**History and Logic of Science**

2022

A Summer school held by School of Philosophy at Zhejiang University

**Basic Info:**

**Instructor:** Prof. John Symons (University of Kansas)

https://www.johnsymons.net/

**Organizer**: Bohang Chen (Zhejiang University)

**Teaching Assistant**: Jimi Yingding (Zhejiang University)

**Time:** 2022.8.22-26, 9am-11:25am (Beijing time)

**Platform:** Dingtalk (online)

**Introduction:**

Theme: Computation and Science

This series of lectures offers both a conceptual and historical survey of the notion of computation while also exploring the effects of computation on scientific practice. The course requires no significant background in logic or computer science.

**Schedules:**

**Meeting 1: Computation, logic, and proof**

Pascal and Leibniz set the stage for thinking about the relationship between mechanism and cognition. We begin with detailed reflection on what their machines were and what they imagined them to be. In the Twentieth Century, the emergence of the modern notion of computing is closely connected with debates in the foundations of mathematics. This lecture focusses on the views of computing articulated by Turing, Church, and Gödel.

**Suggested Readings:**

Webb, J. (2013). Mechanism, mentalism and metamathematics: An essay on finitism (Vol. 137). Springer Science & Business Media. Chapters 1-3

Epstein, R. L., & Carnielli, W. A. (2000). Computability computable functions, logic, and the foundations of mathematics. Wadsworth Publ. Co. Ch 1-3

**Meeting 2: Computation, business, and control**

This lecture outlines the engineering history of computing turning back again to Leibniz and the practical challenge of building a computing machine. The main focus of this session is on engineering from the Second World War until the present.

**Suggested Readings:**

Primiero, G. (2019). On the foundations of computing. Oxford University Press. (esp Part 3)

**Meeting 3: Computability as the science of limits and trade-offs**

This lecture introduces the limitative theorems of computer science with an eye to understanding the epistemic implications of so-called no-go theorems.

**Suggested Readings:**

Denning, P. J. (2003). Great principles of computing. Ch 1-6

Epstein, R. L., & Carnielli, W. A. (2000). Computability computable functions, logic, and the foundations of mathematics. Wadsworth Publ. Co. Ch 4-6

Symons, J. F., & Horner, J. K. (2017). Software error as a limit to inquiry for finite agents: challenges for the post-human scientist. In Philosophy and computing (pp. 85-97). Springer, Cham.

**Meeting 4: Physical Computation**

What makes a physical object a computer? This lecture introduces Hilary Putnam’s critique of computational functionalism in philosophy of mind and explores the implementation debates.

**Suggested Readings:**

Piccinini, G. (2015). Physical computation: A mechanistic account. OUP Oxford.

Symons, J. (2019). “Should Physical Computation be Understood Mechanistically?. APA Newsletter on Philosophy and Computers, 19(1), 18-21.

**Meeting 5: Computation in science - Current controversies**

Contemporary philosophers have argued about the effects of computation on scientific practice, this lecture reviews the literature in philosophy of science from Paul Humphreys’ early work on computation in science to the present. Special attention will be paid to the role of error in software and the effects of machine learning and big data on scientific inquiry.

**Suggested Readings:**

Symons, J., & Horner, J. (2014). Software intensive science. Philosophy & Technology, 27(3), 461-477.

Horner, J. K., & Symons, J. (2019). Understanding error rates in software engineering: Conceptual, empirical, and experimental approaches. Philosophy & Technology, 32(2), 363-378.

Symons, J., & Horner, J. K. (2020). Why there is no general solution to the problem of software verification. Foundations of Science, 25(3), 541-557.

**Course assignments (or, how to get your credits?):**

Based on our meetings and suggested readings, write ONE short essay to respond to ONE essay question (among a few) raised by Prof. Symons.