

WEEK 1. COURSE OUTLINE: COMPUTERS AND COMPUTATIONS

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BACKGROUND

- ▶ Computers are pretty **amazing**.
- ▶ This video **itself** was recorded and is being played on a computing device.
- ▶ Computers and the computations they implement are **pervasive** in contemporary life.
- ▶ A huge amount of tasks have been **automated**, and often at the heart of such automation lies a computing device.
- ▶ Is there anything they **can't** do? Are computers in any way **limited**?

FOCUS OF THE COURSE

- ▶ This, in some sense, is the **main question** to which this course is addressed.
- ▶ What **limits** are there on computations? If there are limitations, what **implications** do these have?
- ▶ In analysing this question, we'll explore topics concerning how the notion of computation **developed**, how computers might be able (or unable) to represent **effective procedures**, **the human mind**, and what kinds of **time** and **space** constraints we might think there are and what the **implications** are for questions such as ethical **responsibility**.

SCHEDULE

- Week 1.** 2. *Nov.* Introduction and outline of the course
- Week 2.** 9. *Nov.* Historical accounts of computation
- Week 3.** 16. *Nov.* Turing computability
- Week 4.** 23. *Nov.* The Halting Problem
- Week 5.** 30. *Nov.* Other models of computation
- Week 6.** 7. *Dec.* Church-Turing Theses
- Week 7.** 14. *Dec.* The Lucas-Penrose Argument
- Week 8.** 21. *Dec.* Computational functionalism
24. December 2020 – 6. January 2021: No lectures.
- Week 9.** 11. *Jan.* Computational Complexity: The Zoo and Feasibility
- Week 10.** 18. *Jan.* Quantum Computation
- Week 11.** 25. *Jan.* Ethics and computations: Who is responsible?
- Week 12.** 1. *Feb.* Computing the standard model of arithmetic
- Week 13.** 8. *Feb.* Digital and Analog Computation

WHAT WE WON'T COVER

- ▶ Debates concerning **Artificial Intelligence**: We'll look at some arguments that the mind cannot be represented by a (Turing) machine (especially the **Lucas-Penrose** Argument).
- ▶ However, we will **not** consider the more specific arguments concerning what artificial intelligence can accomplish, and cognate questions such as the Turing test. The reasons:
 1. I want to focus on the specific nature of computation as it can be **formalised**, and the things we can **prove** about such computations (and whether these results have **implications** or not).
 2. We already have a **fabulous** course at Konstanz on AI (entitled 'Cutting-edge Debates in Artificial Intelligence', run by Dr. Diego Frassinelli and Dr. Caterina Moruzzi) where these topics are covered.

STYLE OF THE COURSE

- ▶ **First:** This course is intended for **masters** students and **advanced undergraduates**.
- ▶ It's therefore not solely **teaching** material, I'll also be exploring some themes that might arise in **research**.
- ▶ The material will be **hard** (especially in the second half of the course).
- ▶ (This **shouldn't** put you off! Philosophy, logic, and mathematics at the research level are **meant** to be hard, that's part of what makes it **fun**.)

STYLE OF THE COURSE

- ▶ **Second:** This is a **philosophy** course and not a **mathematics/theoretical computer science** course.
- ▶ Nonetheless, when discussing the nature of computers, computations, and their limitations, we'll need to get into **formalisation** and discussion of mathematical **results**.
- ▶ Whilst we'll include some **formal definitions** and **proofs** our main objective won't be churning out proofs.
- ▶ This will be especially so towards the end of the course, where we'll deal with some difficult topics that could be given a whole course **on their own**.
- ▶ This doesn't mean that this material is **uninteresting** or **irrelevant**.
- ▶ On the contrary, to get a **really deep** understanding of these topics, it's **necessary** to immerse yourself in the mathematics too.
- ▶ My focus here is to provide **intuitive ideas** that back up the formalism, and give you the tools to explore some of the philosophical issues.

NEXT TIME!

- ▶ **Thanks** for watching!
- ▶ Next week (Week 2) we'll be examining some of the **early history** of computation, how ideas of computation were developed **across cultures**, and the ideas of some **figures** (e.g. Lady Ada Lovelace, Charles Babbage, and Gottfried Wilhelm Leibniz) that would recur in later work.
- ▶ Aside from being interesting **in itself**, this will lay some of the **conceptual framework** for the main technical set up in the following weeks.
- ▶ **See you all soon!**