



UNDERSTANDING THINKING

COURSE SYLLABUS (2021-2022)



Understanding Thinking

Class Meeting Times: Wednesdays 17:00-18:30

Location: Trivastrasse 13

Course taught in English

Teacher Information:

Karsten Miermans (critical thinking)

Email: k.miermans@gmail.com

0177-2390536 (reachable 9 AM-9 PM)

Teacher Information:

Laila Khorasani (neuroscience)

Email: lailakhorasani@gmail.com

Office hours: By appointment

Course Description

What will we learn?

This course will investigate how humans think, from two main perspectives: (1) the strengths and weaknesses of human thinking; and (2) how brains make thinking possible.

(1) Karsten will focus on understanding how we think, and what skills and principles to adopt to think better. Unfortunately, you'll frequently see during this course that we humans frequently fall into 'thinking traps', in particular when we use intuitive reasoning. Such pitfalls are now well-documented by scientists (neuroscientists, amongst others!), and you'll learn how to protect yourself against several of them. One of the tools that we'll develop over the year is 'Bayesian reasoning': a broadly applicable framework to systematically use evidence to form beliefs. In fact, every student will use Bayesian reasoning over the course of the year to a topic of their own choosing.

(2) With Laila you'll dive into the basic principles of neuroscience, by first reviewing the building blocks of the brain. We will primarily review neural functioning, however there are also many other cell types that work in conjunction with neurons that we will also learn about. Once you have a clear grasp of this, we will apply your knowledge to populations of neurons that work together to create your holistic experience. However, these processes do not always occur perfectly, which is why we will also learn about various diseases and disorders of the brain that can affect cognition. Lastly, we will investigate attempts to artificially create intelligence and how these networks relate to the human model. Original scientific literature will be embedded throughout the class so you can begin to familiarize yourself with how science is conducted in the laboratory, and how we turn experimental results into our fundamental understanding of how biology works. If interest and time allows, we may also study comparative neuroscience, or compare the brains of different organisms.

How will we work?

Each session will start with a lecture, followed by small group work and discussion. The critical thinking component (Karsten) will also involve a project for each student, where the student

learns to apply the techniques we learn to a topic they care about. We don't plan to have homework for this course. We hope to also organize one or more field trips (to a real neuroscience lab, for example).

Learning Goals

At the end of this course, students will:

- Be aware of some of the common pitfalls of human thinking
- Be able to systematically examine claims from multiple perspectives
- Be able to systematically update one's beliefs based on evidence
- Understand the basics of the brain: from a cellular to a structural level
- Describe classic neuroscience research techniques and how they illuminate information about the nervous system
- Learn to critically analyze the strengths and limitations of scientific methodology
- Understand the underlying circuitry behind biologically and artificially intelligent systems
- Consider the implications of advancing neurotechnology to augment the human experience

Topics

CRITICAL THINKING

- I. Reasoning
- II. Evidence & updating on evidence
- III. Cognitive biases & thinking traps

NEUROSCIENCE

- I. Introduction to Neuroscience
- II. Neuroscience Behind Cognition
- III. Neural Circuits: Function and Dysfunction
- IV. Replicating the Brain: Artificial Intelligence