Computing

History and Culture

HSTM 20282 (10 credits)

HSTM 20782 (20 credits)

Semester 2, 2008-2009

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Office hours: Tuesday 14.00-15.00, or by appointment

Lectures: Tuesday 11.00-11.50, Kilburn IT103

Seminars: Thursday 16.00-16.50, Kilburn IT103

Timetable

(NB: it's occasionally necessary to change the order or contents of the timetable. Announcements will be provided at lectures or electronically.)

Week	Dates	A: Tuesday, 11.00-11.50	B: Thursday, 16.00-16.50
01	3 Feb 5 Feb	Introduction	Computers on film
02	10 Feb 12 Feb	Charles Babbage and the Analytical Engine	Perceptions of the computer
03	17 Feb 19 Feb	Five more 'first' computers	Where did computers come from?
04	24 Feb 26 Feb	Getting bigger, getting smaller: IBM, industry, mainframes and miniaturisation	Robotics and automation
05	3 Mar 5 Mar	The Manchester dimension	Inside Kilburn
06	10 Mar 12 Mar	Artificial intelligence	Does the computer think? Alan Turing and the Turing Test
07	17 Mar 19 Mar	Software	Essay skills
08	24 Apr 26 Apr	The computer in your home	Playing games
Easter break: no seminars/lectures 30 Mar – 17 Apr			
09	21 Apr 23 Apr	Hacker histories	Geek mythology: women, men and computers
10	28 Apr 30 Apr	Internet connections	Identity online
11	5 May 7 May	Conclusion	Exam skills
12	*Reading week: no seminar/lecture*		

Essay due (HSTM 20282 and HSTM 20782): **Friday 1 May 2009**

Project due (HSTM 20782 only): **Tuesday 26 May 2008**

Exam (HSTM 20282 and HSTM 20782): **date to be announced**

Contents

Introduction

What is a computer? How did information-processing equipment develop to dominate, by the dawn of the twenty-first century, so many areas of the society around us? Computers can be perceived in many different ways: as secret weapons that win wars, infernal machines that destroy jobs, vehicles for journeys of personal discovery, badges of industrial success, and irritants that don't work properly and need to be kicked. So too can the people who use them: computing culture has either created or focused attention on the public images of Victorian capitalists, wartime boffins, 1970s techno-radicals, 1980s whizzkids, hackers, crackers, geeks, cybernauts and perfectly ordinary, downtrodden wage-slaves who drink too much coffee.

This course unit combines the social, cultural, intellectual and technical histories of what we know as the computer. We will focus on a range of themes and ideas which interlock to build up the wider picture — the mechanical calculating machines of the nineteenth century, the contested birthplace of the 'modern' computer, the changing balance of influence between hardware to software, the possibility of artificial intelligence, the emotional appeal of a computer in the home, the question of whether computers must be 'toys for the boys,' and many more. The course may be taken with equal success by students specialising in the field and by those who have never studied computer science, but are interested in learning more about the background of one of the dominant technologies of our time.

Aims

This course unit aims to provide students with a good working knowledge of major developments in the history of computing and information technology, particularly from the Second World War onwards. Students are also expected to develop their skills in critical reasoning and analysis, understanding the different motivations of historical characters and the different ways in which they interpret and describe events. Students should appreciate, and are assessed on their ability to analyse, the different factors — social, technical, sometimes accidental — which have shaped the history of computing and defined the computer.

Intended learning outcomes

By the end of this unit, it is expected that a student taking the 10-credit version will

- possess a good working knowledge of major developments in the history of computing and information technology, particularly from the Second World War onwards
- have developed skills in critical reasoning and analysis, understanding the different motivations of historical characters in the history of computing, and the differences in the ways they interpret and describe events
- appreciate, and display the ability to analyse and discuss, the different factors — social, technical, sometimes accidental — which have shaped the history of computing and the definition of the computer itself

In addition, a student taking the 20-credit version will be able to

- define (in consultation with the unit lecturer) a research project in the history of computing
- find, and assess critically, relevant primary and secondary sources
- produce, with full scholarly apparatus, a report (or alternative piece of work, subject to the lecturer's approval) based on this research.

Teaching

This course unit will be taught in two slots weekly: Tuesday at 11am and Thursday at 4pm. Each session runs for 50 minutes in Kilburn Building room IT103.

Tuesday's class will usually be a lecture, sometimes with discussion. Thursday's class will usually be a seminar (that is, a group discussion based on a reading or other activity).

You may ask questions at any time in a lecture or seminar. Feel free to (politely) interrupt if there's anything you need to clarify, or if you think I have made a mistake.

Each class has one or two short **required readings**. You need to do these **in advance.** There are also **background readings,** which are usually the sources I used for the lecture content. You should read as much background material as you have time for in the parts of the course which interest you most.

Attendance at classes is required. Anyone who is repeatedly absent without a good explanation may receive penalties up to and including **exclusion from the course.** Reading is not a full substitute for the lectures and seminars, which will provide you with important course content and help to improve your discussion, summarising and essay-writing skills. You should **take notes**, and file them with any handouts distributed. These will be useful for preparation of coursework.

Blackboard

This course is running with Blackboard support for the first time in 2008-09. I will try to make sure the Blackboard content is always up to date, but please be patient: we're building it from scratch this year.

You should **check Blackboard regularly** (blackboard.manchester.ac.uk) for new course materials, updates, and suggested reading for research. Any **corrections** to the paper handout will also be announced on the Blackboard site.

Assessment

Assessment is by examination, and by essay (or alternative kinds of project work if agreed beforehand with the lecturer). A range of permitted essay titles will be distributed early in the course.

Students taking the **10-credit version, HSTM 20282**, will be assessed on

- **one essay** of about 1500 words (1350-1650 words acceptable), to be submitted by **Friday 1 May 2009,** counting for 50% of the total
- **one examination** of two hours' duration, in the Semester 2 exam period (date to be announced), counting for 50% of the total

Students taking the **20-credit version, HSTM 20782**, will be assessed on

- **one essay** as above, counting for 25% of the total
- **one examination** as above, counting for 25% of the total
- **one project** or extended critical essay, to be submitted by **Tuesday 26 May 2009** and counting for 50% of the total

All work should be submitted in accordance with the **essay guidelines** supplied for this unit. Arrangements for handing in will be announced during the course. **Late essays** will be penalised according to Faculty of Life Sciences guidelines.

Project (HSTM 20782 only)

The project on the 20-credit version of the course is intended to introduce you to specialist literature on a topic that you want to study in more depth. The project may take the form of an extended research piece (3000-3500 words), and could address one of the themes from the essay list just given, or a theme of your own. You should take care that your essay and project themes are not too similar, and must consult the lecturer to get your title approved. You need to allow considerable time for reading around the subject. Start looking for the readings you will need as soon as possible in the library, and if they are already on loan, put in reservations.

You might also like to consider other formats for a project. Possibilities include oral history interview work; a short dramatisation or documentary presentation (either recorded or presented before the group, time permitting); web-based presentation, or work on documents or artefacts held by the School of Computer Science, National Archive for the History of Computing or Museum of Science and Industry (if you know of, or can find, staff who are willing to help you out.) If you are thinking of one of these alternative formats, you should discuss it as early as possible with the lecturer to make sure your work will meet the requirements of the course.

Contacting us

This course is organised by the **Centre for the History of Science, Technology and Medicine (CHSTM)** — **not** by the School of Computer Science. CHSTM is part of the Faculty of Life Sciences and is based in the Simon Building on Brunswick Street. See <www.manchester.ac.uk/chstm> for full details.

Your lecturer and seminar organiser is **Dr James Sumner.** I can most easily be contacted by email, on <james.sumner@manchester.ac.uk>. You can phone me on 0161 275 5845 (also voicemail).

I have a regular **tutorial hour** in my office, 2.34 Simon Building, Tuesdays 2 till 3pm. If you can't make this time, email me for an appointment, suggesting times when you're available.

The **CHSTM Office** is 2.21 Simon (limited office hours, posted on the door). Email <chstm@manchester.ac.uk>, phone 0161 275 5850.

Course communications

You should **check your University e-mail account regularly,** as course announcements will be circulated this way. If you prefer to use a private address, you should arrange to forward e-mails from your University address to it.

A note about plagiarism

Plagiarism is a very serious offence, comparable to cheating in exams. It consists of passing off others' work as though it were your own (eg lifting passages – either word-for-word or closely paraphrased – from books, articles, online sources, etc.). Even 'recycling' parts of your **own** work, which has previously been submitted for assessment at this University or elsewhere, is defined as plagiarism.

It is not difficult for staff, who are all professional academic writers, to recognise instances of plagiarism. Likewise, software for detecting material lifted from internet sources is regularly employed in this regard.

Ignorance of the rules on plagiarism will not be accepted as a defence. It is your responsibility to familiarise yourself with the University's policy on plagiarism before you

prepare and submit any coursework so that you do not inadvertently commit this offence. All students should look at the University's guide to avoiding plagiarism:

www.humanities.manchester.ac.uk/studyskills/assignments/plagiarism/

Here, plagiarism is defined, and various misuses of sources are analysed for their errors. Since academic writing typically draws on the work and specific language of other writers, it is vital that you understand the (often subtle) distinctions between ethical use of others' texts and unethical appropriations of the work of others. The penalties for plagiarism range from being required to resubmit the piece of work in question (with a maximum possible mark of 40%) for minor instances to **expulsion from the University** in serious ones.

Disability support

The University of Manchester is committed to providing all students access to learning in the way most beneficial to them. It is important to tell us about any additional support that you need. If you have a disability, a learning difficulty or any condition that **you feel** may affect your work, then you might want to tell us about it. Please feel free to approach us to discuss any additional needs that you have. You may wish to email us, or we can arrange a meeting. Any discussion we have will be confidential. If you wish, you can also inform the Disability Support Office. It is based on the lower ground floor of the John Owens Building. You can drop in, but for appointments/enquiries telephone 0161 275 7512, or email disability@manchester.ac.uk.

What to do each week

- Attend the lecture and seminar and **make notes**.
- If there is required reading set for next week's seminar, read it in advance, note down your answers to the questions set, and come prepared to discuss them. Sometimes the seminar will be based around a short written exercise instead of a reading. This will usually involve reading and responding to a few short pieces of documentary evidence, and shouldn't take more than half an hour.
- Read the "required reading" and **make notes on this too.** Think how it relates to the lecture and to the rest of the course so far. Look at the exam past papers in this handbook: which question (or there may be more than one) is relevant to the reading? How would you use the reading to help you answer it?
- For most weeks there are plenty of "recommended background readings". The annotations will help you to choose which ones are most likely to be useful to you. Use them to learn more about the parts of the course you are most interested in, when you are planning an essay, and when you need more coverage for exam preparation.

Course readings

There is one book which **you should buy for this course.** It contains several of the required readings. Most of the other chapters are useful background reading for the various lectures.

- Campbell-Kelly, Martin, and William Aspray, *Computer: a history of the information machine*, 2nd edition. Boulder: Westview 2004.

An acceptable alternative is the earlier edition, which can now be picked up for a few pounds second-hand (try, for instance, abebooks.co.uk or Amazon New & Used).

- Campbell-Kelly, Martin, and William Aspray, *Computer: a history of the information machine*, 1st edition. New York: Basic Books 1997.

The main difference is that the 2004 edition has revised versions of the final two chapters, devoting much more space to the Web and internet commerce in general. A copy of the 2004 edition is available for one-night loan in the **Short Loan Collection** in the John Rylands University Library.

Other useful general histories

- Ceruzzi, Paul E, *A History of Modern Computing*, 2nd edition. Cambridge, Mass: MIT Press 2003.

  The main current alternative to Campbell-Kelly and Aspray. Covers a narrower time period (roughly 1945-1990) in more detail. Where Campbell-Kelly and Aspray write business history, focusing on commercial applications and software, Ceruzzi writes technical history, focusing on hardware producers and information technology concepts.

- Swedin, Eric, and David L Ferro, *Computers: the life story of a technology*. Westport, Conn: Greenwood 2005.

  The whole history of computing in 150 pages. Try this first if you want a quick and readable overview, to get things into perspective before tackling more complex studies. Not detailed enough to substitute for Campbell-Kelly and Aspray. Mostly covers 'standard' stories you will find in other texts, but Chapter 7 is a fresh attempt to address convergent tech, open-source and security.

- Williams, Michael R, *A History of Computing Technology*, 2nd edition. London: Wiley 1997.

  Broad history from the ancient world to the 1960s, from a mathematical and technical perspective. Very little on users.

There are many general histories of computing aimed at a more popular audience. While not always good essay sources, these can be useful in helping you to pick up the historical background. Some of the most interesting are:

- Palfreman, John, and Doron Swade, *The Dream Machine*. London: BBC Books 1993.

  Accompanies the TV documentary series used in this course.

- Augarten, Stan, *Bit by Bit: an illustrated history of computers*. London: Unwin 1985.

  Light, accessible survey.

- Hally, Mike, *Electronic Brains: stories from the dawn of the computer age*. London: Granta 2005.

  Another readable popular survey. More attention to British cases than the others.

- Lohr, Steve, *Go To: the story of the math majors, bridge players, engineers, chess wizards, maverick scientists and iconoclasts*. London: Profile 2002.

  Anecdotal long-range overview of the development of computer languages, 1950s-90s. Based on many interviews with influential coders.

- Lubar, Steven D (1993) *Infoculture: the Smithsonian book of Information Age inventions*. Houghton Mifflin.

  Looks at computing technologies amongst other information/communications developments.

Some more specialised texts

The most appropriate background readings are listed for individual lectures and seminars in this handbook. You will often find these useful in essay preparation, or as background for exam revision.

The following is a list of useful texts which, though specialised, are relevant to more than one week's material, or give a different perspective which may be useful for writing essays or (especially) projects.

- Abbate, Janet, *Inventing the Internet*. Cambridge, Mass: MIT Press 1999.
  First serious book-length Internet history, mainly covering the ARPAnet years.
- Agar, Jon, *The Government Machine: a revolutionary history of the computer*. Cambridge, Mass: MIT Press 2003.
  Detailed British-focused survey which sees the rise of computing technology as a part of the general growth of the large information organisation, as typified by the Civil Service "machine."
- Aspray, William, ed, *Computing Before Computers*. Ames: Iowa State University Press 1990.
  Multi-author survey of early computing machinery, including an account of analogue computing.
- Brock, Gerald W, *The Second Information Revolution*. Cambridge, Mass: Harvard University Press 2003.
  Computers in the context of the postwar explosion in communications technology.
- Campbell-Kelly, Martin, *From Airline Reservations to Sonic the Hedgehog: a history of the software industry*. Cambridge, Mass: MIT Press 2003.
  First book-length treatment of the software industry. Focuses mainly on US cases and on the commercial dimension.
- Edwards, Paul, *The Closed World: computers and the politics of discourse in Cold War America*. Cambridge, Mass: MIT Press 1996.
  Engages the politics so often lacking from accounts of computer history, and introduces ideas from cultural theory, to address how military and civil policymakers' ideas about control, surveillance and territory changed in the Cold War, and the role played by cybernetics, computers and AI.
- Hendry, John, *Innovating for Failure: government policy and the early British computer industry*. Cambridge, Mass: MIT Press 1989.
  The shift from consensus to competition and its effect on a nation's technological profile.
- Ifrah, Georges, *The Universal History of Computing: from the abacus to the quantum computer*. London: Wiley 2002.
  Very wide-ranging general-interest text on techniques of computation, translated from a French source: its arrangement and interpretations are often interestingly different from comparable English-language studies.
- Kidder, Tracy. *The Soul of a New Machine*. Boston: Little, Brown, 1981.
  Classic journalistic study of one company's project to develop a minicomputer and "make a lot of money."
- Lavington, Simon, *Early British Computers*. Manchester: Manchester University Press.
  Relatively technical overview.
- Metropolis, Nicholas, Jack Howlett and Gian-Carlo Rota, eds, *A History of Computing in the Twentieth Century*. New York: Academic Press 1980.
  Among the most technical/mathematical of overview studies. Coverage mostly 1940s-60s. Includes first-hand recollections by Backus, Dijkstra, Eckert, Good, Mauchly, Wilkes, Zuse and others.
- Norberg, Arthur, and Judy O'Neill, *Transforming Computer Technology: Information Processing for the Pentagon, 1962-1986*. Baltimore: Johns Hopkins, 1996.
  The role of the US Advanced Research Projects Agency in sponsoring computer science research for (possible) military application, much of which eventually became part of 'everyday' computing. Includes AI work and ARPAnet.

- Rochlin, Gene, *Trapped in the Net: the unanticipated consequences of computerization*. Princeton University Press 1997.

  Not (necessarily) the Internet, but the 'net' of commitments and dependencies we sign up for when we transfer tasks to automated digital information structures. From supermarket checkouts to banking to airline safety, Rochlin considers the risks of trusting the technology.

- Turkle, Sherry, *The Second Self: computers and the human spirit*. New York: Simon and Schuster 1984.

  Classic study, one of the first seriously to address the involvement of computers in the social and psychological lives of experts and non-experts. Includes studies of the first generation of children growing up with digital equipment as 'everyday' familiar objects.

- Wardrip-Fruin, Noah, and Nick Montfort, *The New Media Reader*. Cambridge, Mass: MIT Press 2003.

  Valuable collection of primary sources written to promote or describe new methods of information distribution, often involving computers. Includes work by Alan Turing, Norbert Wiener, Ted Nelson, Richard Stallman and the originators of the World Wide Web.

- Yates, JoAnne, *Control through Communication: the rise of system in American management*. Baltimore: Johns Hopkins University Press 1989.

  Includes coverage of early information processing.

If there's a book which you find helpful but which isn't on this list, let me know!

Where can I look for more history of computing?

If you want to look further, an excellent annotated bibliography is

- Thomas Haigh, "History Resources" at <www.sigcis.org/?q=node/10>

  Maintained for the Society for the History of Technology Special Interest Group on Computers, Information and Society (SHOT SIGCIS). Lists books and articles, museums and archives, oral history resources, recommended texts for beginners, texts *about* the history of computing, and more.

You may also find relevant scholarly articles by journal searching. There is one journal devoted to the field, *IEEE Annals of History of Computing*. Journals which regularly publish history of computing content include *Technology and Culture* and *Business History Review*.

Where to find the readings and other texts

The University's online catalogue covers all of its major collections and sites. To find materials:

- Go to the John Rylands University Library (JRUL) website at <www.manchester.ac.uk/library>
- Click 'Library Catalogue'
- Enter some details of the work you are looking for. Leaving 'Main Catalogue' selected for 'Collection' and 'All' for 'Library Site' will search all the major sites. There should be at least one copy of everything relevant to this course on the **main JRUL site,** but you may find extra copies in the **Joule Library** on the North Campus or the **Precinct Library** next to the shopping precinct on Oxford Road.
- Note that searching 'Main Catalogue' does not search everything in the Short Loan Collection. In particular, it won't find photocopied readings, so you won't find the required reading for this course unit this way. See instead the next section…

How to find the required readings for this course unit

- **Aspray and Campbell-Kelly** is the required text which you are expected to buy for this course.
- All the other required readings will be available **electronically** where possible, either in electronic full text or as PDF images of scanned photocopies. We are aiming to link these directly from the course's Blackboard presence.
- Where electronic distribution is not possible, you can access **photocopies** of the required readings in the **Short Loan Collection.** To find photocopies, go to the library catalogue as above, then **change 'Collection' from 'Main Catalogue' to 'Short loan collections'** and enter some details — eg, for the Artificial Intelligence required reading, put 'Crevier' in the 'Author' field.

The Short Loan Collection is based on the ground floor of the main JRUL site. Ask a librarian if you are unsure where to find material with a particular shelfmark.

How to find material outside the University

The main non-University library in Manchester is the **Central Library** on St Peter's Square, which holds many local collections and archives (potentially useful if you are writing an essay on Manchester.) More information is available at <www.manchester.gov.uk/libraries/central/>.

COPAC, accessed at <www.copac.ac.uk>, is a union catalogue allowing you to search the collections of the British Library and over 20 major university research libraries at the same time. If you find useful material via COPAC, you may be able to borrow it through Inter-Library Loans and Document Supply at Manchester: see <www.library.manchester.ac.uk/using/dsu/>.

General notes

If you find that a text you need to use has been borrowed by another reader, you can reserve it through the online catalogue. This means that anyone who has taken out a popular book will usually find it is recalled quickly.

Don't hog books or photocopies. There may be up to 40 students registered on this course unit, beside the other readers in the University: obviously, there will not be enough for every reader to take out a copy at once. You should therefore return all materials to the Library as soon as you have finished with them. You may wish to take your own copies of anything you need to use regularly.

Notes and guidance on critical reading

Critical writing depends on critical reading. Most of the papers you write will involve reflection on academic texts – the thinking and research that has already been done on your subject. In order to write your own analysis of this subject, you will need to do careful critical reading of sources and to use them critically to make your own argument. The judgments and interpretations you make of the texts you read are the first steps towards formulating your own approach.

Critical reading: what is it?

To read critically is to make judgements about how a text is argued. This is a highly reflective skill requiring you to "stand back" and gain some distance from the text you are reading. (You might have to read a text through once to get a basic grasp of content before you launch into an intensive critical reading.) **The key is this:**

- **don't** read looking only or primarily for information

- **do** read looking for ways of thinking about the subject matter

When you are reading, highlighting, or taking notes, avoid extracting and compiling lists of evidence, lists of facts and examples. Avoid approaching a text by asking "What information can I get out of it?" Rather ask "How does this text work? How is it argued? How is the evidence (the facts, examples, etc.) used and interpreted? How does the text reach its conclusions?

How do I read looking for 'ways of thinking'?

1. First determine the central claims or purpose of the text (its **thesis**). A critical reading attempts to assess how these central claims are developed or argued.

2. Begin to make some judgements about context. What audience is the text written for? Who is it in dialogue with? (This will probably be other scholars or authors with differing viewpoints: these will often be cited in the text or in footnotes). In what historical context is it written? All these matters of context can contribute to your assessment of what is going on in a text.

3. Distinguish the kinds of reasoning the text employs. What concepts are defined and used? Does the text appeal to a theory or theories (abstract approaches or interpretative tools)? Is any specific methodology laid out? If there is an appeal to a particular concept, theory, or method, how is that concept, theory, or method then used to organize and interpret the data? You might also examine how the text is organized: how has the author analysed (broken down) the material?

4. Examine the evidence (the supporting facts, examples, etc) the text employs. Supporting evidence is indispensable to an argument. Having worked through Steps 1-3, you are now in a position to grasp how the evidence is used to develop the argument and its controlling claims and concepts. Steps 1-3 allow you to see evidence in its context. Consider the kinds of evidence that are used. What counts as evidence in this argument? Is the evidence statistical? literary? historical? etc. From what sources is the evidence taken? Are these sources primary or secondary?

5. Critical reading may involve evaluation. Your reading of a text is already critical if it accounts for and makes a series of judgments about how a text is argued. However, some essays may also require you to assess the strengths and weaknesses of an argument. If the argument is strong, why? Could it be better or differently supported? Are there gaps, leaps, or inconsistencies in the argument? Is the method of analysis problematic? Could the evidence be interpreted differently? Are the conclusions warranted by the evidence presented? What are the unargued assumptions? Are they problematic? What might an opposing argument be?

Some practical guidelines

1. Critical reading occurs after some preliminary processes of reading. Begin by skimming research materials, especially introductions and conclusions, in order to strategically choose where to focus your critical efforts.

2. When highlighting a text or taking notes from it, teach yourself to highlight argument: those places in a text where an author explains her analytical moves, the concepts she uses, how she uses them, how she arrives at conclusions. Don't let yourself foreground and isolate facts and examples, no matter how interesting they may be. First, look for the large patterns that give purpose, order, and meaning to those examples. The opening sentences of paragraphs can be important to this task.

3. When you begin to think about how you might use a portion of a text in the argument you are forging in your own paper, try to remain aware of how this portion fits into the whole argument from which it is taken. Paying attention to context is a fundamental critical move.

4. When you quote directly from a source, use the quotation critically. This means that you should not substitute the quotation for your own articulation of a point. Rather, introduce the quotation by laying out the judgments you are making about it, and the reasons why you are using it. Often a quotation is followed by some further analysis.

01A. Introduction

TUESDAY 3 FEBRUARY

Attempts to automate calculation and other kinds of information-processing can be found as far back as human history can be recorded. The history of this endeavour is not only long but complex and controversial. This lecture sets out the aims, scope and themes of the course.

Required reading

- If you receive this handbook before the course starts, please read, in preparation for next week, **chapter 1** of the required text, Campbell-Kelly and Aspray's *Computer*. See "Course readings" for details.

Recommended background reading

- Williams, Michael R, *A History of Computing Technology*, 2nd edition. London: Wiley 1997, pp 191-198.

  Brief background on the astrolabe and Antikythera device.

- Freeth, Tony, et al, "Letter: Calendars with Olympiad display and eclipse prediction on the Antikythera Mechanism", *Nature* **454** (2008), 614-617.

  The latest research on the Antikythera mechanism. *Nature* is one of the most high-profile scientific journals in the world, so we can assume there's widespread interest in the idea of (very) early computers.

01B. Computers on film

THURSDAY 5 FEBRUARY

Since the idea of the electronic computing machines first reached general audiences in the late 1940s, computers and computer operators have been represented in a variety of ways on film and television. From the 1970s, television was also used to encourage mass audiences to get involved in computer use themselves. This class presents excerpts of some of the video material available to look at during the course.

02A. Charles Babbage and the Analytical Engine

TUESDAY 10 FEBRUARY

The mathematician and manufacturing theorist Charles Babbage (1791-1871) has been described by some as the 'father of the modern computer'. Some historians, noting the limited direct influence of his work on later developments, prefer to think of him as more of a godfather or great-uncle. This lecture addresses Babbage's plans for cog-driven, programmable brass calculating machines in the context of the problems of his time. We will look at Babbage's achievements, dreams and disappointments, and at his relationship with Ada, Countess of Lovelace (1815-1852), whose popular account of his work has led her to be described (again, not without considerable dispute) as the "first programmer".

Required reading

- Campbell-Kelly and Aspray, chapters 1 and 2: "When Computers Were People" and "The Mechanical Office".

Recommended background reading

- Babbage, Charles, *Passages from the Life of a Philosopher*. London: Pickering, 1994 reprint (first published 1864.)

  Babbage's autobiography. Very readable, and the best possible way of getting an insight into this eccentric and sometimes tragic character.

- Williams, Michael R, *A History of Computing Technology*, 2nd edition. London: Wiley 1997. Chapter 4.

  Accessible account of how the Babbage and Scheutz machines worked.

- Hyman, Anthony, *Charles Babbage: pioneer of the computer*. Princeton University Press 1982.

  Best book-length biography of Babbage.

- Swade, Doron, "The Shocking Truth about Babbage and his Calculating Engines." *Resurrection*, New Year 2004, 18-27; online at <http://www.cs.man.ac.uk/CCS/res/res32.htm#d>

  More recent research on the role of the nineteenth-century science writer and populariser, Dionysius Lardner.

- Menabrea, Luigi, translated with additional notes by Ada Lovelace, "Sketch of the Analytical Engine invented by Charles Babbage." Originally published in the *Bibliothèque Universelle de Genève*, 1842; online transcript at <www.fourmilab.ch/babbage/sketch.html>.

  The single most influential account of the unbuilt Engine's nature and possibilities. Read the "Notes by the Translator" and assess Lovelace's contribution for yourself.

- Schaffer, Simon, "Babbage's Intelligence: calculating engines and the factory system." *Critical Inquiry* **21** (1994) 203-227.

  The importance of social and geographical place, setting Babbage in the wider context of Victorian industrialism.

- Stein, Dorothy, *Ada: a life and a legacy.* Cambridge, Mass: MIT Press 1985.

  Biography aiming to de-mythologise Ada Lovelace. Generally good on the peculiar position of a mathematically-inclined, socially privileged woman in nineteenth-century society, but beware the occasional attempt to apply twentieth-century psychological insights.

- Toole, Betty A, *Ada: the enchantress of numbers*. Mill Valley, Calif: Strawberry Press 1992.

  Toole is an opponent of those (like Stein) who downplay Lovelace's abilities. This volume consists mostly of excerpts from Lovelace's letters to Babbage and others.

Recommended video

- The Dream Machine, part 1: "Giant Brains" (1991)

  The Dream Machine (BBC/WGBH Boston co-production) was a five-part documentary on the history and projected future of the computer, including useful interviews with significant people (many of them no longer alive). This first instalment covers the work of Charles Babbage and the development of electronic computing in the 1940s and 50s.

Recommended museum exhibit

- Babbage's Difference Engine Number 2 (1991; 2000), The Science Museum, London.

  The vast mechanism specified in Babbage's second (and in some ways *simplified*) plan for the Difference Engine was eventually completed to the original designs, in full working order, for his 1991 bicentenary. The printing apparatus was completed nine years later. The Science Museum also has on public display a small trial component of the unbuilt Analytical Engine.

02B. Perceptions of the computer

THURSDAY 12 FEBRUARY

In this session you will investigate primary sources — direct evidence from the historical period we are studying — to consider how popular perceptions of computers have changed over the years. More information will be given out in class.

03A. Five more 'first' computers

TUESDAY 17 FEBRUARY

What, and where, and when was the first computer? Babbage's (unbuilt) Analytical Engine is often suggested seriously as the answer to this question. Yet Babbage's machine does not embody all the principles we would expect to find in a computer today, and many machines were used for computation before his time.

This lecture takes us to the Second World War, and a little beyond, to discuss several very different machines which have all been put forward as the 'true' first computer in the present-day sense. The aim is to identify what, in terms of its architecture and abilities, we expect a 'modern' computer to be able to do; and, at the same time, to examine the powerful emotional appeal of the 'first', which has been a focus for civic pride, institutional development and bitter, decades-long resentment…

Required reading

- Campbell-Kelly and Aspray, chapter 4: "Inventing the Computer".

Recommended background reading

- Williams, Michael R, *A History of Computing Technology*, 2nd edition. London: Wiley 1997. Chapters 6 and 7.
- Zuse, Konrad, *The Computer — My Life*. Berlin: Springer Verlag 1993.
  Zuse's own recollections of his early machines, wartime working conditions and more.
- Hinsley, F H, and Alan Stripp, eds, *Codebreakers: the inside story of Bletchley Park*. Oxford: Oxford University Press 1994.
  Multi-author volume consisting entirely of first-hand recollections by those who worked on Britain's wartime cryptanalysis programme. Gives a good sense of the sheer scale and variety of the operations surrounding the information-processing endeavour.
- Von Neumann, John, "First Draft Report on the EDVAC", introduction (first circulated 1945). Online at <qss.stanford.edu/~godfrey/vonNeumann/vnedvac.pdf> and various other places.
  Highly technical in parts, but gives you a flavour of the depth and intentions of this influential proposal.
- Burks, Alice Rowe, *Who Invented the Computer?* Amherst: Prometheus 2003.
  Interesting example of an account which takes for granted that specific inventor(s) can be identified, and that the battle remains worth fighting. The book focuses on the ENIAC patent trial, arguing strongly for the Atanasoff-Berry Computer as true "first," and objecting to continuing support for Eckert and Mauchly as inventors.
- Agar, Jon, "Digital Patina: texts, spirit and the first computer." *History and Technology* **15** (1998) 121-135.
  Discusses recent projects to rebuild or emulate different institutions' 'first' computers, in particular the Manchester Baby.

03B. Where did computers come from?

THURSDAY 19 FEBRUARY

Various 'prehistories' of the computer as we know it can be written: its roots can be found in business or government needs, in mathematical theory, in scientific experimentation. This seminar returns to the idea of Babbage's legacy and looks at some other lines of development, focusing in particular on the lost world of analogue computing.

Required reading

- Campbell-Kelly and Aspray, chapter 3: "Babbage's Dream Comes True".

Seminar questions

- What's the difference between an analogue and a digital computer?
- Do analogue machines belong in the "history of computing" as we know it?
- Did Babbage's dream really "come true"?
- How has Babbage influenced computing? Think about cultural as well as technical issues.

Recommended background reading

- Small, James, *The Analogue Alternative: the electronic analogue computer in Britain and the USA, 1930-1975*. Washington, DC: Taylor and Francis 2001.
  Detailed overview.
- Swade, Doron, "'It will not slice a pineapple': Babbage, miracles and machines", in Francis Spufford and Jenny Uglow, eds, *Cultural Babbage: technology, time and invention*. London: Faber and Faber 1996.
  Babbage's historical reputation, and the role of miracles in his demonstrations with the model Difference Engine.
- Bromley, Allan G, "Difference Engines and Analytical Engines" in William Aspray, ed, *Computing Before Computers*. Ames: Iowa State University Press 1990.
  More technical account of how Babbage's engines (would have) worked. Also includes information on the Scheutz Difference Engine and other, later machines.

04A. Getting bigger, getting smaller: IBM, industry, mainframes and miniaturisation

TUESDAY 24 FEBRUARY

This lecture is partly the story of International Business Machines, a corporation which dominated information processing in the USA (and many other places) in the years before the coming of the computer, and swiftly learned to do the same in the digital computing age. It is also the story of a young industry whose most noticeable defining feature — speeding-up of processes and shrinking-down of components at an astonishing rate — had unpredictable consequences for the balance of power between a large, entrenched operation and its smaller but (sometimes) more adaptable competitors. Finally, it is the story of how, as valves gave way to transistors, and transistors in their turn gave way to integrated circuits etched in silicon, the project of processing data caught up not only people and companies but whole geographical areas in its operation.

Required reading

- Campbell-Kelly and Aspray, chapters 5 and 6: "The Computer Becomes a Business Machine" and "The Maturing of the Mainframe: the Rise and Fall of IBM"

Recommended background reading

- Ceruzzi, Paul E, *A History of Modern Computing*, 2nd edition. Cambridge, Mass: MIT Press 2003. Chapters 1 and 4.
- Williams, Michael R, *A History of Computing Technology*, 2nd edition. London: Wiley 1997. Chapter 9.
- Watson, Thomas J, and Peter Petre, *Father, Son & Co.: my life at IBM and beyond*. London: Bantam 1990.

  Autobiography of the younger Watson, looking back at his father's life, the growth of IBM, and the move into digital computing.
- DeLamarter, Richard, *Big Blue: IBM's use and abuse of power*. London: Macmillan 1986.

  Readable anti-IBM account by an economist involved in the antitrust initiative. Contrasts interestingly with official histories.
- Lécuyer, Christophe, *Making Silicon Valley: innovation and the growth of high tech*, 1930-1970. Cambridge, Mass: MIT Press 2006.

  How a small collection of firms making radio and radar parts in the far American West grew into a defining feature of the information-technology world.
- Christine Finn, *Artifacts: an archaeologist's year in Silicon Valley*. Cambridge, Mass: MIT Press 2001.

  See in particular the "Photo Essay" (pp xviii-xlix). Finn's aim is to investigate, not so much the Valley's built environment, as its overall culture.

Recommended video

- *The Dream Machine*, part 2: "Inventing the Future" (1991)

  Covers a lot of important themes which will be picked up throughout the course: the growth of the US and British hardware industries, the first programming languages, popular representations of the computer, miniaturisation and the early stirrings of a desire for personal computers.

04B. Robotics and automation

THURSDAY 26 FEBRUARY

This seminar will look at different concepts of the robot (some practical, some not-so-practical) and their relationship to automation and computerisation in general. To prepare, look at a translation of the 1921 Czech play which introduced the term 'robot' — though not the concept of a mechanical worker — into the language:

Required reading

- Čapek, Karel, *RUR* (*Rossum's Universal Robots*), English-language translation by David Wyllie, "Introductory Scene" online at <etext.library.adelaide.edu.au/c/capek/karel/rur/act0.html>.

Seminar questions

- How do Čapek's robots differ from robots as we know them?
- And how are they similar?

- What point is Čapek making with the concept of the robot?
- It's clear almost from the outset that the story of the RUR factory is not going to end happily. Why?

Recommended background reading

- The rest of *RUR*: see index page at < etext.library.adelaide.edu.au/c/capek/karel/rur/>.
  This is a recent translation. You can also see the somewhat different script used for the first English-language production, of 1923, collected in *RUR and The Insect Play*, Oxford University Press 1961 (paper copy in JRUL).
- Nocks, Lisa. *The Robot: the life story of a technology*. Westport, Conn: Greenwood 2007.
  Broad overview covering early automata, mechanical automation, the link to AI, and recent scientific prototypes.
- Hankins, Thomas, and Robert Silverman, *Instruments and the Imagination.* Chichester: Princeton University Press 1996.
  The long historical view of automated devices, including fascinating examples shrouded in mystery and magic.
- Schaffer, Simon, "Babbage's dancer and the impresarios of mechanism", in Francis Spufford and Jenny Uglow, eds, *Cultural Babbage: technology, time and invention*. London: Faber and Faber 1996.
  Charles Babbage's early interest in automata; and the mysterious Mechanical Turk.
- Evans, Christopher, *The Mighty Micro*. London: Gollancz 1979, 139-151.
  This chapter on "Work and robots" should give you an indication of how automation and its relationship to the employment question were being presented to the public around 1980.

05A. The Manchester dimension

TUESDAY 3 MARCH

On 21 June 1948, the University of Manchester's Small Scale Experimental Machine ('Baby') exhibited the first-ever successful demonstration of stored-program processing; less than three years later the first Ferranti Mark 1, developed by the local engineering firm, was sold to the University and thus became the first commercially available computer in the world. These notable 'firsts' (see Week 3), and the pioneering research work done in Electrotechnics and subsequently in the Department of Computer Science (the earliest-established of its kind in the UK), have helped to keep afloat the technological reputation of Manchester, the one-time 'shock city' of the Industrial Revolution, which has been marginalised by the decline of manufacturing and the limited prestige offered to regional identity in British national culture.

This lecture gives an overview of Manchester has contributed to the history of the computer, and how the computer has contributed to the history of Manchester.

Required reading

- Napper, Brian, et al, Computer 50: the University of Manchester celebrates the birth of the modern computer. Online at <www.computer50.org>.
  Created for the 1998 anniversary of the SSEM's first successful run: includes information on personnel and equipment, plus details of the 1998 celebrations themselves.

Recommended background reading

- Williams, Michael R, *A History of Computing Technology*, 2nd edition. London: Wiley 1997. pp 304-346.

  Sets early Manchester developments in the broader context of British computing.

- Briggs, Asa, *Victorian Cities*, London: Odhams 1963. Chapter 3: "Manchester, symbol of a new age".

  Classic study of the nineteenth-century culture that defined Manchester in the eyes of the world.

- *IEEE Annals of the History of Computing* **15**:3 (1993), special issue on "Computing at the University of Manchester."

  For full details, see the JRUL print copy or the index available at the IEEE site (the full text is available for download.) Pieces include John Pickstone and Geof Bowker on Manchester computing's place in the industrial history of the area; Mary Croarken on the early Electro-Technics Department and the pre-history of Mancunian computers; and Simon Lavington's more technical account of computer architectures to 1975.

- "The Computer that Changed the World." CD-ROM. Europress Software 1998.

  Multimedia presentation including archive clips and interviews with participants. Copies are held by the course lecturer and many people associated with the Department/School of Computer Science.

Recommended museum exhibit

- The Manchester Baby rebuild (1998), Museum of Science and Industry, Castlefield, Manchester.

  Not the 1948 machine itself (which was adapted into the more powerful Mark 1, and later broken up for parts or abandoned), but a structurally faithful replica, using as close to original parts as possible, built for the fiftieth anniversary. See the Museum website at <www.mosi.org.uk> for times of guided demonstrations by volunteers.

05B. Inside Kilburn

THURSDAY 5 MARCH

The University of Manchester's Department (now School) of Computer Science was founded in 1964 as the first department in the UK to offer undergraduate degrees in the subject. Tom Kilburn (1921-2001) was its first head, and the University's main Computer Science building is named in honour of him. Starting with Kilburn's own recollections of his life and work, this seminar will look at some traces of Manchester's computing past inside the Kilburn Building itself.

Required reading

- Bowker, Geof, and Richard Giordano, "Interview with Tom Kilburn," *IEEE Annals of the History of Computing* **15** (1993) 17-31.

Seminar questions

- What are the biggest differences between Tom Kilburn's undergraduate/early career days and your own?
- Does Kilburn see himself as a mathematician, or an engineer? How do you know? How does this influence his picture of what computer science is all about?
- What does Kilburn focus on? What doesn't he discuss (compared to other accounts of early computing you have read)?
- What did the Mark 1 developers need to do in order to manage a successful computer service?

06A. Artificial intelligence

TUESDAY 10 MARCH

Early computers were designed to replace human mental effort, and the term 'giant brain' or 'electronic brain' was often applied, especially in the popular press — although many experts insisted that their machines' operations were very different from, and more limited than, those of the human brain.

Debates over the nature of 'brainlike' behaviour spawned 'Artificial Intelligence' as a vibrant area of academic activity, sitting somewhere between computer science, cognitive psychology and philosophy. Many researchers were, and still are, confident that sufficiently complex computer systems will ultimately learn to take on roles currently filled by thinking humans; in the past twenty to thirty years, however, a limited success record and a trenchant strain of criticism have led some to believe that AI, as currently understood, will never achieve its goals. There is also a view that the movement, if it *were* successful, would alter human society in unpredictable and perhaps very dangerous ways.

Required reading

- Crevier, Daniel, *AI: the tumultuous history of the search for artificial intelligence*. New York: Basic Books 1993, chapter 5: "Clouds on the AI horizon".

Recommended background reading

- Further chapters in Crevier 1993 (above)
- Pratt, Vernon, *Thinking Machines: the evolution of artificial intelligence*. Oxford: Blackwell 1987.

  Discusses the work of both Babbage and Turing, and the earlier ideas of the famed philosopher Gottfried Leibniz, in AI context.
- Minsky, Marvin, *The Society of Mind*. New York: Simon and Schuster 1986.

  Philosophical account by one of the most high-profile researchers who see AI as a probable future prospect.
- Dreyfus, Hubert, *What Computers Can't Do: the limits of artificial intelligence*, revised edition. London: Harper Colophon 1979.

  The most influential attack on the possibility of meaningfully "intelligent" machines.
- Martin, C Dianne, "The myth of the awesome thinking machine", *Communications of the ACM* **36** (1993), 121-133.

  Surveys popular ideas of early digital computers (discussed in earlier weeks) as 'brains' or 'robots'.
- Bloomfield, Brian, ed, *The Question of Artificial Intelligence*. London: Croom Helm 1987.

  Fairly advanced philosophical and sociological accounts by various authors. Includes Bloomfield's own piece on the culture of the AI community, and Harry Collins on "expert systems" and the possibility of mechanising skill and expertise.
- Roland, Alex, with Philip Shiman, *Strategic Computing: DARPA and the quest for machine intelligence*. Cambridge, Mass: MIT Press 2002.

  The US Department of Defense Advance Research Projects Agency spent a billion dollars trying to make AI happen in the 1980s. This book considers why they didn't manage it, and what they got instead.

06B. Does the computer think? Alan Turing and the Turing Test

THURSDAY 12 MARCH

One who became particularly interested in questions of 'brainlike' artificial behaviour was the mathematician Alan Turing (1912-1954), who had worked on codebreaking at Bletchley Park, and was appointed to a post in Manchester in 1948. In a classic 1950 paper, Turing tried to lay down rules as to when a machine should be accepted as demonstrating true intelligence, of the kind we recognise instantly in humans but find very difficult to define precisely.

Required reading

- Turing, Alan, "Computing Machinery and Intelligence," *Mind* **59** (1950) 433-460. Reprinted in various publications (see bibliography on Andrew Hodges' Turing site for details) and online in several places including <cogprints.ecs.soton.ac.uk/archive/00000499/00/turing.html>.

Seminar questions

- Look at Turing's description of the Turing Test. Do you agree with Turing that a machine that passes the test *must* be accepted as thinking, to the same degree that a human thinks?
- If not, what do you make of Turing's responses to possible objections?
- The Turing Test is an *operational* definition of intelligence: not a list of properties to look for, but a sequence of steps to take. Why did Turing think it was important to create an operational definition?
- What impression do you get of Turing as a communicator of scientific ideas?

Recommended background reading

- Hodges, Andrew, *Alan Turing: the Enigma.* London: Vintage 1992 (originally published 1983.)

  Definitive Turing biography. Too long and detailed for casual reading, but essential background for a Turing-based essay or project. Available cheaply in paperback. Useful sections to read, covering sex, intelligence, morphogenesis and Manchester, are pp372-455.

- Hodges, Andrew, *Alan Turing Website* at <www.turing.org.uk>.

  Online companion-piece to the biography, including useful additional material.

- Agar, Jon, *Turing and the Universal Machine: the making of the modern computer*. Cambridge: Icon 2001.

  Effective, fairly simple brief survey of major issues surrounding Turing, computability and universality, aimed at a general audience. Easily found in many bookstores.

- Copeland, B Jack, ed, *The Essential Turing*. Oxford: Clarendon 2004.

  An extensive collection of Turing's own writings (together with some material from various colleagues), spanning 1936-54 and so covering computability, the Bletchley Park years, automatic computing, artificial intelligence, morphogenesis and more. The editor adds a useful introduction to each source text, together with several analytical overview pieces.

Recommended video

- *Horizon:* "The Strange Life and Death of Dr Turing" (BBC2, 1992)

  At the time he was recruited to Manchester from the National Physical Laboratory in 1948, Alan Turing had behind him considerable achievements in computability theory, wartime cryptanalysis and the design of a computer. Ahead

of him lay equally significant work on the nature of artificial intelligence, investigations into the theory of biological form, and disgrace — which many hold responsible for his untimely death — at the hands of a society fundamentally out of line with his identity and beliefs. This BBC documentary gives a brief history of Turing's ideas, and outlines the controversy surrounding his demise.

07A. The software crisis

TUESDAY 17 MARCH

If, thirty years ago, you had asked a non-specialist to give an example of "a company in the computer business," the answer (if there was one) would probably have been "IBM" — or just maybe, in Britain, "ICL", a corporation similarly associated with the making, fitting and servicing of hardware.

If you asked the same question today, the answer would with equal probability be "Microsoft," a corporation founded in the mid-70s and always devoted almost exclusively to software. No longer is the hardware chosen first, and software commissioned to make use of it: today, software is the chief defining feature of any computer-based system's identity, and hardware decisions are determined by software requirements.

This lecture looks at the beginnings of the concept of software and the software industry, at operating systems and programming languages, in an attempt to understand this major shift in computing culture.

Required reading

- Campbell-Kelly and Aspray, chapter 8: "Software".

Recommended background reading

- Campbell-Kelly and Aspray, chapter 9
- Ceruzzi, Paul E, *A History of Modern Computing*, 2nd edition. Cambridge, Mass: MIT Press 2003. Chapter 3.
- Campbell-Kelly, Martin, From Airline Reservations to Sonic the Hedgehog: a history of the software industry. Cambridge, Mass: MIT 2003.

  Full-length history of software, mainly from a US perspective and focusing on business history. An earlier version of Chapter 8 — which usefully points out a recent tendency to exaggerate the role of Microsoft in recent software history — is available electronically:
- Campbell-Kelly, Martin, "Not Only Microsoft: the maturing of the personal computer software industry, 1982-1985," *Business History Review* **75** (2001) 103-145.
- "Anecdotes" on the Software History Center's website at <www.softwarehistory.org/history/anecdotes.html>.

  First-hand interviews with early software designers and producers. Note that people are not always the most impartial observers of their own histories; but reading first-hand accounts can give you a vivid idea of how the people involved saw their problems, responsibilities and opportunities.

07B. Essay skills

THURSDAY 19 MARCH

This class will give tips about researching and writing. We will discuss what makes a good or a bad essay.

Some sample essay writing will be distributed in advance. Your task, during the week before the class, is to 'mark' this work. You will suggest a mark, and give comments on a sheet similar to the one you will receive for your own essay later in the course. You should make notes on what seems to work well in the sample essays, what problems you find, and how you would correct them.

Books on research and essay-writing

- Dixon, Thomas, *How To Get A First.* London: Routledge 2004.
- Walliman, Nicholas, Your Undergraduate Dissertation: the Essential Guide for Success. London: Sage 2004.
- Barnet, Sylvan, et al, *A Short Guide to College Writing.* London: Longman 2004.
- Booth, Wayne, et al, *The Craft of Research*, 2nd edn. Chicago: University of Chicago Press 2003.
- Storey, William Kelleher, *Writing History: a guide for students*, 2nd edn. Oxford: Oxford University Press 2004.

08A. The computer in your home

TUESDAY 24 APRIL

In the era of big mainframes, computers existed in corporate space: a computer in the home would have seemed as out of place and impractical as a jumbo jet in the garage. The arrival of cheap microprocessors, however, coincided with a movement to 'democratise' computing power, and a new generation of mostly amateur enthusiasts began to seek computers of their very own. This lecture examines the new and dramatic phase in computer culture which unfolded as a result.

Required reading

- Haddon, Leslie, "The Home Computer: the making of a consumer electronic." *Science as Culture* **2** (1988) 7-51. At <www.manchester.ac.uk/library/texts/hstm20281/hstm20281_hadd.pdf> (use your standard University network username and password.)

Recommended background reading

- Campbell-Kelly and Aspray, chapter 10: "The Shaping of the Personal Computer"
- Ceruzzi, Paul E, *A History of Modern Computing*, 2nd edition. Cambridge, Mass: MIT Press 2003. Chapters 7 and 8.
- Campbell-Kelly, Martin, From Airline Reservations to Sonic the Hedgehog: a history of the software industry. Cambridge, Mass: MIT 2003. Chapters 8 and 9.
- Evans, Christopher, *The Mighty Micro*. London: Gollancz 1979.

  The book which alerted British public and policy-makers to the 'challenge of the chip.'
- Spufford, Francis, "Chapter 3: The Universe in a Bottle" in *Backroom Boys*. London: Faber 2003.

  Off-beat but fascinating story of the seminal space-trader game Elite, originated on the BBC Micro platform. Well worth reading to get an idea of the conditions in which early-80s programmers operated.
- Lindsay, Christina, "From the Shadows: Users as Designers, Producers, Marketers, Distributors and Technical Support", in Nelly Oudshoorn and Trevor Pinch, eds, *How Users Matter*. Cambridge, Mass: MIT Press, 2003, 29-50.

  The survival of an early personal-computing community (TRS-80), and the role of users in the development and representation of technologies

- Freiberger, Paul, and Michael Swaine *Fire in the Valley: the making of the personal computer.* London: McGraw-Hill 1999.

  Readable, dramatic popular account (beware occasional reporting of anecdote or legend as fact) focusing on US producers. Available electronically via NetLibrary.

- Hiltzik, Michael, Dealers of Lightning: Xerox PARC and the Dawn of the Computer Age. London: Orion 2000.

  The story of the institution whose staff created so many features of the modern graphical user interface.

Recommended video

- *The Dream Machine*, part 3: "The Paperback Computer" (1991)

  Covers the foundations of 'user-friendliness' and 'usability', the difference made by disposable integrated circuits, and several well-remembered individuals (Clive Sinclair, Steve Jobs) and machines (Altair 8800, Xerox Alto, the original Apple Mac…)

- *Horizon*: "Now the Chips are Down" (BBC2, 31 March 1978).

  The documentary which introduced many viewers to the microprocessor for the first time. Was also viewed, privately, by many policymakers. The presentation is in many ways negative, focusing on possible unemployment and the destruction of traditional industries — in sharp contrast to what came later.

08B. Playing games

THURSDAY 26 APRIL

A market report in late 2008 estimated that the videogame industry's annual earnings from sales had, for the first time, overtaken music and video combined in the UK. Yet computer games (not all of which are videogames) still seem to have a marginal role in society: beyond the occasional scare story, they are ignored by the media, while many IT professionals see them as a distraction.

Game-playing actually has a longstanding relationship with research at the forefront of computer science, sponsored by some exceedingly 'serious' clients — most notably the US military. Gamers and Cold Warriors alike were attracted to the latest in graphics, response processing, and AI simulation; but their hopes and cultures were often very different. Looking in particular at one of the first-ever videogames, this seminar explores how long-haired countercultural hackers first got hooked on making war.

Required reading

- Brand, Stewart, "Spacewar: Fanatic Life and Symbolic Death among the Computer Bums" Originally published in *Rolling Stone*, December 1972; online at <www.wheels.org/spacewar/stone/rolling_stone.html>.

Spacewar emulator

You can experience a faithful re-creation of Spacewar, running on a Java emulation of the PDP-1 minicomputer, at <spacewar.oversigma.com>.

Seminar questions

- Why *Spacewar*? Why were these early gamers attracted to life-or-death battle in a science-fiction environment?
- What were the aims of the "Counter-computer" movement? How much of their influence can you see in computer use today?
- How have computer games changed?

- "Spacewar serves Earthpeace." Do you agree?

Recommended background reading

- Herz, J C, *Joystick Nation*. London: Abacus 1997.
  Fast-paced, light but insightful survey of the cultural impact of videogames, from arcade to console.
- Kline, Stephen, Nick Dyer-Witheford and Greig de Peuter, *Digital Play: the interaction of technology, culture, and marketing*. Montreal: McGill-Queen's University Press 2003.
  Some questionable cultural/economic theory, but worth a look for its survey of the growth of the videogame concept from 1960 to around 2001.
- Montfort, Nick, *Twisty Little Passages: an approach to interactive fiction*. Cambridge, Mass: MIT Press 2003.
  Discusses interactive fiction and 'text adventure' games, a huge commercial phenomenon in the 1980s.
- Atkins, Barry, *More than a Game: the computer game as fictional form*. Manchester University Press 2003.
  Are 'realistic' computer games really like real life? No. This survey of four key games of the 1990s and early 2000s looks for the roots of gameplay experience in various fictional forms.
- Cassell, Justine, and Henry Jenkins, eds, *From Barbie to Mortal Kombat: Gender and Computer Games*. Cambridge, Mass: MIT Press 1998.
  Includes numerous interviews with designers, coders and gamers.
- Poole, Steven, *Trigger Happy: the inner life of videogames*. London: Fourth Estate 2000.
  Musings on the nature and influence of the videogame. Not very scholarly, but has been influential as one of the first book-length accounts to appear.
- Raessens, Joost, and Jeffrey Goldstein, eds, *Handbook of Computer Game Studies*. Cambridge, Mass: MIT Press 2005.
  Wide-ranging collection of essays, of varying quality, on the social content and effects of games (mostly videogames). Several pieces have a gender theory dimension.

Recommended video

- *Commercial Breaks:* "The Battle for Santa's Software" (BBC2, 13 December 1984).
  Business documentary. The film-makers set out to tell the story of the highly-successful Liverpool games company, Imagine, famous for tabloid headlines involving teenage "whiz-kid" programmers, fast cars and fortunes. The reality turned out to be very different…

09A. Hacker histories

TUESDAY 21 APRIL

We have looked at many aspects of the computer's development and place in the wider world: but what about those who operate computers? Even now that the computer is a familiar household object, there are still identifiable kinds of 'computer people,' who enjoy a mixed reputation in society. They are sometimes viewed as wizards, sometimes as dullards — but rarely as just 'ordinary.' Why is this? Have the 'boffins,' 'nerds' or 'code junkies' always been a breed apart?

In this lecture we begin to address this question by looking at the shifting meanings of the term 'hacking'. From college pranks, to obsessive or particularly ingenious interaction with the computer, to unauthorised remote access, hacks and hackers have been presented as socially useful, criminally destructive or plain weird — but always as

subversive. If 'computer people' are fascinated by rules, they are also fascinated by how to break them.

Required reading

- Levy, Steven, *Hackers: heroes of the computer revolution*, updated edition. London: Penguin 2001, Chapter 2: "The Hacker Ethic".

  Hackers is a well-known and colourful account of hacker activity (first published 1984), among the first to put hacking on the popular cultural map. Levy defines three waves of hackers: early minicomputer users at specialist (mostly university) facilities; the builders of the first user-owned microcomputers; and games software developers in the early 1980s. This chapter is Levy's take on the philosophy laid down by members of MIT's Tech Model Railway Club after they were introduced to the TX-0 minicomputer.

Recommended background reading

- Further chapters in Levy 2001
- Cringely, Robert X, *Accidental Empires: how the boys of Silicon Valley make their millions, battle foreign competition, and still can't get a date*. London: Penguin 1996.

  Informal, gossipy, very readable account of the US personal computer and software industry. Don't rely on it as an authoritative historical account; concentrate on how it portrays the people described — and how they themselves like to be portrayed.
- Turkle, Sherry, *The Second Self: computers and the human spirit*. New York: Simon and Schuster 1984, chapter 6: "Hackers: loving the machine for itself."

  Influential attempt to characterise the psychology and social relations of the serious hacker, with case studies from MIT.
- Himanen, Pekka, *The hacker ethic: a radical approach to the philosophy of business*. New York: Random House 2001.

  Social theory of hacker values, contrasted with the traditional ('Protestant') work ethic. Prologue by Linus Torvalds.
- Raymond, Eric, "The Jargon File". Online at <www.catb.org/jargon>.

  Guide to hacker language, with appendices charting some hacker folklore and (supposedly) typical hacker traits.
- Cornwall, Hugo [pseud, = Peter Sommer], *The Hacker's Handbook*, London: Century Communications 1985. Full text online at <www.textfiles.com/etext/MODERN/hhbk>.

  Hugely controversial in its day, the how-to manual which in Britain popularised the idea of the 'hacker' as a dangerous whizkid obsessed with breaking into computer systems.
- Peterson, T F, *Nightwork: a history of hacks and pranks at MIT*. Cambridge, Mass: MIT Press 2003.

  Why hacking is called hacking: the term's origins in elegant (non-computing) campus trickery.

09B.Geek mythology: women, men and computers

THURSDAY 23 APRIL

Carnegie Mellon University (alongside Stanford and MIT, one of the three famed centres of computer science innovation) underwent a surprising change in the late 1990s. In 1995, the percentage of women undergraduates entering the School of Computer Science was 7%. In 2000, it was 42%, an international record. The reforms which caused this change were largely based on a collaboration between Allan Fisher, a member of the Computer Science faculty, and Jane Margolis, a social scientist who conducted hundreds of hours of interviews on the positive and negative experience of female students.

This seminar looks at some of Margolis and Fisher's findings. Does the lack of women in most CS departments result from 'lack of interest' or pre-existing 'male dominance'? Or is there a more complicated explanation to be found in the obsessive behaviour of the 'typical' computer geek?

Required reading

- "Chapter 4: Geek Mythology" in Margolis, Jane, and Allan Fisher, *Unlocking the Clubhouse: women in computing*. Cambridge, Mass: MIT Press 2003. (Online via NetLibrary.)

Seminar questions

- What's familiar to you in the picture Margolis and Fisher paint of life in Computer Science at CMU? What's different?
- What is the "geek mythology paradox" (pp 67-68)?
- If Margolis and Fisher's explanation of the problem is correct, what changes need to be made to the way computer science is promoted and taught?
- Do you agree with their position?

Recommended background reading

- Further chapters in Margolis and Fisher 2003, especially Chapter 2 (on school-age computer users.)
- Light, Jennifer, "When computers were women," *Technology and Culture* **40** (1999) 455-483.

  Why did women engineers and programmers disappear from the historical record of the ENIAC?
- Abbate, Janet, ed, special issue on "Women and Gender in the History of Computing." *IEEE Annals of the History of Computing* **25**:4 (2003).

  A range of approaches to diverse cases in the nineteenth and twentieth centuries, including some first-hand memoirs of women computer users.

10A. Internet connections

TUESDAY 28 APRIL

The communication systems which make up the internet (or is it 'Internet'?), and in particular the World Wide Web, have been the hottest, most widely-debated feature of computing culture in recent years — a fact few would have predicted even in 1990. This lecture ties together the military origins of distributed communication networks, the idealism of early hypertext enthusiasts, and big-business responses to the promise of worldwide, instantaneous and (partly) anonymous transactions, to explain how the public internet evolved.

Required reading

- Haigh, Thomas, "Protocols for profit: web and e-mail technologies as product and infrastructure" in William Aspray and Paul Ceruzzi, eds, *The Internet and American Business*. Cambridge, Mass: MIT Press 2008. Draft version (suitable for use) free online at <tomandmaria.com/Tom/Writing/ProtocolsForProfitDRAFT.pdf>.

Recommended background reading

- Further chapters in Aspray and Ceruzzi 2008.

  This is the only good broad survey so far of the commercial use, rather than the initial production of Internet technology: it's part history, part policy study. See in particular Haigh's second chapter, on search engines and portals; Campbell-Kelly and Garcia-Swartz on computer utility/software-as-service; and Aspray on filesharing and the music industry.
- Campbell-Kelly and Aspray, chapter 12
- Ceruzzi, Paul E, *A History of Modern Computing*, 2nd edition. Cambridge, Mass: MIT Press 2003, chapter 10.
- Abbate, Janet, *Inventing the Internet*. Cambridge, Mass: MIT Press 1999.

  Comprehensive history of ARPAnet (the internet's precursor), from the early Cold War context which created it to the emergence of the commercial internet and the birth of the Web.
- Russell, Andrew L, "'Rough Consensus and Running Code' and the Internet-OSI Standards War", *IEEE Annals of History of Computing* **28**:3 (2006), 48-61.

  The battle between 'bottom-up' and 'top-down' visions of network planning.
- Frana, Philip L, "Before the Web there was Gopher," *IEEE Annals of History of Computing* **26**:1 (2004) 20-41.

  Useful not only as a description of the vanished Gopher system (flourished 1991-4), but for its depiction of a time when the World Wide Web was neither the only, nor the most obvious, model of internet use.
- Nelson, Ted, "Xanalogical Structure, Needed Now More than Ever" (1999) Online at <doi.acm.org/10.1145/345966.346033>

  Recent specification from the hypertext pioneer, which sets the WWW model in interesting context…
- Luke, Timothy, "Cyberspace as Meta-Nation: The Net Effects of Online E-Publicanism," *Alternatives* **26** (2001) 113-142.

  Questions whether the rise of electronic communication systems promises 'freedom' for all.

Recommended video

- *The Net* (BBC2, 1994).

  Since around 1990, 'educational' TV documentary programming on computers has been rare: to most audiences, computer technology is ordinary and familiar now. An exception was the mid-90s bubble of interest around the as-yet unfamiliar internet and World-Wide Web. The BBC's final (to date) computer magazine show covered IT issues more broadly, but — as the title suggests — took internet culture as a defining theme.

10B. Identity online

THURSDAY 30 APRIL

The growth of online traffic has not only changed the world commercially. 'Internet living' create new ambiguities in the lives, aspirations and even selves of computer users. Shielded by their terminals, users have been experimenting with different identities since well before the arrival of the public internet. Here we will look at a classic study of a text-based role-playing gamer community which tackles the thorny issue of the online gender-swap.

Required reading

- Turkle, Sherry, *Life on the Screen: identity in the age of the internet*. London: Phoenix 1997, chapter 8: "TinySex and Gender Trouble". At <www.manchester.ac.uk/library/texts/hstm20281/hstm20281_turk.pdf> (use your standard University network username and password.)

Seminar questions

- What's the appeal of adopting an alternative identity (specifically, of a different gender) online?
- What differences do you notice between the ways people behave online — for instance, on social networking sites — and in real life?
- Why do we automatically use 'in real life' to mean 'not on a computer'? Are online activities and identities less real?

Recommended background reading

- Wajcman, Judy, *TechnoFeminism*. Oxford: Polity 2004.
  Chapter 3 is a relatively accessible introduction to the wider issues in gender theory which inform discussion of 'online' or 'virtual' identities.
- Nakamura, Lisa, *Cybertypes: race, ethnicity, and identity on the internet*. New York: Routledge 2002.
  The groundswell of 1990s literature on online identity focused heavily on gender issues; Nakamura raises comparable questions of racial identity online.
- Plus your own experience of blogs, social networking sites, user-generated videos, product reviews, "Wikipedia, the free encyclopedia that anyone can edit"…

11A. Conclusion

TUESDAY 5 MAY

This session will look back over the course and forward to the exam, tying together the various themes, and help you to consider what you have got out of it. There will also be an opportunity to raise any questions and suggestions you may have about the course content.

11B. Exam skills

THURSDAY 7 MAY

This final session will provide advice on how to tackle the exam.

If you enjoy this course and would like to continue with study in this area at postgraduate level, CHSTM runs a Masters and doctoral programme.

The Centre for the History of Science, Technology and Medicine (CHSTM) is a major international focus for research in the history of modern science, technology and medicine. It includes the Wellcome Unit for the History of Medicine and the UK National Archive for the History of Computing. The interests of Centre staff lie predominantly in 19th and 20th century history, mostly in Britain, Europe and the USA, but also including STM in developing countries. The department is small and informal, with a lively postgraduate community, and strong formal and informal seminar programmes.

MSc programme

This programme allows students to gain one of five awards

MSc History of Science, Technology and Medicine

MSc History of Science and Technology

MSc History of Medicine

MSc Science Communication

MSc Research Methods in the History of Science, Technology and Medicine

All students take common core set units in Semester 1 and then choose from a range of options in Semester 2: the balance of these options and the topic of the dissertation determine the MSc awarded. Available options are:

Nineteenth-century Physical Sciences and Technology

Nineteenth-century Biosciences and Medicine

Science Communication

Twentieth-century Physical Sciences and Technology

Twentieth-century Biosciences and Medicine

Science, Nature, Museums

Research degrees: PhD/MPhil

Two research degrees are offered: PhD (3 years full-time, 6 years part-time) and MPhil (1 year full-time, 2 years part-time). The MPhil can be regarded as a preparatory degree for the PhD, or as a free-standing research Master's. We expect PhD applicants to have a strong background in HSTM (e.g. a good MSc in the subject, or considerable exposure to HSTM at undergraduate level).

Full details of all CHSTM's activities and courses can be found at

www.manchester.ac.uk/chstm

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