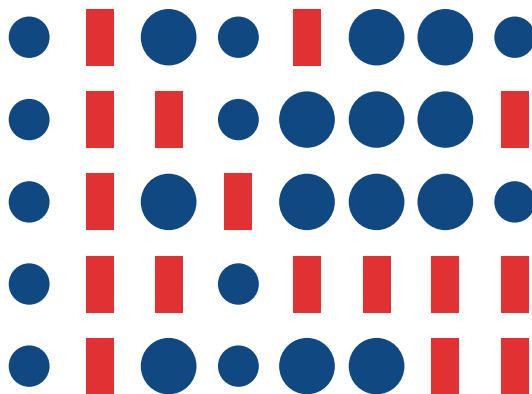


6th International Conference on the
History and Philosophy of Computing

Zurich, October 27-29, 2021



HaPoC

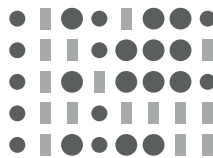
2021

PROGRAM AND SHORT ABSTRACTS

6th International Conference on the History and Philosophy of Computing

Zurich, October 27-29, 2021

PROGRAM AND SHORT ABSTRACTS



HaPoC

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6th HaPoC Conference

Zurich, October 27-29, 2021

While computing appears as a technological and scientific field in constant progression, our conception and knowledge of computers are also subject to change over time. In particular, digital machines of the 20th century were inspired by the biological individual, replacing with a solipsistic mental view the cultural and social aspects attached to the image of machines in the 19th century. However, the growing cultural import of computing practices has become ever more pressing in our days in all dimensions of social life. Not only have cultural phenomena increasingly become the object of computational analysis, but computational practices have also proved inseparable from the cultural environment in which they evolve.

Therefore, it is urgent to critically address the entanglement of computing practices with the main cultural challenges of our epoch. The global and collective nature of such problems (e.g. climate change, global pandemics, systemic inequalities, resurgence of totalitarianism, to name a few) requires a comprehensive perspective on computing, where social and cultural aspects occupy a central position. For these reasons, thinking about machines asks today for an interdisciplinary approach, where art is as necessary as engineering, anthropological insights as important as psychological models, and the critical perspectives of history and philosophy as decisive as the axioms and theorems of theoretical computer science.

For more than a decade, the “History and Philosophy of Computing” Conference (HaPoC) has contributed to building such an interdisciplinary community and environment. Continuing this orientation, the HaPoC’s 6th edition aims to bring together historians, philosophers, computer scientists, social scientists, designers, manufacturers, practitioners, artists, logicians, mathematicians, each with their own experience and expertise, to take part in the collective construction of a comprehensive image of computing.

Attending HaPoC-6 under Corona Conditions

We are delighted that you can take part in the 6th International Conference on History and Philosophy of Computing at ETH Zurich! As organizers, we are obliged to provide you with information on the possible risks and consequences of taking part. We kindly ask you to read through the following points and to observe the associated requirements:

Before the event:

- Anyone who has been in contact with COVID-19 patients during the last 14 days is not allowed to visit ETH Zurich, and therefore may not attend events.
- If you were diagnosed with COVID-19, you may only come back from self-isolation to ETH Zurich after the decision of the cantonal doctor or treating physician.
- We recommend that high-risk individuals only take part in the event after consulting with their primary care physician.
- If you have any symptoms of COVID-19 (such as fever or feverishness, sore throat, cough, shortness of breath, aching muscles, sudden loss of sense of smell or taste, conjunctivitis, headache, gastrointestinal symptoms, rhinitis), you may not visit ETH Zurich.
- When travelling to and from the event with public transport, please avoid rush hours and comply with the mask-wearing obligation issued by the BAG (Federal Office of Public Health). Inform yourself in good time about the Federal travel regulations. Face coverings must also be worn in the ETH Link shuttlebus.
- **For all events taking place on ETH Zurich premises, a Covid certificate is now mandatory. Please make sure you bring either the paper document or the electronic certificate in the app, along with a form of ID.**

During the event:

- Face masks must be worn inside of all ETH buildings. Please bring your own mask with you.
- A mask must be worn at all times during the event.
- Participants must follow the social distancing and hygiene rules during the event, the written instructions on site (markings, signs) and the verbal instructions of the organisers.

After the event:

- Anyone who falls ill with COVID-19 immediately after the event must inform the organiser.

In attending the event, you confirm that you have noted the information above and you meet the conditions for participation.

Venues

Due to the current pandemic situation, the Conference will take place in a hybrid format, with attendance and contributions both on-site and online.

Main Venue:

The main venue is the Werner Siemens-Auditorium, in the HIT building on the ETH Höggerberg Campus (see site plan on the opposite page).

The Werner Siemens-Auditorium is located at the following address:

HIT E 51
Building HIT
Wolfgang-Pauli-Str. 27
8093 Zürich
Switzerland

Arrival by public transports:

Bus lines **37**, **69**, or **80** or **ETH eLink** to bus stop "Zürich, ETH Höggerberg".

The **eLink bus** is a direct shuttle bus commuting between ETH Zentrum campus (located near the main train station of Zurich "Zürich Hauptbahnhof") and ETH Höggerberg. This service is not on the public transportation map. At ETH Zentrum, eLink stops at the station "Zürich, ETH Polyterrasse" beneath the large terrace next to the ETH main building as well as at "Zürich, Haldenegg". Between 7 am and 7:30 am it also departs from the central train station at the station "Zürich, Bahnhofquai/HB".

The eLink can be used for free by conference guests of the ETH.

The QR codes in the opposite page will allow you to download both the map of public transportation in Zurich and the ETH eLink timetable from the different stops.

Online Venue:

Online contributions and attendance will take place via zoom. You must be registered to receive all the necessary information.

A gather.town space will be set up during the whole Conference for online coffee breaks and spontaneous meetings between online participants.

Screening Event Venue:

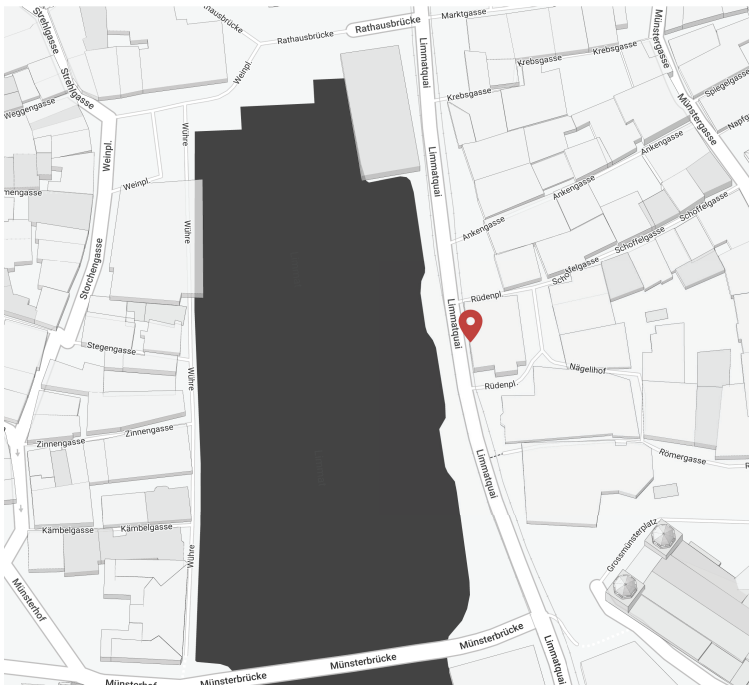
On the first evening, the program features a screening event at the Collegium Helveticum (ETH Campus Zentrum, Schmelzbergstrasse 25, 8092 Zürich, Building STW; see map p. 13). The event will be preceded by a reception kindly offered by the Collegium Helveticum.

Lunch Venue:

The venue for the two lunches is the Bellavista Restaurant. The restaurant is located within the Höggerberg Campus (Höggerberggring 47) only a few meters away from the Conference venue (see map p. 9).

Conference Dinner:

The venue for the Conference dinner is the traditional restaurant Haus zum Rüden, located at: Limmatquai 42, 8001 Zurich.



Haus zum Rüden @ Google Maps

General Information

Registration

All on-site and online participants are required to register, filling the corresponding online form, to be found at the official HaPoC 2021 website: hapoc2021.sciencesconf.org.

Registration is mandatory and free of charge.

Instructions for speakers

Duration of contributed talks: 30 minutes (including discussion)

Duration of plenary lectures: 60 minutes (including discussion)

The conference room will be prepared to feature full hybrid mode. For this reason, on-site presentations will only be possible using the room's computer (Mac). Contributors will be required to transfer their presentation files (in PDF) and check that they work as expected during the break before their session, at the latest. Should you have special requirements concerning your presentation (eg. file formats other than PDF), please let us know as soon as possible.

Online contributions will take place as standard zoom presentations. Please make sure to use the suitable infrastructure (microphone, earphones, stable internet connection - via ethernet cable if possible-, etc.) and to choose an appropriate environment.

Internet

In any ETH building, including the Conference room, you may connect to the *eduroam* network with your own institute's username and password. Please make sure to obtain the username and password in advance, as they may be different from your usual institutional ones.

Registration on the networks *public* and *public-5* is possible for participants who can receive text messages on their phones.

Phone and Data Roaming

Switzerland is not included in the EU roaming zone. If you're coming from the EU, please check with your service provider whether your package includes Switzerland. Local SIMs with data packages can be purchased for 20-30 CHF in all cellular company outlets (central train station, airport train station and many other places city-wide)

Electricity

Switzerland uses a unique plug (type J). You can also use a European two-prong plug (type C), but anything else would require an adapter. Be sure to get one in advance!

You can use your electric appliances in Switzerland if the standard voltage in your country is between 220 - 240 V.

Program

All times are CET (Central European Time = Zurich time)

Wednesday, October 27, 2021

- | | |
|---------------|--|
| 08:00 – 08:50 | Registration |
| 08:50 – 09:00 | Welcome |
| 09:00 – 10:00 | <p>Keynote: Mireille Hildebrandt
 <i>Written and Coded 'Speech Acts': Never the Twain Shall Meet?</i>
 Chair: Juan Luis Gastaldi</p> |
| 10:00 – 11:00 | <p>Session 1 – Conceptual Perspectives – Chair: Viola Schiaffonati
 Javier Toscano
 <i>Intentionalities of Code: Historical Practices and Devices.</i>
 <i>A Philosophical Account</i>
 Edith Schmid
 <i>Computing Systems as Social Institutions</i></p> |
| 11:00 – 11:20 | Coffee Break |
| 11:20 – 12:50 | <p>Session 2 – Physical Aspects of Computing – Chair: Luc Pellissier
 Edgar Daylight
 <i>Church's Reception of Turing's 1936 Paper: A Philosophical Angle</i>
 Philipp Macele
 <i>There is no Hardware – Lynn Conway and the Mead-Conway-Revolution</i>
 Michael Jackson
 <i>Cyber-Physical Programming</i></p> |
| 12:50 – 14:00 | Lunch Break |
| 14:00 – 15:30 | <p>Session 3 – Computing and the State – Chair: Liesbeth De Mol
 Moritz Feichtinger
 <i>Databasing Djungle-War: The US-Army's Data-Processing Systems During the Vietnam War, 1966-1975</i>
 Moritz Mähr
 <i>The Public, the Private, and the Domestication of the Information System.</i>
 <i>How Data Protection Governed the Swiss Administration in the 1970s.</i>
 Marcelo Vianna
 <i>"Processing the Development": Technical Groups, Profiles and Decisions on Computer Technologies in Brazil in the Late 1950s</i></p> |
| 15:30 – 16:00 | Coffee Break |

16:00 – 17:30 **Session 4 – Conceptual Perspectives – Chair: Giuseppe Primiero**

Nick Wiggershaus

An Agential Theory of Implementation for Computer Science

David Waszek

Informational Equivalence but Computational Differences?

Herbert Simon on Representations in Scientific Practice

Philippos Papayannopoulos, Nir Fresco and Oron Shagrir

On Two Different Kinds of Computational Indeterminacy

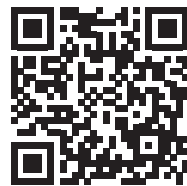
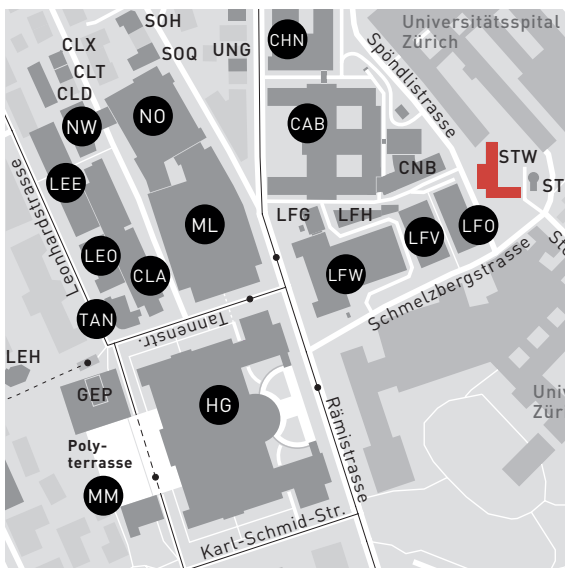
17:30 – 18:30 HaPoC General Assembly – Chair: Giuseppe Primiero
All participants are kindly invited to attend

Venue change: *Collegium Helveticum, Schmelzbergstrasse 25, 8006 Zürich*

19:30 – 21:30 **Screening Event: *Knit's Island***

Ekiem Barbier, Guilhem Causee and Quentin L'helgoualc'h

Excerpt of a work in progress video game documentary followed by a round table and discussion with the directors. Moderator: J. L. Gastaldi. The screening will start at 20:15, and will be preceded by an apéro. This event will take place in person only (no online participation possible).



Collegium Helveticum
@ Google Maps

Site plan of the ETH Höggerberg Campus. The Collegium Helveticum is located in the STW building (in red).

Thursday, October 28, 2021

- 08:30 – 09:00 Check-in
- 09:00 – 10:30 **Session 5 – History and Philosophy – Chair: Simone Martini**
Michael Friedman
Leibniz on Stocking Frame, Computing and Weaving
Aggelos Biboudis, Jeremy Gibbons and Oleg Kiselyov
All Things Flow: Unfolding the History of Streams
Tomas Petricek and Joel Jakubovic
Complementary Science of Interactive Programming Systems
- 10:30 – 10:50 Coffee Break
- 10:50 – 12:50 **Session 6 – Social History – Chair: Roy Wagner**
Mate Szabo
The Early Days of the Hungarian Software Industry
Jelena Stanulovic
Influence of the Self-Management in the Development of Personal Computers in Socialist Yugoslavia During the '80s
Carmen Flury and Rosalía Guerrero
A National School Computer for the Emerging Digital Society: East German and Swedish Efforts to Develop a State-Mandated Educational Computer in the 1980s-1990s
Mirjam Mayer and Ricky Wichum
Public Data and Personal Computers. The Emergence of a Personal Computing Culture in the Swiss Federal Administration, ca. 1980
- 12:50 – 14:00 Lunch Break
- 14:00 – 15:00 **Keynote: Thomas Haigh**
Becoming Universal: A New History of Modern Computing
Chair: Liesbeth De Mol
- 15:00 – 16:00 **Session 7 – Artificial Intelligence – Chair: Viola Schiaffonati**
Camilla Quaresmini and Giuseppe Primiero
Data Quality Dimensions for Fair AI
Robin Zebrowski, John Sullins, Eric Dietrich, Bram Van Heuveln and Chris Fields
The History and Legacy of the AI Wars
- 16:00 – 16:30 Coffee Break

- 16:30 – 17:30 **Session 8 – Socioeconomic Perspectives – Chair: Juan Luis Gastaldi**
Veronica Dahl
Doughnut Computing: Aiming at Human and Ecological Well-Being
Chris Holland
Slipping Through Our Fingers Even As We Tighten Our Grip on the Controller: Rentism and the Consequences for Video Games
- 17:30 – 18:30 **Keynote: Barbara Liskov**
Reflections on Programming Methodology
Chair: Simone Martini
- 19:30 Conference Dinner
Venue: *Haus zum Rüden, Limmatquai 42, 8001 Zürich (see map p. 10)*

Friday, October, 29 2021

- 08:00 – 08:30 Check-in
- 08:30 – 10:00 **Session 9 – Machine Learning – Chair: Viola Schiaffonati**
Jens Ulrik Hansen and Paula Quinon
The Role of Expert Knowledge in Big Data and Machine Learning
Maximilian Noichl
The Epistemic Vices and Virtues of Dimensionality Reduction
Stefan Trausan-Matu
A Poststructuralist Perspective on Computer-Generated Literature
- 10:00 – 10:20 Coffee Break
- 10:20 – 11:50 **Session 10 – History and Philosophy – Chair: Luc Pellissier**
Troy Astarte
From Monitors to Monitors: an Early History of Concurrency Primitives
Cliff Jones
One Concurrent Program: Three Attempts at Its Formal Verification
Laura Fontanella
The Evolution of the Concept of Proof Through Realizability
- 11:50 – 12:50 **Keynote: Juliette Kennedy**
On the Semantic Content of Gödel's 1931 Proof of the Incompleteness Theorem
Chair: Giuseppe Primiero
- 12:50 – 14:00 Concluding Remarks and Farewell

Short Abstracts

Keynotes

Thomas Haigh (University of Wisconsin-Milwaukee)
Becoming Universal: A New History of Modern Computing

Thursday, Oct 28, 14:00 – 15:00

Thomas Haigh will discuss the new overview history of computing he has written with Paul Ceruzzi, exploring the challenges involved in producing a coherent and comprehensive synthetic history of computing and the choices and trade-offs the authors made during the process. The biggest challenge is the remarkable flexibility of the electronic digital computer, which from 1945 to 2020 has evolved from a specialized and hugely expensive technology used for scientific computation to an inexpensive and ubiquitous technology embedded into devices of all kinds and used in almost every human activity. From this viewpoint, the computer became an (almost) universal machine only incrementally, a contrast with the theoretical perspective from which even the simplest programmable devices are often equated with Turing's Universal Machine.

Mireille Hildebrandt (Vrije Universiteit Brussel)
Written and Coded 'Speech Acts'. Never the Twain Shall Meet?

Wednesday, Oct 27, 9:00 – 10:00

In this keynote I will inquire into the difference that makes a difference (Bateson) between text- and code-driven 'speech acts'. I will raise some pivotal questions regarding the relationship between counting, speech, calculation and qualification, while comparing the performative effect of written speech acts with the real-world effects of computing systems. My argument is part of a call for legal philosophers to pay keen attention to computer science and philosophy of technology, and a call to computer scientists to pay keen attention to philosophy of language, more notably speech act theory and interpretation theory. The focus will be on how the use and the affordances of natural language inform the fine line between ambiguity and shifts in meaning on the one hand and continuity and closure on the other. This will allow me to highlight where written and coded 'speech acts' differ and how their use may be complementary in a way that reinforces rather than diminishes human agency.

Barbara Liskov (MIT Computer Science & Artificial Intelligence Lab)
Reflections on Programming Methodology

Thursday, Oct 28, 17:30 – 18:30

Research in programming methodology led to the development of the principles and methods that underlie how modern software systems are designed and structured. At the center of this work are the notions of abstraction and modularity. These ideas are related: design is the process of inventing and identifying abstractions, and the implementations of the abstractions become the modules that make up the program. This talk will discuss our current understanding of abstraction and modularity and the research that got us to where we are today.

Juliette Kennedy (University of Helsinki)
On the Semantic Content of Gödel's 1931 Proof of the Incompleteness Theorem

Friday, Oct 29, 11:50 – 12:50

Gödel's 1931 proof avoids semantic notions, and yet there are residues of these in the proof. We examine the semantic aspects of the 1931 proof in light of Gödel's general views at the time and later on. Kripke argues that the negative solution of the Entscheidungsproblem follows almost immediately from Gödel [1931]. So why didn't Gödel solve the *Entscheidungsproblem*?

Screening Event

Ekiem Barbier, Guilhem Causse and Quentin L'helgoualc'h (Les Films Invisibles)
***Knit's Island* (work in progress video game documentary)**

Wednesday, Oct 27, 20:15 – 21:30 | Venue: Collegium Helveticum

“Knit’s Island” is a documentary about the discovery of a neighboring world, almost fused with ours. Under the guise of avatars, a film crew enters online video games and comes into contact with players. Who are these inhabitants? Are they really playing? Through the encounters with these characters, the discovery of their fears and aspirations and the craft of their imaginary worlds, this film reveals a different perspective of the virtual and questions of our world’s becoming.



Knit's Island (E. Barbier, G. Causse and Q. L'helgoualc'h, *Les Films Invisibles*)

Contributed Talks

Troy Astarte (Swansea University)

From Monitors to Monitors: an Early History of Concurrency Primitives

Session 10 | Friday, Oct 29, 10:20 – 10:50

As computers became multi-component systems in the 1950s, handling the speed differentials efficiently was identified as a major challenge. The desire for better understanding and control of 'concurrency' spread into hardware, software, and formalism. This work-in-progress talk traces some early attempts to find primitives for concurrency.

Initially, system programs called 'monitors' were used for directly managing synchronisation. Attempts to reframe synchronisation at a higher level led to a series of algorithms; Dijkstra's semaphores were a reaction to the algorithms' complexity. Towards the end of the 1960s, new desires for clearer 'structured programming' created a milieu in which Dijkstra, Hoare, and Brinch Hansen (among others) aimed for a concurrency primitive which embodied the new view of programming. Via conditional critical regions and Dijkstra's 'secretaries', the monitor appeared to provide the desired encapsulation. A few programming languages adopted the construct: we finish by considering Modula and Concurrent Pascal.

This story shows the effects of grappling with the power brought by concurrency while trying to manage greater conceptual (and textual) complexity. The actors involved sought a balance between abstraction and tolerable implementation and their work demonstrates changing priorities in programming and computer science.

Aggelos Biboudis, Jeremy Gibbons and Oleg Kiselyov (Swisscom AG, University of Oxford, Tohoku University)

All Things Flow: Unfolding the History of Streams

Session 5 | Thursday, Oct 28, 9:30 – 10:00

Heraclitus observed that all things flow and nothing remains still; "you cannot step into the same river twice". So what is a stream in computer science, and where did this notion come from? We divide streaming abstractions into four categories:

- a) as a means of processing lots of data in limited memory;
- b) as event processing and correlation;
- c) to capture the semantics of I/O; and
- d) as iteration abstractions.

Following these four axes, we unfold the history of streams, and give an overview of how this abstraction started to come into existence as a mainstream programming language facility. Our goal is to present briefly the related concepts through literature review, drawing connections between programming language features and technologies. This discussion will be of interest to the young computer science researcher, the curious software engineer, and the grizzled database query optimization specialist.

Veronica Dahl (NSERC, Simon Fraser University)
Doughnut Computing: Aiming at Human and Ecological Well-Being

Session 8 | Thursday, Oct 28, 16:30 – 17:00

Computing Sciences evolved from social organizations with unequal power distribution, based on forced hierarchies partly justified by the dualist idea, held by philosophical tradition from Plato to Descartes, that humans are separate from and superior to “nature”. This idea was extended and leveraged by dominant élites to cheapen or degrade the “others” (nature, women, non-whites, resource-rich countries...) which enabled them to take from others much more than is given back.

In coherence with this mindset, and despite its many socially useful results, CS has enabled governments and corporations to use data collection, statistics and algorithms as instruments to preserve and deepen an unequal status quo which is destroying the living world and pauperizing and marginalizing women, racialized people, diversities and former colonies—in short, those whose unpaid or underpaid work and resources support the dominant groups many-fold. We argue that CS must explicitly support the goal of enabling social and ecological well-being and we propose a CS methodology based on inferential programming, capable of helping us achieve this goal through computationally supporting the Doughnut model (K. Raworth, 2017) as a compass.

Edgar Daylight (Siegen University, Lille University)
Church’s Reception of Turing’s 1936 Paper: A Philosophical Angle

Session 2 | Wednesday, Oct 27, 11:20 – 11:50

While Turing has been labeled a materialist in the literature, I will argue instead that Turing wrote his 1936 article “On Computable Numbers” in concurrence with the idealism of Eddington and especially that of McTaggart. Turing’s 1936 “machines” were, however, taken to be physical machines by the logician Church, who espoused a kind of instrumentalism until at least 1937. Contextualizing this philosophical gulf between Turing and Church sheds new light on the germination of recursive function theory in Princeton and the rise to prominence of the so-called ‘physical Church-Turing Thesis’ in computer science.

Moritz Feichtinger (Univeristé de Lausanne)

Databasing Djungle-War: The US-Army's Data-Processing Systems During the Vietnam War, 1966-1975

Session 3 | Wednesday, Oct 27, 14:00 – 14:30

Databasing is a set of practices that combine epistemological, technical and socio-cultural elements. Thus, collecting, storing and processing knowledge in digital database-systems can be analyzed historically. The proposed paper revisits a historical application of databasing that is of particular importance: the attempt of the US-Army to monitor the psychological and political attitudes of South Vietnam's rural population in midst of a protracted guerrilla war.

Beginning in 1966 and inspired by approaches from Operations Research and System Analysis, the Department of Defense mobilized social scientists, computer experts and analysts as well as the latest information technology of the time to capture, calculate and control the progress of its counterinsurgency effort.

A close reading of the Vietnam War era data-processing systems offers important insights for the discussion of historic computing practices and cultures. Analyzing the practices of data-collection, their translation into digital formats and the resulting conceptual design of the database reveals the integration and impact of biases and presumptions. Reconstructing technical and organizational procedures in data-processing shows how abstraction and aggregation of data generated novel interpretations of social dynamics. Finally, it can be explored how results of such aggregation processes were displayed and presented and in which ways they found their way into political-military decision making.

Carmen Flury and Rosalía Guerrero (Zurich University of Teacher Training,)

A National School Computer for the Emerging Digital Society: East German and Swedish Efforts to Develop a State-Mandated Educational Computer in the 1980s-1990s

Session 6 | Thursday, Oct 28, 11:50 – 12:20

In the late 1970s and 1980s, governments of many European states launched programs to introduce computer technology into their classrooms and school curricula. These educational responses to the rapid developments in microchip technology were fueled by concerns over economic competitiveness that put information technology at the heart of boosting productivity, innovation, and prosperity of their national economies. This paper is concerned with a historical comparison of how governments in Sweden and East Germany set out to appropriate computer technology and adapt it to their school system's needs and requirements to train pupils to become skilled computer users. Whilst the political and economic systems of the two national cases were very different in nature, both countries followed a predominantly centralized approach to equip schools with computers that were specifically designed for educational use. In

comparing the approaches taken by the government of a democratic, market-oriented country on the one hand, and an authoritarian socialist regime on the other, the paper focuses on how the need to develop a state-specified school computer was argued for by state officials, and how its technical criteria were detailed in a balancing act between pedagogical considerations, and financial and technical constraints history of computation in the 17th century.

Laura Fontanella (Université Paris Est Créteil)
The Evolution of the Concept of Proof Through Realizability

Session 10 | Friday, Oct 29, 11:20 – 11:50

Realizability was introduced in the 40's by Kleene in order to implement the BHK-interpretation which described the intuitionistic notion of 'proof'. In this framework, a proof was viewed as a computable function. Thus, Kleene's original version of realizability consisted in an interpretation of the proofs in Heyting arithmetic as recursive enumerable functions (one of the models formalizing the notion of computable function). The general goal of realizability is to extract the computational content of mathematical theories. A given theory is interpreted in a model of computation by establishing a correspondence between the formulae of the theory on the one hand and programs on the other. If realizability originated from a broader research in constructive mathematics, in the 90's research in this field led to pass the barrier of intuitionistic logic to include classical logic, and later even set theory. In fact, J.-L. Krivine developed a method for realizing Zermelo-Fraenkel set theory including the axiom of choice, which is the paradigm of non-constructive mathematics. Following the history of realizability, we discuss the evolution of the concept of proof-as-a-computable-function: from recursive functions, to lambda-terms, to functions computable in Krivine's abstract machine.

Michael Friedman (Humboldt University)
Leibniz on Stocking Frame, Computing and Weaving

Session 5 | Thursday, Oct 28, 9:00 – 9:30

How were weaving machines and the mechanization of textile practices connected with calculating machines in the 17th century? One of the first textile-related machines to be invented in England in the early modern period is the stocking frame, which mechanized knitting in 1589. As the talk will aim to show, this invention was not only unique – indeed, it was a machine which had no predecessor – it was also one of the triggers to Leibniz's reflections on weaving in general, and especially on the stocking machine. As will be seen, Leibniz saw weaving and its mechanization as a part of (a future) geometry. Moreover, in a manuscript from 1676: *Dissertatio exoterica de usu geometriae*, Leibniz compared this machine to his own automatic "living" calculating machine: his "lebendige Rechenbank". Taking into account other references of Leibniz to weaving and its possible mathematization, the talk aims to question not only this surprising

relation between weaving and computation machines in Leibniz' thought, but also to inquire how Leibniz' conception of weaving machines as computational shapes the way we view the history of computation in the 17th century.

Jens Ulrik Hansen and Paula Quinon (Roskilde University, Warsaw University of Technology)

The Role of Expert Knowledge in Big Data and Machine Learning

Session 9 | Friday, Oct 29, 8:30 – 9:00

According to popular belief, Big Data and Machine Learning is a brand-new approach to science that has the potential to revolutionize scientific progress. In the extreme version of the belief, Big Data and Machine Learning allows to mine vast amounts of data without prior knowledge and exempts from carrying about causality because correlation is enough. In the moderate version, researchers see a resurgence of inductive methods or agnostic science and postulate that new scientific methods can be applied to many fields in a similar way without the need for domain knowledge.

We argue that the need for some expertise remains and ask how little expertise is sufficient for Big Data and Machine Learning to work effectively. We discuss case studies (skin cancer detection, protein folding, language generation) where we present the methods used and highlight moments where expert knowledge is involved. We classify the different aspects of expert knowledge involved in the application of Big Data and Machine Learning: the expert knowledge needed to prepare training data samples or the expert knowledge needed to select algorithms. We observe that the way in which Big Data and Machine Learning enter scientific methodology involves continuous conceptual shifts rather than rigid paradigm shifts.

Chris Holland (Bakersfield College)

Slipping Through Our Fingers Even As We Tighten Our Grip on the Controller: Rentism and the Consequences for Video Games

Session 8 | Thursday, Oct 28, 17:00 – 17:30

Pizza parlors were changed forever in the mid-1970s with the arrival of the first video game, Pong. Atari introduced the Atari 2600 in 1977, enabling gamers to play their favorite video games at home thanks to the invention of the interchangeable video game cartridge. While Kittler (1995), and Kaldrack and Leeker (2015) offer arguments for software not existing as machine-independent faculties and there being no such thing as “stand-alone hardware”, Manovich (2013) responds software is able to take on different forms and can be very independent of machines via media hybridization; a reality in the video game industry. Frase (2016) contends with increasing controls regarding intellectual property, the debate between Kittler, Manovich, and Kaldrack and Leeker misses the increasing encroachment of rentism into the video game world.

Between shrinking video game cartridges and the dawn of the internet and cloud technology the rentism involved with video games is more apparent and making the concept of “property” malleable. It will be the purpose of this study to explore the shift from ownership to rentism in the phenomenon that is subscription-based gaming and ask what does the implied ownership mean for gamers who simply want to play?

Michael Jackson (Independent Consultant)
Cyber-Physical Programming

Session 2 | Wednesday, Oct 27, 12:20 – 12:50

Programming for a critical cyber-physical system presents a characteristic challenge. The system is bipartite: a machine (the computing equipment) and a governed world (whose behaviour is to be governed), interacting at an interface of physical sensors and actuators. The challenge is to develop software whose execution ensures a desired governed behaviour: in effect, programming both parts as a unified system. The parts are disparate. The machine is quasi-formal, executing its program according to the programming language semantics, with reliability very close to mathematical certainty. The governed world is neither programmable nor reliable: its behaviour emerges from its own physical properties, and from interaction with the machine in terms of the very low-level phenomena communicable by the physical sensors and actuators. Crucially, the governed world is non-formal: in Einstein’s words: “As far as the propositions of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality.” The disparity between the machine and the governed world is especially challenging in critical systems where confidence in system behaviour must be close to mathematical certainty. This talk explores the disparity, briefly examining some putative approaches to addressing the challenge it presents.

Cliff Jones (Newcastle University)
One Concurrent Program: Three Attempts at Its Formal Verification

Session 10 | Friday, Oct 29, 10:50 – 11:20

The talk will trace a relatively linear sequence of early research ideas on ways to verify concurrent programs formally; but it does so forwards and then backwards in time. After briefly outlining the context, the key insights from three distinct approaches from the 1970s are identified (Ashcroft/Manna, Ashcroft (solo) and Owicki). The main part of the talk will focus on a specific program taken from the last published of the three pieces of research (Susan Owicki’s): her verification of her Findpos example will be outlined followed by attempts at verifying the same example using the earlier approaches. Reconsidering the prior approaches on the basis of Owicki’s useful example illuminates similarities and differences between the proposals. Along the way, observations about interactions between researchers (and some “blind spots”) are noted.

Philipp Macele (Leuphana University)

There is no Hardware – Lynn Conway and the Mead-Conway-Revolution

Session 2 | Wednesday, Oct 27, 11:50 – 12:20

Whereas the first fully electronic computing systems did not even differentiate between hardware and software, today, integrated circuits provide only the foundation for Babylonian towers of programming languages which cover the hardware with multiple layers of code. Consequently, hardware seems to play a relatively small role – a feeling that is reflected in scientific discourse where there is no counterpart to the research field of software studies. In addition to that, the process of hardware development has long since removed itself from the level of materiality. Chip design is no longer done manually on drawing paper, but with the help of Computer Aided Design and Hardware Description Languages. The talk will introduce and expand on a methodological change in chip design in the late 1970s and early 1980s that made chip development, and this is the hypothesis, a process somewhat independent from materiality. The focal point will be the so-called Mead-Conway-Revolution as well as Lynn Conway herself and the development of their publication “Introduction to Very Large Scale Integration Systems”. To that end, I will roughly outline the circumstances of the change in addition to showing some archive material I was able to track down.

Moritz Mähr (ETH Zurich)

The Public, the Private, and the Domestication of the Information System. How Data Protection Governed the Swiss Administration in the 1970s

Session 3 | Wednesday, Oct 27, 14:30 – 15:00

“The public, the private, and the domestication of the information system” examines how data protection emerged in Switzerland in the 1970s. The historical study shows how interactive information systems became part of a new computerized administrative reality in the 1970s, with greatly expanded means of action. Both the public and politicians found it difficult to imagine how the new technology would be used in administration, and – influenced by the Watergate scandal – saw above all the potential for abuse. Driven by fears predominantly related to pop-cultural representations of surveillance technologies, a political debate began about the limits of computerized administration. Without computers, the administration saw its ability to manage an ever-increasing number of issues threatened. Data protection provided a semantic platform to renegotiate the relationship between the public and a computerized administration. Analysis of this trading zone reveals the mutual adjustments made by the public, politicians, and administrators in the discussion of a data protection law. For this study, press articles from major Swiss media as well as reports, minutes, correspondence and other official sources from the Swiss Federal Archives are analyzed.

Mirjam Mayer and Ricky Wichum (ETH Zurich)

Public Data and Personal Computers. The Emergence of a Personal Computing Culture in the Swiss Federal Administration, ca. 1980

Session 6 | Thursday, Oct 28, 12:20 – 12:50

In this paper we investigate the emergence of a personal computing culture in the Swiss Federal Administration which included the use of personal computers as administration tools, information systems and New Public Management policies. Computing cultures are shaped by contested reconfigurations of organizational power, alliances, forms of communication, conceptual work, user interests, and technological change. Drawing back on sources of the Swiss Federal Archive (BAR), we study two interfaces between computers and administration. First, we investigate the interface between the civil servant and the personal computer that was built by the use of the PC and its various peripherals in the Swiss Federal Administration in the 1980s. Second, we examine an information system called “STATINF” that allowed private users access to governmental databases. Finally, we discuss which consequences and effects resulted from this personal computing culture for the knowledge of the state, the autonomy of citizens and civil servants, and the distinction between private and public.

Maximilian Noichl (University of Vienna)

The Epistemic Vices and Virtues of Dimensionality Reduction

Session 9 | Friday, Oct 29, 9:00 – 9:30

Nonlinear methods of dimensionality-reduction play an increasingly important role in scientific practice across a huge variety of domains. But as they are explorative, non-deterministic, and somewhat opaque techniques that are nonetheless easy to use and yield highly accessible visual output, their epistemic affordances, which have hitherto not been examined by philosophers, differ radically from that of earlier methods that served similar purposes.

In this contribution, we trace their proliferation across various disciplines through a citation analysis of articles that make use of them, and survey informal information sources which surround the dissemination of the techniques, including documentations, comments on open-source code, tutorials, and message-board discussions.

Based on this analysis, we argue that the adoption of nonlinear dimensionality reduction brings with itself a shift in epistemic virtues, in which scientists, by stressing values like accessibility, interactivity, and explorability, as well as transparency of the mutability of results, try to overcome their relative opacity and variability.

As the application of nonlinear dimensionality-reduction is still hotly debated, philosophers of science can observe in real time how scientists in different domains negotiate novel epistemic landscapes, while we learn whether their adoption is ultimately successful.

Philippos Papayannopoulos, Nir Fresco and Oron Shagrir (Hebrew University of Jerusalem, Ben Gurion University of the Negev)

On Two Different Kinds of Computational Indeterminacy

Session 4 | Wednesday, Oct 27, 17:00 – 17:30

It is often indeterminate what function a given computational system computes. This phenomenon has been referred to as “computational indeterminacy” or “multiplicity of computations”. In this talk, we argue that what has typically been considered and referred to as the (unique) challenge of computational indeterminacy in fact subsumes two distinct phenomena, which are typically bundled together and should be teased apart. One kind of indeterminacy concerns a functional (or formal) characterization of the system’s relevant behavior (briefly: how its physical states are grouped together and corresponded to abstract states). Another kind concerns the manner in which the abstract (or computational) states are interpreted (briefly: what function the system computes). We discuss the similarities and differences between the two kinds of computational indeterminacy, their implications for certain accounts of “computational individuation” in the literature, and their relevance to different levels of organization within the computational system. We also examine the interrelationships between our proposed accounts of the two kinds of indeterminacy and the main accounts of “computational implementation”. Finally, we draw some connections between the two kinds of indeterminacy and the challenges posed by the triviality arguments and deviant encodings in the philosophy of computation.

Tomas Petricek and Joel Jakobovic (University of Kent)

Complementary Science of Interactive Programming Systems

Session 5 | Thursday, Oct 28, 10:00 – 10:30

Is it worth looking at the history of programming, not just for the sake of history, but in order to discover lost ideas that could be utilized by present-day computer scientists to advance the state of the art of programming? We answer the question in the affirmative, propose a methodology for doing so and present an early experiment that recovers a number of interesting programming ideas from, against all odds, Commodore 64 BASIC.

Camilla Quaresmini and Giuseppe Primiero (University of Milan)

Data Quality Dimensions for Fair AI

Session 7 | Thursday, Oct 28, 15:00 – 15:30

AI systems are often biased, as they misidentify patterns in data. When dealing with people, algorithms use data to make decisions affecting human lives, mechanically feeding systematic

discriminations and wrong classifications. We consider current toolkits for bias mitigation and how they improperly reduce quality to mere accuracy. Providing an analysis of data quality dimensions, we construct a study case for the CleanLab algorithms. Considering two noisy cases for the Gender attribute, we show how to improve the classification algorithm for an incomplete or inconsistent label set. The aim of our work is to prepare the ground for an extension of fairness assessment tools.

Edith Schmid (ETH Zurich)
Computing Systems as Social Institutions

Session 1 | Wednesday, Oct 27, 10:30 – 11:00

The contribution advocates the concept of a social institution for computing systems involving human agents. This allows for a conceptualization of such systems comprehensible for both social sciences and computer sciences. In social sciences, institutions are considered as constitutive structural elements of societies, or cultures. Computer scientists might say: social institutions are like programs controlling human agents. So, there is a structural core in social institutions allowing for a transdisciplinary discourse. I will argue that conceiving the increasing number of computing systems as social institutions, will not only facilitate the exchange between computer scientists and social scientists, but also allow access to a rich body of knowledge with regards to the interplay between institutions and the humans they govern.

I will first propose a definition of the structural core of a social institution. I will then, with the help of examples, show how the conceptualization of computing systems as social institutions enable a targeted discussion of highly topical issues, e.g., what is the role of an institution's 'idée directrice', or guiding principle, and its dissemination?

Jelena Stanulovic (University of Belgrade)
Influence of the Self-Management in the Development of Personal Computers in Socialist Yugoslavia During the '80s

Session 6 | Thursday, Oct 28, 11:20 – 11:50

During the '80s, the Yugoslav federal government enforced measures on import customs and taxes, which harmed technology deployment. Home-use (personal) computers were just a few, due to the authorized import price that was exceedingly lower than the PC market price, and due to the high custom duty costs.

By analyzing the influence of self-management in socialism ("Factories to the workers") we can presume that the culture among Yugoslav computer hobbyists and enthusiasts is very much alike to a hacker culture based on the shared pursuit of science, especially movement for open software. Surprisingly, government restrictions and major changes in technology development

conveyed the use of science and technology in households. This also brings us to an entrepreneurial culture before self-management was abolished (1989).

The paper will analyze the influence of self-management socialism and government restrictions on the use of science and technology development in households through an example of PC magazine “Racunari” (Computers) that broke the market by publishing how to build the PC from the imported hardware components that were to be found on the market.

Mate Szabo (University of Oxford)
The Early Days of the Hungarian Software Industry

Session 6 | Thursday, Oct 28, 10:50 – 11:20

In my talk I discuss the origins and early developments of the Hungarian software industry from the late 1960s into the 1980s, and to contribute to the scant literature on the history of the software industry in the Eastern Bloc. It is well known that by the end of the 1960s, the Eastern Bloc was lagging several years behind the West in computer hardware. The situation with regards to software was even worse. Hungary’s software “industry” shared most problems with the other Eastern Bloc countries, among them the high number of different, non-compatible computer makes. These circumstances kept Hungary’s software industry in the era of custom-made software, producing compilers for the most widely used languages and one-of-a-kind programs for the ministries and the largest actors in the country’s industry. Throughout the 1970s the country’s software industry was impacted by two factors. First, somewhat surprisingly, Hungarian software enterprises established several cooperations with Western European computer companies through “software export”. Second, a relatively large number of Western “clones” became available, which were able to run original Western software (with small modifications). In my talk, I discuss these tendencies that impacted the beginnings and early development of the Hungarian software industry in more detail.

Javier Toscano (APRA Foundation)
**Intentionalities of Code: Historical Practices and Devices.
 A Philosophical Account**

Session 1 | Wednesday, Oct 27, 10:00 – 10:30

Computing does not only imply an interaction with machines, but also –maybe more poignantly– a way of thinking. As historians of technology acknowledge, computing meant in the past so much as counting, or even reasoning (e.g. Leibniz 1890). But in this sense, the history of computing has a much earlier beginning than what is popularly thought. The first machines that we can recognize as abstract computers were imagined by Charles Babbage in the 19th Century, but the first codes were assembled centuries before, to be performed by social machineries.

Of course, in order for this account to unfold, we need to precise what coding and programming are (or can be), and how they articulate together a social structure to produce cultural meaning, a certain dynamic and a given output. Drawing on early definitions of programming by mathematicians von Neumann and Goldstine (1947), as well as logicians Newell, Simon and Shaw (1958), but especially on a recent human-evolutionary hypothesis by cognitive scientist Michael Tomasello (2014), which maintains that humankind relies on a cooperative mechanism that ultimately resulted in a particular modality of social thinking, this article explores the deep historical foundations of computing and coding from a reinterpretation of specific cultural practices.

Stefan Trausan-Matu (University Politehnica of Bucharest)
A Poststructuralist Perspective on Computer-Generated Literature

Session 9 | Friday, Oct 29, 9:30 – 10:00

There is a long history of computer programs that generate short stories starting from a structuralist approach, for example, from stories' grammars, rules or knowledge bases. In addition to this rationalistic systems, in recent years, empiristic systems, based on deep neural networks were developed. In both approaches the results are dissapointing, readers immediately realise the mechanistic character of the texts, the fact that the 'author' is not human, it does not have the experience of life, that there is not an "empathetic flow between two living, breathing beings", as recently mentioned by Laura Smith. Empathy was emphasized also by Terry Winograd as a major lack of artificial intelligence systems, Heidegger's hermeneutics being sugested. The alternative approach proposed in this paper starts from a poststructuralist perspective, based on the dialogism, heteroglossia and polyphony ideas of Mikhail Bakhtin. The life experience that should be reflected in the generated texts is characterized by a space-time complex, which is represented in texts by Bakhtin's chronotopes. This alternative, poststructuralistic approach was already used in computer systems for discourse analysis and music generation (chat conversations sonification) starting from the polyphonic model of Stefan Trausan-Matu. Hermenutics was also considered and operationalized in the so-called hermenophore tools.

Marcelo Vianna (Federal Institute of Education, Sc. and Tech. of Rio Grande do Sul)
"Processing the Development": Technical Groups, Profiles and Decisions on Computer Technologies in Brazil in the Late 1950s

Session 3 | Wednesday, Oct 27, 15:00 – 15:30

The first computers arrived in Brazil in the late 1950s, stimulated by the rise of the national developmentalist government of Juscelino Kubitschek (JK). Through the Plano de Metas (Plan of Goals, 1956-1961), an ambitious project for structural transformation in the Brazilian economy, it began a process of substituting imports of consumer goods, which encouraged the incorporation of new technologies, including computers. In order to promote the dissemination of

these technologies, two technical groups were created, GTAC (Working Group on the Application of Computers) in August 1958 and GEACE (Executive Group for the Application of Electronic Computers) in April 1959. Through the profiles of their members, designated especially from the military area, with varied expertise in Nuclear Energy, Electronics and Administration, it is possible to understand the decisions taken by the State, which encouraged the acquisition of foreign technologies to provide rapid industrialization. In addition, the decision-making capacity of GTAC / GEACE and the repercussions of their decisions will be observed, especially the idealization of a Government DPC, from the installation of a UNIVAC 1105 for processing the 1960 Census. This paper will also observe the limits of performance that would lead to the rapid collapse of the agency.

David Waszek (CNRS, Archives Henri-Poincaré)
Informational Equivalence but Computational Differences? Herbert Simon on Representations in Scientific Practice

Session 4 | Wednesday, Oct 27, 16:30 – 17:00

To explain why, in scientific problem-solving, a diagram can be “worth ten thousand words,” Jill Larkin and Herbert Simon (1987) introduced a computer model: two representations can be “informationally” equivalent but differ “computationally,” just as the same data can be encoded in a computer in multiple ways, more or less suited to different kinds of processing. In this paper, I recontextualize, clarify, and criticize their proposal. Its roots lay in cognitive psychology, more precisely in the “imagery debate” of the 1970s on whether there are image-like mental representations. Simon (1972, 1978) initially hoped to solve this debate by thoroughly reducing the differences between forms of mental representations (e.g., between images and sentences) to differences in computational efficiency. However, I argue that his attempts to carry out this ambitious reduction by invoking fledgling notions from theoretical computer science – those of data type and of data structure – ultimately proved unsuccessful. This failure sheds light on what his and Larkin’s later work on scientific representations does and does not achieve: it allows comparing, not representations in and of themselves, but rather representations conceived as computational roles in particular problem-solving processes—that is, representations together with a particular way of using them.

Nick Wiggershaus (Lille University)
An Agential Theory of Implementation for Computer Science

Session 4 | Wednesday, Oct 27, 16:00 – 16:30

In this talk I present an agential theory of implementation for computer science. I argue that such an account is needed to address a particular problem when it comes to the ontological status of computer programs: How do the abstract formal/symbolic aspects of programs relate to concrete physical devices in which they are executed? The structure of the talk follows

three steps: (1) Whilst the “problem of implementation” has been dealt with in the context of philosophy of mind and natural systems (i.e., the brain), the results fail to adequately account for human induced computations in artifacts. (2) I argue that an agential theory of implementation can overcome those shortcomings. For so doing, I employ recent developments from the unconventional computing community and the “scientific representation” literature. (3) More specifically, I show how a synthesis of the so-called Abstraction/Representation Theory (ART) and Frigg & Nguyen’s novel account of scientific representation (DEKI) – based on a hydraulic analog computer (MONIAC) – yields a robust notion of an agential theory of implementation for computer science.

**Robin Zebrowski, John Sullins, Eric Dietrich, Bram Van Heuveln
and Chris Fields** (Beloit College, Sonoma State University, Rensselaer
Polytechnic Institute)

The History and Legacy of the AI Wars

Session 7 | Thursday, Oct 28, 15:30 – 16:00

In spite of the last seventy years of philosophical debate about the nature, structure, and aspirations of AI technology, the rapid onset of algorithmic ubiquity seeking to achieve human-levels of intelligence seems to be taking many people unfamiliar with this history by surprise. In order to fully understand the current debates about AI ethics, consciousness, and embodiment, we should look back to the contentious AI Wars that spanned roughly fifty years between 1950-2000. In this paper, we take a look at the history of these debates, showing that philosophy has been the landscape for the biggest arguments in AI, from questions of optimal architectures to the frame problem, and the questions about hardware, software, and logic that underpin it all. We start with our recently-published book, “Great Philosophical Objections to Artificial Intelligence: The History and Legacy of the AI Wars” (Bloomsbury, 2021) and engage with the ways philosophy as a field moved on from many of those debates without ever resolving them, setting up the foundations for the contemporary debates and sometimes even ignoring those earlier lessons.

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