CCTP-5038: History and Philosophy of Computing, Spring 2024
Communication, Culture & Technology Program
Georgetown University

Professor: Martin Irvine
Email: irvinem@georgetown.edu

Time and Dates: Thursday 11:00AM-1:30PM

Location: Lauinger 110 (Idea Lab)

Course Resources: Web Syllabus, Online Library, Online Platforms

Students will participate in the course with a suite of Web-based platforms and e-text resources:

(1) A custom-designed Website created by the professor for the course syllabus, links to readings, and weekly assignments: **https://irvine.georgetown.domains/5038/**

(2) An E-Text Course Library in a shared Google Drive Folder. Most course readings (and research resources) will be available in pdf format prepared by the professor and available for download and/or online reading in Google Drive (GU Google account).

(3) Google Docs, Slides. Students will also create and contribute to shared, annotatable Google Docs files for certain assignments and dialogue (both during synchronous online class-time, and working on group projects outside of class-times).

(4) The Canvas Discussion platform for weekly assignments.

(5) Zoom video conferencing for virtual office hour meetings (when necessary).

Professor Contact Information: email: irvinem@georgetown.edu

Office Hours: Before class meetings, and by appointment.

COURSE DESCRIPTION

Have you wondered about the deeper history of ideas that enabled us to get where we are today in all our computing and data systems? This course provides students with an inside view of the history of ideas that have made computing possible, starting from the earliest beginnings in the 1600s to our contemporary digital electronic systems, digital media, data networks, and AI. To facilitate access to the deeper history, students will learn how use and interpret earlier original primary documents and earlier examples of technologies archived in libraries and museums. We will study the history of computing from the perspective of the key concepts and design principles that have made computing possible, and not as a story of the inevitable "progress" of machines, products, or innovations. You will discover the very essential human ideas and capabilities that motivated the beginnings of computing in the Enlightenment era (1600s-1700s), and have continued to motivate the designs of computing systems in the various technical implementations down to us today. Recovering the history of ideas in computer reveals that the key concepts in computing are accessible to everyone, but have accidentally become “black boxed” (inaccessible, closed-off from understanding) from two main causes: (1) our modern political economy for technology with computing tech industries that market closed “products” only accessible to specialists, and (2) the false modern institutionalized division of disciplines and sciences into "math/science/tech" and "humanities/social science/arts" domains of knowledge. We will apply our CCT interdisciplinary approach to “de-blackbox” (make accessible for understanding) the key concepts in computing, and create a truer view of computing that draws from overlapping histories in philosophy, logic, mathematics, science, communications, social contexts, and supporting technologies. Students will work on interdisciplinary research projects for doing their own “deep dive” into the history of concepts and contexts that have led to where we are today.

Syllabus Structure

The 14 week units of the course are organized around six "Nodal Moments" in the history of ideas and how they became implemented in different stages of the technologies. A "node" in this context means a moment in time and place where people, ideas, social conditions, and developments in underlying technologies intersect and interconnect, like a node in a network that connects many active "links" at the same time. We will also follow how earlier nodes produce links that become connected to further nodes through the whole history, leading right to our present moment.

Conceptual Framework and Methods Used in the Course

Intellectual history (history of ideas). We will study major moments in the history of philosophy, mathematics, logic, and design concepts for technologies, studied in their social contexts and as reinterpreted and re-applied throughout developments in other contexts.

Systems and Design Thinking: learning to understand how everything in computing – past and present – is based on designing complex (multi-part) *systems* of combined *subsystems* (modules); that is, as interconnecting components, combined orchestrated in a unifying master-design termed an architecture.

Semiotics. Theory of symbol systems (signs, symbols, diagrams, writing, notation for math, logic, and code), symbolic thought, interpretation, and physical representation that underlies all design thinking in computing, math, code, programming.

Archival methods. How to access and interpret earlier, original, primary sources (documents, artefacts, devices, technical documentation) from online data sources (archives, libraries, museums).

LEARNING GOALS AND COMPETENCIES

Students will learn the combined methods in our framework for a truer and more complete understanding of the core concepts in computing technologies from their deeper histories of development, and be able to apply this knowledge to their own further research, learning, and career development. By the end of the course, students will be able to apply this interdisciplinary knowledge to many other fields and careers, including design, applications in digital media, and becoming capable communicators for "de-blackboxed" explanations of computing, including our complex data and AI systems Students will be able to explain the reasons behind the design of our contemporary computing systems, and better understand what is possible (and not) in future developments.

Learning archival methods for access to the history in original primary sources is an important skill in many disciplines and career paths. Students with this competency will always be in demand for being able to research, interpret, and apply the historical knowledge gained from direct access to primary sources (original documents, designs, artefacts, earlier technologies) in understanding the foundation of computing systems today, and what can be possible in new future designs.

COURSE READINGS AND REQUIRED BOOKS

Many of the course readings are provided as pdf documents linked in each week unit on the course syllabus website: **https://irvine.georgetown.domains/5038/**

There are three required books, available at the GU bookstore, but, of course, you can get them from online sellers as well.

Selections from these books are in pdfs in the e-text library, but these books are important to have (in print) for ongoing reference and your own annotations.

Georges Ifrah, *The Universal History of Computing: From the Abacus to the Quantum Computer*. New York: Wiley, 2001.

Howard Rheingold, Tools for Thought: The History and Future of Mind-Expanding Technology. rev. ed. Cambridge, MA: MIT Press, 2000.

Peter J. Denning and Craig H. Martell. *Great Principles of Computing*. Cambridge, MA: MIT Press, 2015.

COURSE ASSIGNMENTS AND GRADING CRITERIA

Assignments and Grading

This course will include different kinds of projects for you to learn the history of ideas and how to study and interpret original documents and examples of artefacts and machines in the history of computing. Each week's assignment will combine your reading and reflection on assigned texts with your investigation and study of online resources for important historical documentation and images of artefacts and machines in the history of computing.

For each week, students will write a short reflection essay posted on Canvas on the readings and research sources of the week. Follow the instructions for questions and topics to write about. Your post should also include questions and asking for more explanations of topics in class. (Remember: if you have a question or don't understand something, you won't be alone. Most of what we study will probably be new to you, so never be afraid to ask questions!)

Students will also write a final research paper in which you apply the methods and learning in the course to a topic or question that want to learn more about (formats will be discussed later).

Final grades will be based on:

(1) Class participation: weekly writing assignments, and group projects (as assigned) (50%).

(2) A final research project based on applying the concepts and methods of the course to a topic that you want to research further. (50%).

Weekly Assignments and Discussions in Canvas

A**ll readings and assignments are to be completed during the week before the numbered week units**. Each week unit defines what we will be covering in class discussions for that week.

Weekly writing assignments must be posted in Canvas **at least 6 hours before class**, so that all class members can review each other's work and be prepared for discussion in class.

COURSE SCHEDULE AND SYLLABUS

This course has 14 week units, organized around six "Nodal Moments" in the history of ideas and how they became implemented in different stages of the technologies (see above). For the course structure, contents of each unit, and assignments, see the course website (the main reference): https://irvine.georgetown.domains/5038/

Course Outline:
Note: Contents of units are subject to revision. Updated syllabus topics and content will always be on the course website.

Week	Node	Main Topics
1		Introduction to course. Student introductions,
2		Introduction to the history and philosophy of computing, course methods, with some examples for brief case studies in applying the methods of the course.
3	Node 1	**17th-18th Century Node**: Introduction and Overview. The era termed the "Scientific-Mathematical Revolution" and the "Enlightenment." Why begin here? Pascal and Leibniz: philosophy, mathematics, science, and the first "Arithmetic machines" (mechanical calculators). Introducing the primary documents and examples of the technical implementation of key concepts and design principles.
4		What were the key concepts and how were they implemented in designs for early calculating machines? Studying the design of Pascal's and Leibniz's calculating machines.
5	Node 2	**19th Century Node**: Introduction and Overview. George Boole, Charles Babbage, Ada Lovelace, Samuel Morse. They were working in same decades (1830s-1850s) of the "Industrial Revolution." What were they trying to figure out, how does it all connect? Introducing the primary documents and examples of the technical implementation of key concepts and design principles.
6		Case studies with primary sources and early mechanical computers. Babbage's Engines and the context of applied mathematics.
7	Node 3	**19th-early 20th Century Node**: Introduction and Overview. C. S. Peirce, "logic as semeiotic" and Claude Shannon's application of Boole's and Peirce's logic to designs for binary electronics and the concept of digital binary electronic information. Introducing the primary documents and examples of the technical implementation of key concepts and design principles.

8		Peirce's semeiotic, Morse Code, Shannon and theory of information. From Information to Data and concept of code/encoding. Case study: Morse Code to Unicode (our digital text encoding format)
9	Node 4	**20th Century Node**: Introduction and Overview. Development of Modern Digital Computing Systems. The key concepts in modern electronic computing; how John Von Neumann, Alan Turing, and many others in different communities extended logic and mathematics for defining computation in electronic system designs. Introducing the primary documents and examples of the technical implementation of key concepts and design principles.
10		Case studies with major examples from the writings and design of computer systems. Key concepts: "Arithmetical and Logic Processing Unit" becomes our standard "CPU." Defining two orders of symbolic representation in binary: representing (encoding) "data" and representing (encoding) operations (programs). Physical memory and time.
11	Node 5	**1960s-1980s Node.** Introduction and Overview. Development of digital data format for all our symbolic systems (writing and text, graphics, images, audio). Operating systems developed and digital data formats becoming standardized. 1960s developers like Doug Engelbart move computing beyond number crunching for specialists. Engelbart's lab conceives and designs a new computing environment as a semiotic system for any kind of user. Development of graphical interfaces and interactive systems. Primary documents and designs from Doug Engelbart's lab at Stanford.
12		Case studies: Engelbart's *Augmenting Human Intellect Project*, Xerox PARC's first fully graphical interactive system, the key concepts that led the way to the first Apple MacIntosh. Design principles for interactive computing, GUI and HCI principles.
13	Node 6	**Contemporary computing Node, 1980s-2000.** Digital multimedia, data, the Internet and Web. Primary documents for digital design and the Internet.
14		Student Projects: Discussion and in-class presentations.

COURSE POLICIES AND EXPECTATIONS

Student Expectations

This course will be conducted as a seminar and requires each student's direct participation in the learning objectives in each week's course unit. Each syllabus unit is designed as a building block in the interdisciplinary learning path of the course, and students will write weekly short essays that reflect on and apply the main concepts and approaches in each week's unit.

You are expected to complete all readings, assignments, and activities **on time before each class meeting.** In order to get credit for participation, you must complete all assignments on time.

Participation is thus essential to your success in this class. You are expected to actively participate in weekly discussions with fellow students (online and in-class), and to contribute to group assignments.

Time Expectations

Students should plan on spending approximately **10 hours per week** on the work for each week unit.

Communication Expectations

Communication with the Professor

I will email students with updates to weekly readings and assignments, and other course matters, during the course. You are expected to read all email communications from the professor, and follow updates, additional instructions, or suggestions.

You can email me any time with your questions, concerns, and/or to schedule a time to meet (in my office or over Zoom). I will answer all student email messages within 24 hours.

Communication with Classmates

You will be expected to engage with your fellow classmates via the Canvas Discussions platform, and on other platforms as assigned (e.g., Google docs).

Discussion Guidelines

A graduate course is an open space to also learn from each other and to consider different points of view and experiences from different backgrounds. For that purpose, we ask each student to respect the opinions and thoughts of other students and be courteous in the way you express yourself, especially if you disagree. Students (with the professor) must commit to being respectful and considerate of all opinions, but we can also all expect that varying points of view can be supported with evidence or with reasons for differing interpretations, and not simply argued as a matter of personal preference or ideology.

LEARNING AND RESEARCH RESOURSES

Georgetown Library & Resources for Learning and Research

The Georgetown Library is one of the best in the US. As soon as possible, get to know how to search for books and articles from the library's main page:

https://library.georgetown.edu/

Increasingly, publishers are providing books and journals in etext form, and Georgetown Library subscribes to most of the sources you will need for your studies.

If you have a question for a librarian you can go to their "Ask Us" page where you will have the option to chat online, send an email, or schedule a Zoom appointment to discuss a research topic, develop a search strategy, or examine resources for projects and papers. Librarians offer an overview of and in-depth assistance with important resources for senior or master's theses, dissertations, papers and other types of research. This service is available to currently enrolled students who need assistance with Georgetown-assigned projects and papers. Please review the Services & Resources Guide for Online Students for additional information.

Students enrolled in courses have access to the University Library System's eResources, including 500+ research databases, 1.5+ million ebooks, and thousands of periodicals and other multimedia files (films, webinars, music, and images). You can access these resources through the Library's Homepage by using your NetID and password.

Learning Resources

Georgetown offers a host of learning resources to its students. Two that you might find particularly helpful in this course are the Writing Center and Refworks.

- The Writing Center offers peer tutoring by trained graduate and undergraduate students who can assist you at any point in the writing process. They help at any stage of your writing process, from brainstorming to revision. Tutors can offer advice on thesis development, use of evidence, organization, flow, sentence structure, grammar, and more. The Writing Center will not proofread or edit papers; rather, they will help to improve your proofreading and editing skills to become a better writer. Appointments can be booked online through their website.
- Refworks is an online research management tool that aids in organizing, storing, and presenting citation sources for papers and projects.

Technical Support for Canvas

All students have 24/7 access to Canvas technical support 24 hours a day, 7 days a week, including live chat and a support hotline at 855-338-2770. Use the 'Help' icon in the lower left of your Canvas window to view all available support and feedback options. If you're looking for help on a specific feature, check out the Canvas Student Guide.

UNIVERSITY POLICIES AND SERVICES

Academic Integrity

Students at Georgetown University are expected to maintain the highest standards of academic and personal integrity. Although most Georgetown students conduct themselves in accordance with these standards, occasionally, there are students who violate the code of conduct.

Academic dishonesty in any form is a serious offense, and students found in violation are subject to academic penalties that include, but are not limited to failure of the course, termination from the program, and revocation of degrees already conferred. All students are expected to fully adhere to the policies and procedures of Georgetown's Honor System and to take the Honor Code Pledge:

Honor Code Pledge

In pursuit of the high ideals and rigorous standards of academic life I commit myself to respect and to uphold the Georgetown University honor system; to live out a commitment to integrity in all my words and actions; to be honest in every academic endeavor; and to conduct myself honorably, as a responsible member of the Georgetown community as we live and work together; to live out the ideals of Georgetown University I commit myself to be a person for others in my daily life, respectful of difference and disagreement; To care for this venerable campus and all of those with whom I share it; and to fulfill in all ways the trust placed in me to carry on the Georgetown tradition.

Plagiarism

Stealing someone else's work is a terminal offense in the workplace, and it will wreck your career in academia, too. Students are expected to work with integrity and honesty in all their assignments. The Georgetown University Honor System defines plagiarism as "the act of passing off as one's own the ideas or writings of another." More guidance is available through the Gervase Programs. If you have any doubts about plagiarism, paraphrasing, and the need to credit, check out Plagiarism.org.

All submissions for assignments must be your original work. Acknowledge quoted and cited text, diagrams, and images from your sources in a standard reference citation format. Any submission suspected of plagiarism will be immediately referred to the Honor Council for investigation and possible adjudication. All students are expected to follow Georgetown's honor code unconditionally. If you have not done so, please read the honor code material located online at the Honor Council website.

ACCOMODATIONS AND CONDUCT POLICIES

Students with Disabilities

Under the Americans with Disabilities Act (ADA) and the Rehabilitation Act of 1973, individuals with disabilities have the right to specific accommodations that do not fundamentally alter the nature of the course. Some accommodations might include note takers, books on tape, extended time on assignments, and interpreter services among others. Students are responsible for communicating their needs to the Academic Resource Center, the office that oversees disability support services, (202-687-8354):

arc@georgetown.edu; https://academicsupport.georgetown.edu/disability/

before the start of classes to allow time to review the documentation and make recommendations for appropriate accommodations.

The University is not responsible for making special accommodations for students who have not declared their disabilities and have not requested an accommodation in a timely manner. For the most current and up-to-date policy information, please refer to the Georgetown University Academic Resource Center website. Students are highly encouraged to discuss the documentation and accommodation process with an Academic Resource Center administrator.

Accessibility and Inclusion

One of the central tenets of Georgetown's educational mission is *cura personalis*, a Latin phrase meaning "care of the whole person." Georgetown is committed to showing care and concern for each student by creating an inclusive and accessible learning environment that follows universal design principles to meet the needs of its diverse student body.

I am committed to creating a learning environment for my students that supports a diversity of thoughts, perspectives and experiences, and honors your identities (including race, gender, class, sexuality, religion, ability, etc.). If your name or pronoun needs to be corrected, please let me know early in the semester so that I can make the appropriate changes to my records.

Title IX/Sexual Misconduct

Georgetown University and its faculty are committed to supporting survivors and those impacted by sexual misconduct, which includes sexual assault, sexual harassment, relationship violence, and stalking. Georgetown requires faculty members, unless otherwise designated as confidential, to report all disclosures of sexual misconduct to the University Title IX Coordinator or a Deputy Title IX Coordinator. If you disclose an incident of sexual misconduct to a professor in or outside of the classroom (with the exception of disclosures in papers), that faculty member must report the incident to the Title IX Coordinator, or Deputy Title IX Coordinator. The coordinator will, in turn, reach out to the student to provide support, resources, and the option to meet. Please note that University policy requires faculty to report any disclosures about sexual misconduct to the Title IX Coordinator, whose role is to coordinate the University's response to sexual misconduct.

Georgetown has a number of fully confidential professional resources who can provide support and assistance to survivors of sexual assault and other forms of sexual misconduct. These resources include:

- Jen Schweer, MA, LPC, Associate Director of Health Education Services for Sexual Assault Response and Prevention (202) 687-0323 | jls242@georgetown.edu
- Counseling and Psychiatric Services (CAPS), (202) 687-6985 | After Hours: (833) 960-3006
- Sexual Assault Response and Prevention (SARP) confidential email: sarp@georgetown.edu
- Get Help Resources

More information about reporting options and resources can be found on the Sexual Misconduct Website.

SUPPORT SERVICES

Georgetown offers a variety of support services for students that can be accessed online, and also this newsletter, which will provide you with information about well-being resources and virtual meetings that can connect you with mental health professionals on and off campus during this time. Below are some resources available to you:

- Academic Resource Center: 202-687-8354 | arc@georgetown.edu
- Counseling and Psychiatric Services: 202-687-6985
- Institutional Diversity, Equity & Affirmative Action (IDEAA): (202) 687-4798