems. *British Journal for the Philosophy of Science*, 69(4): 1009–1035.

W9. **Signalling Networks (I)**

Brian Skyrms (2010). Networks I: Logic and Information Processing, in *Signals: Evolution, Learning, and Information* (Chapter 11). Oxford: Oxford University Press. 136–144.

Brian Skyrms (2010). Networks II: Teamwork, in *Signals: Evolution, Learning, and Information* (Chapter 13). Oxford: Oxford University Press. 149–160.

Brian Skyrms (2010). Learning to Network, in *Signals: Evolution, Learning, and Information* (Chapter 13). Oxford: Oxford University Press. 161–177.

W10. **Signalling Networks (II)**

Kevin Zollman (2005). Talking to Neighbors: The Evolution of Regional Meaning. *Philosophy of Science*, 72(1): 69–85.

Elliott Wagner (2009). Communication and Structured Correlation. *Erkenntnis*, 71(3): 377–393.

Jeffrey A. Barrett, Brian Skyrms, and Aydin Mohseni. Self-Assembling Networks. *British Journal for the Philosophy of Science*, Forthcoming.

W11. **Complex Signals and Compositionality (I)**

Brian Skyrms (2010). Complex Signals and Compositionality, in *Signals: Evolution, Learning, and Information* (Chapter 12). Oxford: Oxford University Press. 145–148.

Michael Franke (2016). The Evolution of Compositionality in Signaling Games. *Journal of Logic, Language and Information*, 25(3–4): 355–377.

Shane Steinert-Threlkeld (2016). Compositional Signaling in a Complex World. *Journal of Logic, Language, and Information*, 25(3–4): 379–397.

W12. **Complex Signals and Compositionality (II)**

Jeffrey A. Barrett, Brian Skyrms, and Calvin Cochran. Hierarchical Models for the Evolution of Compositional Language. Preprint.

Handout on reflexivity.

Epilogue

W13. **Summing Up**

David Lewis (2002/1969). Conventions of Language, in *Convention: A Philosophical Study* (Chapter V). Oxford: Blackwell. 160–202.

Disclaimer

This document is meant to be binding; however, in the event of circumstances beyond my control, the course contents, evaluation scheme and other parts of this syllabus are subject to change.