

Course Syllabus

Bernard Dionysius Geoghegan

Programming as a Cultural Technique

Advanced Undergraduate or Graduate Level-Course

Course Description

Programming undergirds an ever-wider array of our cultural, economic, and political infrastructures. Global finance, electrical power grids, the internet, culture industries, and biomedicine are among the spheres whose everyday procedures depend on computer programs. Yet it was not until the 1980s that engineers and cultural theorists began seriously asking how programming relates to human culture. Early accounts—such as those of Ben Schneiderman and Friedrich Kittler—posited a strong opposition between the logical operations of computer programs and the phenomenological world of human perception. More recent studies in the history of technology, software studies, and critical code studies suggest coextensive and interwoven relations between programming and human culture. This course will offer an introduction to that literature and review seminal reflections by cultural theorists and programmers on what it means “to program.” We will also ask whether programming may be understood as a cultural technique [*Kulturtechnik*], in the sense given to that term recently by Germanophone media theorists. Topics to be discussed include the ontology of computer code, the interrelations among programming and gender, and the place of software in contemporary political economy.

The course will meet twice a week: Once in the classroom for lectures and discussion, and again in the computer laboratory for instruction in Perl programming. At the end of the semester students have the option of writing a 10-15 page paper or writing a program in Perl.

Learning Goals

Students will become familiar with major topics and themes in recent research on the cultural history and critical theory of programming, critical, software, and cultural techniques. Students will leave the class with the ability to write basic programs in Perl. In-class presentations and discussions, as well as weekly writing responses, will develop students' skills in oral presentation, writing, and analysis.

Required Texts

- ♣ Schwartz, Randal L., Brian D. Foy, and Tom Christiansen. *Learning Perl*, O'Reilly. USA: O'Reilly, 2011.
- ♣ All other required texts available as PDF on Moodle/Blackboard.

Note: Supplementary texts may be used for in-class presentations or final papers but are not required reading. Supplementary readings that are not online can be obtained directly from the professor.

Required Materials

- ♣ A laptop computer with Perl programming capability must be brought to all courses. Instructions on installation of Perl will be provided in the first session.

Evaluation

Class Participation 25% of final grade

Class Presentation 25% of final grade

Final Paper or Program: 50% of final grade

Class Participation

- ⤴ Students are expected to attend class regularly and contribute to class discussions. Failure to do so will negatively effect your grade. Students are required to submit short responses (500 words) to the readings before class on Moodle/Blackboard. Regular and thoughtful contributions to the online forums may serve as a substitute for in-class discussion.

Class Presentation:

- ⤴ During the course of the semester students will prepare one class presentation based on ***a selection*** from the week's supplementary readings. The presentation should be around 15 minutes long, with a brief introduction to the week's main readings followed by a longer discussion of how the secondary texts contextualize and complicate the main readings. The creative and instructive use of visual media or handouts is encouraged. Students with relevant personal or professional experiences (e.g. with digital art, working in social media, etc.) are welcome (and encouraged!) to incorporate that knowledge into their presentations. Students are encouraged to consult with the professor during office hours for help preparing their presentations.

Final Paper or Program:

- ⤴ At the end of the term students may write a research paper of ten to fifteen pages that deals with topics and texts treated in the course lectures. Students are also welcome to write a program for their final assignment. All students are required to prepare a short one-page proposal describing their final project, and discuss it with the professor, three weeks before the final class meeting.

Students with Disabilities

The professor is available to discuss appropriate academic accommodations that you may require as a student with a disability. Request for academic accommodations need to be made during the first week of the semester, except for unusual circumstances, so arrangements can be made.

Academic Integrity

Students are expected to comply with university regulations regarding academic integrity. If you are in doubt about what constitutes academic dishonesty, speak to the instructor before the assignment is due. Failure to maintain academic integrity on an assignment will result in a loss of credit for that assignment – at a minimum. Other penalties may also apply.

Sexual Harassment Policy

No member of the course of the university community – students, faculty, administrators, or staff - may sexually harass any other member of the community. Individuals should contact the professor, dean, or university administrators if they have questions or concerns regarding sexual harassment.

Course Schedule

[weekly sessions in the computer lab not listed]

Introduction: Is Programming a Cultural Technique?

Readings:

- ▲ Geoghegan, Bernard Dionysius. “The Culture and Technique of Kulturtechnik.” *Theory, Culture & Society*. [forthcoming]
- ▲ Krämer, Sybille. “The Cultural Techniques of Time Axis Manipulation: On Friedrich Kittler’s Conception of Media.” *Theory, Culture & Society* 23, no. 7/8 (December 2006): 93–109.
- ▲ Siegert, Bernhard. “Cacography or Communication? Cultural Techniques in German Media Studies.” *Grey Room* 29, no. Winter 2008 (2007): 26–47.
- ▲ Siegert, Bernhard. “The Map Is the Territory.” *Radical Philosophy*, no. 169 (October 2011): 13–16.

Supplementary Readings:

- ▲ Krämer, Sybille, and Horst Bredekamp. “Kultur, Technik, Kulturtechnik: Wider Die Diskursivierung Der Kultur.” In *Bild, Schrift, Zahl*, edited by Sybille Krämer and Horst Bredekamp, 11–22. Munich: Wilhelm Fink, 2008.
- ▲ Macho, Thomas. “Zeit Und Zahl: Kalender- Und Zeitrechnung Als Kulturtechniken.” In *Bild, Schrift, Zahl*, edited by Sybille Krämer and Horst Bredekamp, 179–192. Munich: Wilhelm Fink, 2008.
- ▲ Maye, Harun. “Was Ist Eine Kulturtechnik?” *Zeitschrift Für Medien- Und Kulturforschung*, no. 1 (2010): 121–137.
- ▲ Schüttpelz, Erhard. “Die Medienanthropologische Kehre Der Kulturtechniken.” *Archiv Für Mediengeschichte* (2006): 87–110.
- ▲ Siegert, Bernhard. “Kulturtechnik.” In *Einführung in Die Kulturwissenschaft*, edited by Harun Maye and Leander Scholz, 95–118. Munich: UTB, 2007.

What is Software Studies?

Readings:

- ▲ Dijkstra, Edsger W. “The Humble Programmer.” *Commun. ACM* 15, no. 10 (October 1972): 859–866.
- ▲ Fuller, Matthew, ed. “Introduction.” In *Software Studies: A Lexicon*, 1–14. USA: The MIT Press, 2008.
- ▲ Chun, Wendy Hui Kyong. “On Software, or the Persistence of Visual Knowledge.” *Grey Room* (January 2004): 26–51.
- ▲ Manovich, Lev. *Software Takes Control*. “[Introduction and Chapter 1.]” [online at www.softwarestudies.com].
- ▲ Cox, Geoff, and Adrian Ward. “Perl.” In *Software Studies: A Lexicon*, edited by Matthew Fuller, 207–213. The MIT Press, 2008.

Supplementary Readings:

- ▲ Fuller, Matthew. *Behind the Blip: Essays on the Culture of Software*. New York: Autonomedia, 2003.
- ▲ Galloway, Alexander R. “Language Wants To Be Overlooked: On Software and Ideology.” *Journal of Visual Culture* 5, no. 3 (December 1, 2006): 315–331.

- ⤴ Kirschenbaum, Matthew G. “Virtuality and VRML: Software Studies After Manovich.” *Electronic Book Review* (August 8, 2003).
<http://www.electronicbookreview.com/thread/technocapitalism/morememory>.
- ⤴ Manovich, Lev. *Software Takes Control*. [online at www.softwarestudies.com]

What is Code?

Readings:

- ⤴ Kittler, Friedrich. “Code.” In *Software Studies: A Lexicon*, edited by Matthew Fuller, 40–47. USA: The MIT Press, 2008.
- ⤴ Marino, Mark. “Critical Code Studies.” *Electronic Book Review* (September 4, 2006).
<http://www.electronicbookreview.com/thread/electropoetics/codology/>.
- ⤴ Chun, Wendy Hui Kyong. “On Sourcery and Source Codes [Chapter 1].” In *Programmed Visions: Software and Memory*. Cambridge: MIT Press, 2011.

Supplementary Readings:

- ⤴ Cayley, John. “The Code Is Not the Text (unless It Is the Text)” (September 10, 2002).
<http://www.electronicbookreview.com/thread/electropoetics/literal>.
- ⤴ Chun, Wendy. *Programmed Visions: Software and Memory*. Cambridge: MIT Press, 2011.
- ⤴ Mackenzie, Adrian. “The Problem of Computer Code: Leviathan or Common Power?”
<http://www.lancs.ac.uk/staff/mackenza/papers/code-leviathan.pdf>.

Software vs. Hardware

Readings:

- ⤴ Kay, Alan. “Computer Software.” *Scientific American* 251, no. 3 (September 1984): 52–59.
- ⤴ Kittler, Friedrich A. “There Is No Software.” In *Literature, Media, Information Systems*, edited by John Johnston, 147–155. Amsterdam: G+B Arts International, 1997.
- ⤴ Manovich, Lev. “There Is Only Software”
http://www.manovich.net/DOCS/Manovich.there_is_only_software.pdf

Supplementary Readings:

- ⤴ Kittler, Friedrich A. “Hardware, Das Unbekannte Wesen.” In *Medien, Computer, Realität: Wirklichkeitsvorstellungen Und Neue Medien*, edited by Sybille Krämer, 118–132. Suhrkamp, 1998. <http://hydra.humanities.uci.edu/kittler/hardware.html>.
- ⤴ Montfort, Nick, and Ian Bogost. *Racing the Beam: The Atari Video Computer System*. Cambridge, Mass: MIT Press, 2009.

Preprogramming: From Leibniz to Babbage

Readings:

- ▲ Williams, Michael R., and Allan G. Bromley. "Early Calculation [Excerpt from ch. 1] and Difference and Analytical Engines [Ch 2]." In *Computing Before Computers*, edited by William Aspray, 34–96. Ames: Iowa State University Press, 1990.
- ▲ Leibniz, Gottfried Wilhelm. "Explication De L'arithmetique Binaire, Que Se Sert Seul Caractères 0 & 1; Avec Des Remarques Sur Son Utilité, & Sur Ce Qu'elle Donne Le Sens Des Anciennes Figures Chinoises De Fohy." In *Histoire De L'Academie Royale Des Sciences*, 85–89. Paris: Chez Charles-Etienne Hochereau, 1720. [In English: <http://www.leibniz-translations.com/binary.htm>.]

Supplementary Readings:

- ▲ Ernst, Wolfgang. "Barocke Kombinatorik Als Theorie-Maschine" (2003). www.medienwissenschaft.hu-berlin.de.
- ▲ Goldstine, Herman H. "A Brief History of the Computer." *Proceedings of the American Philosophical Society* 121, no. 5 (October 17, 1977): 339–345.
- ▲ Hochstetter, Erich, Hermann-Josef Greve, Heinz Gumin, and Gottfried Wilhelm Leibniz. *Herrn Von Leibniz' Rechnung Mit Null Und Eins*. Berlin: Siemens Aktiengesellschaft, 1966.
- ▲ Knuth, Donald Ervin. "Positional Number Systems." In *The Art of Computer Programming*, 179–198. Addison-Wesley Series in Computer Science and Information Processing. Reading: Addison-Wesley Publishing Company, 1981.
- ▲ Wiener, Norbert. "Introduction" in *Cybernetics: Or, Control and Communication in the Animal and the Machine*. Cambridge: MIT Press, 1948.
- ▲ Wiener, Norbert. "Time, Communication, and the Nervous System." *Annals of the New York Academy of Sciences* 50, no. 4 (1948): 197–220.

Babbage's Bodies: Gender and Labor in the Difference Engine

Readings:

- ▲ Babbage, Charles. "[Chapters 1-3]" in *Babbage's Calculating Engines: Being a Collection of Papers Relating to Them, Their History and Construction*. Edited by Henry Prevost Babbage. London: E. and F.N. Spon, 1889.
- ▲ Plant, Sadie. "[Excerpts on Ada Lovelace]." In *Zeroes and Ones: Digital Women and the New Technoculture*, 3–23, 74–81. London: Fourth Estate, 1997.
- ▲ Schaffer, Simon. "Babbage's Intelligence: Calculating Engines and the Factory System." *Critical Inquiry* 21, no. 1 (October 1, 1994): 203–227.

Supplementary Readings:

- ▲ Babbage, Charles. "On the Division of Mental Labor [Ch. 6]." In *On the Economy of Machinery and Manufactures*. London: C. Knight, 1832.
- ▲ Babbage, Charles. *Babbage's Calculating Engines: Being a Collection of Papers Relating to Them, Their History and Construction*. Edited by Henry Prevost Babbage. London: E. and F.N. Spon, 1889.
- ▲ Krajewski, Markus. *Der Diener: Mediengeschichte Einer Figur Zwischen König Und Klient*. Frankfurt am Main: S. Fischer, 2010.
- ▲ Shannon, Claude E. "Computers and Automata." *Proceedings of the London Mathematical Society* 10 (October 1953): 1234–1241.

- ♣ Siegel, Greg. “Babbage’s Apparatus: Toward an Archaeology of the Black Box.” *Grey Room* (July 2007): 30–55.

What is Programming?

Readings:

- ♣ Chun, Wendy Hui Kyong. “Programmability.” In *Software Studies: A Lexicon*, edited by Matthew Fuller, 224–229. USA: The MIT Press, 2008.
- ♣ Iverson, Kenneth E. “Notation as a Tool of Thought.” *Commun. ACM* 23, no. 8 (August 1980): 444–465.
- ♣ Ensmenger, Nathan L. “[Chapters 1-2].” *The Computer Boys Take Over: Computers, Programmers, and the Politics of Technical Expertise*. Cambridge: The MIT Press, 2010.

Supplementary Readings:

- ♣ Campbell-Kelly, Martin. *From Airline Reservations to Sonic the Hedgehog: A History of the Software Industry*. Cambridge: MIT Press, 2003.
- ♣ Ensmenger, Nathan L. *The Computer Boys Take Over: Computers, Programmers, and the Politics of Technical Expertise*. Cambridge: The MIT Press, 2010.
- ♣ Krajewski, Markus. “Die Kaffeemaschine. Zur Handelsmächtigen Metaphorik der Programmiersprache JAVA.” *Österreichische Zeitschrift Für Geschichtswissenschaften* 13, no. 3 (n.d.): 87–103.
- ♣ Penny, Simon. “Virtual Reality as the Completion of the Enlightenment Project.” In *Culture on the Brink: Ideologies of Technology*, edited by Gretchen Bender and Timothy Druckrey, 231–248. *Discussions in Contemporary Culture*, 1047-6806 ; No. 9. Seattle: Bay Press, 1994.

What is a Database?

Readings:

- ♣ Bachman, Charles W. “The Programmer as Navigator.” *Commun. ACM* 16, no. 11 (November 1973): 653–658.
- ♣ Manovich, Lev. “Database as Symbolic Form.” In *The Language of New Media*. Cambridge: MIT Press, 2001.
- ♣ Bowker, Geoffrey C. [“Chapter 3”]. *Memory Practices in the Sciences*. Cambridge: MIT Press, 2005.

Supplementary Readings:

- ♣ Bowker, Geoffrey C. *Memory Practices in the Sciences*. Cambridge: MIT Press, 2005.
- ♣ Rheinberger, Hans-Jörg. “Wie Werden Aus Spuren Daten, Wie Verhalten Sich Daten Zu Fakten?” *Nach Feierabend. Zürcher Jahrbuch Für Wissensgeschichte* 3 (2003): 117–125.

What is an Interface?

Readings:

- ▲ Sutherland, Ivan E. "Sketchpad: A Man-Machine Graphical Communication System." *American Federation of Information Processing Societies Conference Proceedings* 23 (1963): 329–246.
- ▲ Schneiderman, Ben. "Direct Manipulation: A Step Beyond Programming Languages." In *The New Media Reader*, edited by Noah Wardrip-Fruin and Nick Montfort, 485–494. Cambridge: MIT Press, 2003.
- ▲ Cassell, Justine. "Embodied Conversational Agents: Representation and Intelligence in User Interface." *AI Magazine* 22, no. 3 (2001): 67–83.
- ▲ Galloway, Alexander R. "The Unworkable Interface." *New Literary History* 39, no. 4 (2008): 931–955.

Supplementary Readings:

- ▲ Coleman, Beth. *Hello Avatar: Rise of the Networked Generation*. Cambridge: MIT Press, 2011.
- ▲ Coy, Wolfgang, and Claus Pias. *PowerPoint. Macht Und Einfluss Eines Präsentationsprogramms*. Frankfurt am Main: Fisher-Taschenbuch, 2009.
- ▲ Licklider, J.C.R. "Man-Computer Symbiosis." *IRE Transactions on Human Factors in Electronics* HFE-1 (March 1960): 4–11.
- ▲ Penny, Simon. "Representation, Enaction, and the Ethics of Simulation." *Electronic Book Review*, 26 June 2004.
<http://www.electronicbookreview.com/thread/firstperson/machanimate>.

Can Programs Think?

Readings:

- ▲ Turing, Alan. "Intelligent Machinery." edited by B. Jack Copeland, 410–432. *The Essential Turing*. Oxford: Clarendon Press.
- ▲ Naur, Peter. "Computing Versus Human Thinking." *Commun. ACM* 50, no. 1 (January 2007): 85–94.
- ▲ Plant, Sadie. "[Excerpts on AI]." In *Zeroes and Ones: Digital Women and the New Technoculture*, 90–109. London: Fourth Estate, 1997.

Supplementary Readings:

- ▲ Dreyfus, Hubert. *What Computers Can't Do: The Limits of Artificial Intelligence*. New York: Harper & Row, 1979.
- ▲ Hayles, N. Katherine. "Traumas of Code." *Critical Inquiry* 33, no. 1 (2006): 136–157.
- ▲ Kelty, Christopher M. "Logical Instruments: Regular Expressions, AI and Thinking About Thinking" (2008). www.kelty.org.
- ▲ MacKay, D. M. "Mind-Like Behaviour in Artefacts." *British Journal for the Philosophy of Science* 3, no. 12 (1953): 352–353.
- ▲ Newell, Allen, and Herbert Simon. "GPS, A Program That Simulates Human Thought." edited by Edward A Feigenbaum and Julian Feldman, 279–293. Pias, Claus. *Computer Spiel Welten*. Berlin: Diaphanes, 2002.
- ▲ Searle, John R. "Minds, Brains, and Programs." *Behavioral and Brain Sciences* 3, no. 03 (1980): 417–424.

- ♣ Shannon, Claude. “A Chess-Playing Machine.” *Scientific American* 182, no. 2 (1950): 48–51.

Political Economies of Code

Readings:

- ♣ Berry, David. “The Relevance of Understanding Code to International Political Economy.” *International Politics* 49, no. 2 (2012): 277–296.
- ♣ Lyotard, Jean-Francois. “[Excerpts]” in *The Postmodern Condition: A Report on Knowledge*. Translated by Geoffrey Bennington and Brian Massumi. Minneapolis: University of Minnesota Press, 1984.
- ♣ Mackenzie, Adrian. “Internationalization.” In *Software Studies: A Lexicon*, edited by Matthew Fuller. The MIT Press, 2008.

Supplementary Readings:

- ♣ Guattari, Félix, and Gilles Deleuze. *Anti-Oedipus: Capitalism and Schizophrenia*. Translated by Robert Hurley. New York: Viking Press, 1977.
- ♣ Jameson, Fredric. *Postmodernism, or, The Cultural Logic of Late Capitalism*. Durham: Duke University Press, 1991.
- ♣ MacKenzie, Adrian. “How to Make Money in Microseconds.” *London Review of Books* 33, no. 10 (May 19, 2011): 16–18. <http://www.lrb.co.uk/v33/n10/donald-mackenzie/how-to-make-money-in-microseconds>

Gender and Programming (14.1.13)

Readings:

- ♣ Light, Jennifer S. “When Computers Were Women.” *Technology and Culture* 40, no. 3 (1999): 455–483.
- ♣ Turing, A. M. “Computing Machinery and Intelligence.” *Mind* 59, no. 236 (1950): 433–460.
- ♣ Hayles, N. Katherine. “Prologue” in *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*. Chicago: University of Chicago Press, 1999.

Supplementary Readings:

- ♣ Hayles, N. Katherine. *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*. Chicago: University of Chicago Press, 1999.
- ♣ Hopper, Grace Murray. “The Education of a Computer.” In *Proceedings of the 1952 ACM National Meeting (Pittsburgh)*, 243–249. ACM ’52. New York, NY, USA: ACM, 1952. <http://doi.acm.org/10.1145/609784.609818>.

Aesthetics of Code

Readings:

- ⤴ Dijkstra, Edsger W. “Letters to the Editor: Go to Statement Considered Harmful.” *Communications of the ACM* 11, no. 3 (March 1968): 147–148.
- ⤴ Fuller, Matthew. “Elegance.” In *Software Studies: A Lexicon*, edited by Matthew Fuller. The MIT Press, 2008.
- ⤴ Knuth, Donald E. “Computer Programming as an Art.” *Commun. ACM* 17, no. 12 (December 1974): 667–673.
- ⤴ Hayles, Katherine N. “Print Is Flat, Code Is Deep: The Importance of Media-Specific Analysis.” *Poetics Today* 25, no. 1 (March 20, 2004): 67–90.
- ⤴ Marino, Mark. “The Ppg256 Perl Primer: The Poetry of Techneculture.” *Emerging Language Practices* 1, no. 1. <http://epc.buffalo.edu/ezones/elp/issue-1/ppg256.php>

Supplementary Readings:

- ⤴ Molzberger, Peter. “Und Programmieren Ist Doch Eine Kunst.” In *Psychologische Aspekte Der Software Entwicklung*, edited by H. Schelle and P. Molzberger. Munich: Oldenbourg, 1983.

Cultures of Coding

Readings:

- ⤴ Stallman, Richard. “The GNU Manifesto” [English: <http://www.gnu.org/gnu/manifesto.html>]
- ⤴ Coleman, Gabriella. “The Political Agnosticism of Free and Open Source Software and the Inadvertent Politics of Contrast.” *Anthropological Quarterly* 77, no. 3 (2004): 507–519.
- ⤴ Takhteyev, Yuri. “[Introduction, Ch. 1, Ch. 2]” in *Coding Places: Software Practice in a South American City*. The MIT Press, 2012.

Supplementary Readings:

- ⤴ Berry, David M. *Copy, Rip, Burn: The Politics of Copyleft and Open Source*. London: Pluto Press, 2008.
- ⤴ Mackenzie, Adrian. “The Performativity of Code Software and Cultures of Circulation.” *Theory, Culture & Society* 22, no. 1 (February 1, 2005): 71–92.
- ⤴ Kelty, Christopher M. *Two Bits: The Cultural Significance of Free Software*. Durham, NC: Duke University Press, 2008.

What is Computer Literacy?

Readings:

- ⤴ Ershov, Andrei P. “Aesthetics and the Human Factor in Programming.” *Commun. ACM* 15, no. 7 (July 1972): 501–505.
- ⤴ Thompson, Ken. “Reflections on Trusting Trust.” *Commun. ACM* 27, no. 8 (August 1984): 761–763.

Supplementary Reading:

- ⤴ Knuth, D. E. “Literate Programming.” *The Computer Journal* 27, no. 2 (January 1, 1984): 97–111.

Additional References:

- Agar, Jon. *The Government Machine : a Revolutionary History of the Computer*. History of Computing. Cambridge, Mass.: MIT Press, 2003.
- Amadae, S. M. *Rationalizing Capitalist Democracy: The Cold War Origins of Rational Choice Liberalism*. Chicago: The University Of Chicago Press, 2003.
- Amelunxen, Hubertus von, Martin Warnke, Wolfgang Coy, and Georg Christoph Tholen. *HyperKult: Geschichte, Theorie Und Kontext Digitaler Medien*. Basel: Stroemfeld, 1997.
- Bardini, Thierry. *Bootstrapping: Douglas Engelbart, Coevolution, and the Origins of Personal Computing*. Stanford: Stanford University Press, 2000.
- Bergin, Thomas J., and Richard G. Gibson, eds. *History of Programming languages—II*. New York, NY, USA: ACM, 1996.
- Berry, David M. *The Philosophy of Software: Code and Mediation in the Digital Age*. New York: Palgrave Macmillan, 2011.
- Bogost, Ian. *How to Do Things with Videogames*. Electronic Mediations. Minneapolis: University of Minnesota Press, 2011.
- . *Unit Operations: An Approach to Videogame Criticism*. Cambridge: MIT Press, 2006.
- Campbell-Kelly, M. “The History of the History of Software.” *Annals of the History of Computing, IEEE* 29, no. 4 (December 2007): 40–51.
- Capretz, Luiz Fernando. “A Brief History of the Object-oriented Approach.” *SIGSOFT: Software Engineering Notes* 28.2 (March 2003): 1–10.
- Coleman, E. Gabriella. “Ethnographic Approaches to Digital Media.” *Annual Review of Anthropology* 39, no. 1 (2010): 487–505.
- Coleman, E. Gabriella, and Alex Golub. “Hacker Practice Moral Genres and the Cultural Articulation of Liberalism.” *Anthropological Theory* 8, no. 3 (September 1, 2008): 255–277.
- Coleman, E. Gabriella. *The Social Construction of Freedom in Free and Open Source Software: Hackers, Ethics, and the Liberal Tradition [dissertation]*. Chicago: University of Chicago, 2005.
- Coleman, Gabriella. “CODE IS SPEECH: Legal Tinkering, Expertise, and Protest Among Free and Open Source Software Developers.” *Cultural Anthropology* 24, no. 3 (2009): 420–454.
- Collins, Harry M. *Artificial Experts: Social Knowledge and Intelligent Machines*. Cambridge: The MIT Press, 1992.
- Coy, Wolfgang, Martin Warnke, and Georg Christoph Tholen. *HyperKult II: Zur Ortsbestimmung Analoger Und Digitaler Medien*. Bielefeld: Transcript, 2005.
- Dreyfus, Hubert. *Alchemy and Artificial Intelligence*. Rand Corporation, 1965.
www.rand.org/pubs/papers/2006/P3244.pdf.
- Dreyfus, Hubert L. “Response to Collins, Artificial Experts.” *Social Studies of Science* 22, no. 4 (1992): 717–726.
- Fuller, Matthew, ed. *Software Studies: A Lexicon*. USA: The MIT Press, 2008.
- Godfrey, M. D., and D. F. Hendry. “The Computer as Von Neumann Planned It.” *IEEE Annals on the History of Computing* 15, no. 1 (January 1993): 11–21.
- Golumbia, David. *The Cultural Logic of Computation*. Cambridge: Harvard University Press, 2009.
- Grier, David Alan. *When Computers Were Human*. Princeton: Princeton University Press, 2007.
- Hagen, Wolfgang. “Der Stil Der Sourcen: Anmerkungen Zur Theorie Und Geschichte Der Programmiersprachen.” In *Hyperkult*, edited by Wolfgang Coy, Christoph Tholen, and R. Warnke. Basel: Stroemfeld, 1997.
- Haigh, T. “Software in the 1960s as Concept, Service, and Product.” *Annals of the History of Computing, IEEE* 24, no. 1 (March 2002): 5–13.
- Hansen, Mark B. N. *Bodies in Code: Interfaces with Digital Media*. Routledge, 2006.
- Haraway, Donna. “A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s.” In *The Haraway Reader*, 7–46. New York: Routledge, 2004.
- . *Modest-Witness@Second-Millennium.FemaleMan-Meets-OncoMouse: Feminism and Technoscience*. New York: Routledge, 1997.
- Hardt, Michael, and Antonio Negri. *Empire*. Cambridge: Harvard University Press, 2000.
- Hayles, N. Katherine. *My Mother Was a Computer: Digital Subjects and Literary Texts*. Chicago: University of Chicago Press, 2005.
- . *Writing Machines*. Cambridge: MIT Press, 2002.
- Heidegger, Martin. *Gelassenheit*. Pfullingen: Neske, 1960.

- Holtorf, Christian, and Claus Pias, eds. *Escape!: Computerspiele Als Kulturtechnik*. Böhlau, 2007.
- Kraft, Philip. *Programmers and Managers: The Routinization of Computer Programming in the United States*. Heidelberg Science Library. New York: Springer-Verlag, 1977.
- Krapp, Peter. *Noise Channels: Glitch and Error in Digital Culture*. Minneapolis: University of Minnesota Press, 2011.
- Lee, J.A.N., J. McCarthy, and J.C.R. Licklider. "The Beginnings at MIT." *Annals of the History of Computing, IEEE* 14, no. 1 (1992): 18–54.
- Macho, Thomas. "Zeit Und Zahl: Kalender- Und Zeitrechnung Als Kulturtechniken." In *Bild, Schrift, Zahl*, edited by Sybille Krämer and Horst Bredekamp, 179–192. Munich: Wilhelm Fink, 2008.
- MacKenzie, Adrian. *Cutting Code: Software And Sociality*. New York: Peter Lang, 2006.
- Mahoney, M.S. "What Makes the History of Software Hard." *Annals of the History of Computing, IEEE* 30, no. 3 (September 2008): 8–18.
- Mahoney, Michael S. "Finding a History for Software Engineering." *Annals of the History of Computing, IEEE* 26, no. 1 (March 2004): 8–19.
- Mindell, David A. "Programs and People." In *Digital Apollo: Human and Machine in Spaceflight*, 145–180. MIT Press, 2008.
- von Neumann, John. "First Draft of a Report on the EDVAC" (1945).
- von Neumann, John. *The Computer and the Brain*. Yale University Press, 2000.
- Newell, Allen, and Herbert A. Simon. "Computer Science as Empirical Inquiry: Symbols and Search." *Commun. ACM* 19, no. 3 (March 1976): 113–126.
- Parikka, Jussi. "Archive Dynamics: Software Culture and Digital Heritage." In *What Is Media Archaeology*, 113–135. USA: Polity, 2012.
- Pias, Claus. *Computer Spiel Welten*. Berlin: Diaphanes, 2002.
- . "On the Epistemology of Computer Simulation." *Zeitschrift Für Medien- Und Kulturforschung* 2011, no. 1 (May): 29–54.
- Scott, Dana S. "Logic and Programming Languages." *Commun. ACM* 20, no. 9 (September 1977): 634–641.
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