SI 541/741, History 661
Prof. Paul N. Edwards
University of Michigan, Fall 2013
Weds 5-8 PM, 2185 North Quad

KNOWLEDGE AND INFORMATION INFRASTRUCTURES

Syllabus v 2.2 — October 28, 2013 (with presenters for each week)

This course offers historical, comparative, and theoretical perspectives on infrastructure from the medieval world to the present. We will focus mainly on knowledge and information infrastructures: libraries, scientific research practices, the Internet, the World Wide Web, and cyberinfrastructures in the physical and social sciences. Infrastructures are ecologies of numerous systems, each with unique origins and goals, which are made to interoperate by means of standards, socket layers, social practices, norms, and individual behaviors that smooth out the connections among them.Okay,

The course examines how infrastructures form, how they change, and how they shape (and are shaped by) social systems. To set the stage, we will briefly explore transportation, electric power, and cities. Interfaces or *gateways* between systems and modes are crucial to infrastructure formation and function. For example, ports link shipping with trucking and rail, and airports link automobile, truck, bus, subway, train, and pedestrian modes. Since the 19th century, modern cities have provided sewer, road, housing, and workspace infrastructures to millions of people, with enormous financial, political, and social requirements and effects. Gateway challenges find significant parallels in information infrastructures. For example, data conversion (from analog to digital, or from one digital format to another) creates difficult problems for system designers and users; connecting networks built on different standards motivated early Internet research. Meanwhile, the "unbundling" characteristic of post-1970s urban infrastructures finds parallels in subscription information services and massively open online courses in universities.

Modern knowledge infrastructures face numerous challenges, such as how to link traditional forms of individual expertise with emerging crowdsourced knowledge generation. To analyze these challenges, the course probes the role of standards, such as shipping containers, library catalogs, classification systems, TCP/IP, HTML, and metadata standards, and changing social structures and knowledge practices, such as scientific disciplines, professional societies, and universities.

Prerequisites: none.

Learning objectives

Students in this course will learn to:

1. Identify and describe common technical, economic, and social characteristics of large-scale infrastructures, such as network effects, standardization, modularity, embeddedness, and extension of an installed base;

2. Articulate and explain the stages of the Large Technical Systems (LTS) model of infrastructure development, as well as critiques and extensions of that model;

3. Analyze historical patterns in one or more major infrastructures;

4. Explain failures in efforts to build new infrastructures;

5. Articulate and explain the existence of common characteristics in the historical trajectories of transportation, communication, and knowledge and information infrastructures.

6. Identify and articulate the character of, and the reasons for, current transformations in knowledge infrastructures.

Requirements and assignments

This course is "front-loaded" with reading that will prepare you for four weeks of research and writing at the end of the course. Please budget your time carefully.

Students in the masters-level version of the course (541) have a different set of requirements from doctoral-level (741) students.

All students

- ***Class participation*** (25 percent of course grade). This is a discussion seminar. Its success depends on the commitment and involvement of *all* participants. **You will be graded on both the regularity and the quality of your participation, including your responses to cold calls.** This requirement includes at least one in-class presentation of course readings. Depending on the number of students in the course, you may be asked to do two or more presentations. These presentations are not graded separately, but are taken into account as part of your overall participation grade. For help with presentations, see "Presentation Guidelines" and "How to Give an Academic Talk" (CTools).

- **Cold calls:** to encourage full involvement and preparation, the professor will "cold call" students (ask you direct questions on the readings). I will expect answers that demonstrate your knowledge of the material and your ability to draw interesting connections among them. This practice is not intended to single out or embarrass anyone. Instead, its goal is to help you learn to think and talk "on your feet," a crucial skill required by almost any profession. Please prepare notes on the readings and come to class ready to speak out frequently.

- **Attendance is required.** Missing more than 2 course sessions during the semester will produce a substantial negative impact on your final grade, since you will not have participated as fully as others.

- ***Group/pair project.*** Working in groups of two or three, students will create case studies comparing the development of two or three dissimilar infrastructures. This project should be based on your term paper research.

  The project will culminate in 2 products:

  1. A class presentation, delivered during one of the last two class sessions (10 percent of course grade).

  2. A medium-length paper (2500-3500 words for pairs, 3000-4000 words for triples) OR a website (or other new media product) including the same amount of text. While this paper should be considerably different from the term paper — focusing on comparative analysis — you need not research an entirely different topic. Due Saturday December 14 (20 percent of course grade). NO LATE PROJECTS.

Additional requirements for 541 students:

- ***1200-1600 word "think piece"*** (10 percent of course grade). Due in class Sept. 25.

- ***Term research paper*** (35 percent of course grade). A 3000-4000 word paper on an infrastructure issue of your choice. This can be a traditional paper, or a hypermedia project (must include the same amount of text). 541 students may use course texts as the primary basis for this project, but must conduct at least some additional research as well (guideline: at least five additional high-quality sources). The assignment has three parts.

  (a) A 400-500 word *prospectus,* clearly describing your topic, your approach, and the sources you plan to use, is due Oct. 23.

  (b) An *extended prospectus* (1000-2000 words), further elaborating your topic and showing evidence of additional research, is due **Monday Nov. 18,** two days before the Research Workshop at which we will discuss everyone's ideas.

  (c) A *final version,* thoroughly revised and proofread, is due by midnight on Wednesday, Dec. 18. NO LATE PROJECTS.

Additional requirements for 741 and 661 (doctoral) students:

- ***Additional required readings*** (see schedule).

- A ***2000-3000 word essay*** on theories of infrastructure development (15 percent of course grade). Due Oct. 9.

- ***Term research paper*** (30 percent of course grade). A 4000-5000 word paper on an infrastructure issue of your choice. This can be a traditional paper or a new media project. In addition to course readings, 741 students must conduct substantial

independent research (at least fifteen additional high-quality sources). Use of original historical sources is encouraged, but not required. The assignment has three parts.

(a) A 500-word *prospectus,* clearly describing your topic, your approach, and the sources you plan to use, is due Oct. 23.

(b) A *extended prospectus* (minimum 1500-2500 words), further elaborating your topic and showing evidence of research, is due **Monday Nov. 18,** two days before the Research Workshop at which we will discuss everyone's ideas.

(c) A *final version,* thoroughly proofread, is due by midnight on Wednesday, Dec. 18. NO LATE PROJECTS.

Required books

Peter Burke, *A Social History of Knowledge II: From the Encyclopédie to Wikipedia* (Polity Press, 2012). NB, this is Volume 2 of a two-part book — be sure to buy the right one.

Stephen Graham and Simon Marvin, *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition* (Routledge, 2001)

Lawrence Busch, *Standards: Recipes for Reality* (MIT Press, 2011)

Janet Abbate, *Inventing the Internet* (MIT Press, 1999)

Paul N. Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (MIT Press, 2010)

David Weinberger, *Too Big to Know: Rethinking Knowledge Now That the Facts Aren't the Facts, Experts Are Everywhere, and the Smartest Person in the Room is the Room* (Basic Books, 2012)

Course Schedule

Sept. 4 — **Introduction: What are Infrastructures?**

Geoffrey C. Bowker and Susan Leigh Star, *Sorting Things Out: Classification and its Consequences* (MIT Press, 1999), 33-50 (CTools)

Paul N. Edwards, *A Vast Machine* (MIT Press, 2010), Introduction and Chapter 1

Recommended:

Paul N. Edwards, "How to Read a Book"

Sept. 11 — **How Infrastructures Form and Grow**

Thomas Parke Hughes, "The Evolution of Large Technological Systems," in W. Bijker, T. P. Hughes, and T. Pinch, eds., *The Social Construction of Technological Systems* (MIT Press, 1987), pp. 51-82 (CTools)

Stephen Graham and Simon Marvin, *Splintering Urbanism*, Chapter 1. Also read the table of contents, the lists of tables and figures, and the page of quotations just before the Prologue (but skip the acknowledgements).

David Ribes and Thomas A. Finholt, "The Long Now of Technology Infrastructure: Articulating Tensions in Development," *Journal of the Association for Information Systems* 10, no. 5 (2009): 375-98.

741/661 required: Erik van der Vleuten, "Infrastructures and Societal Change: A View from the Large Technical Systems Field", *Technology Analysis & Strategic Management* 16:3 (2004), 395–414 (CTools)

Sept. 18 — **Standards, Gateways, and Intermodalism - Paul, Setsuko, Padma, Pei-Yao**

Lawrence Busch, *Standards: Recipes for Reality,* Chapters 1 and 2 (required), Introduction (optional). - Paul

Tineke Egyedi, "Infrastructure Flexibility created by Standardised Gateways: The Cases of XML and the ISO Container," *Knowledge, Technology & Policy* 14, no. 3 (2001), pp. 41-54 (CTools) - Setsuko

Matthew Heins, "The Rise of the Container as a Global Standard," chapter 2 of *The Shipping Container and the Globalization of American Infrastructure,* dissertation draft, University of Michigan (2013) - Padma

741/661 required:

Helen Sampson and Bin Wu, "Compressing Time and Constraining Space: The Contradictory Effects of ICT and Containerization on International Shipping Labour," *IRSH* 48, supplement (2003), 123-152 (CTools) - Pei-Yao

Sept. 25 — **Cities and the "Modern Infrastructural Ideal" - Amine**

Stephen Graham and Simon Marvin, *Splintering Urbanism*. Review Chapter 1, then read the Introduction and chapters 2-5. Focus especially on Chapters 2-3. - Amine

741/661 required:

Bruno Latour, *Paris: Invisible City*. There is both English and French text here, and you can download the text. This site is old, so bear with the jumpy graphics.

— 541: Think piece due in class —

Oct. 2 — **Libraries, Classification, and Knowledge Practices - Rebecca, Nick**

Alex Wright, *Glut: Mastering Information Through the Ages* (Cornell University Press, 2008), chapters 9-10 (CTools) - Rebecca

Peter Burke, *A Social History of Knowledge*, Introduction and Part I: Knowledge Practices - Nick

Oct. 9 — **NO CLASS (but there *is* reading, and an assignment for 741/661)!**

Lawrence Busch, *Standards: Recipes for Reality,* Chapters 3-4 - Joseph

Peter Burke, *A Social History of Knowledge,* Part II: The Price of Progress - Trevor

— 741/661: Theories of Infrastructure Development paper due —

Oct. 16 — **Changing Knowledge Practices - Joseph & Trevor (from 10/9), Setsuko**

Peter Burke, *A Social History of Knowledge*, Part III: A Social History in Three Dimensions - Setsuko

David Weinberger, *Too Big to Know*, Chapter 2

741/661 required:

Eric Monteiro, Neil Pollock, et al., "From Artefacts to Infrastructures," *Computer Supported Cooperative Work* (2012) (CTools) - Padma

Oct. 23 — **The Internet - Will, Amine, Tawfiq, Rebecca**

Andrew L. Russell, "'Rough Consensus and Running Code' and the Internet-OSI Standards War," *IEEE Annals of the History of Computing* 28:3 (2006), 48-61 (CTools) - Will

Janet Abbate, *Inventing the Internet* (Cambridge, MA: MIT Press, 1999). Focus especially on Chapters 1 (7–43) and 3–5 (73–180) - Amine, Tawfiq

741/661 required:

Finn Brunton, "Constitutive Interference: Spam and Online Communities," *Representations* 117, no. 1 (2012), pp. 30-58 - Rebecca

Recommended (all):

Rhonda Hauben, *Netizens: On the History and Impact of Usenet and the Internet* (last modified 1996). A quirky, but interesting history of the early Internet (including especially its interaction with the history of Unix). Also available as a printed book.

— Term paper prospectus due —

Oct. 30 — **The World Wide Web and Wikipedia - Paul, Pei-Yao**

Greg Downey, "Virtual Webs, Physical Technologies, and Hidden Workers: The Spaces of Labor in Information Internetworks," *Technology and Culture* (2001), 209-235 (CTools) - Paul

Wikipedia entries for History of the World Wide Web and History of Wikipedia. The latter is poorly organized but informative; be sure to read through to the end. On both sites, browse some of the links to topics that interest you.

Howard Rheingold, "Xanadu, Network Culture, and Beyond," Ch. 14 of Tools For Thought (online version of 1985 book)

David Weinberger, *Too Big to Know*, Introduction and Chapter 1 - Pei-Yao

741/661 required:

R.S. Geiger and D. Ribes, "The Work of Sustaining Order in Wikipedia: The Banning of a Vandal," *Proceedings of the 2010 ACM Conference on Computer Supported Cooperative Work* (2010), pp. 117-126

Recommended (all):

Alex Wright, "The Web Time Forgot"

Browse the Project Xanadu website, especially the history and archives pages, and Ted Nelson's website (old: xanadu.com.au/ted/, new: ted.hyperland.com).

Tineke M. Egyedi and Ruben van Wendel de Joode, "Standards and Coordination in Open Source Software," *IEEE 3rd Conference on Standardization and Innovation in Information Technology* (2003), 85-97 (CTools)

— Choose group/pair project partners —

Nov. 6 — **Scientific Cyberinfrastructures - Padma, Trevor, Pei-Yao**

Paul N. Edwards, *A Vast Machine*. Review Chapter 1. Then read Chapters 5-8, 10-11, 13, and especially chapter 15 and Conclusion. - Padma, Trevor

741/661 required:

James Howison and James D. Herbsleb, "Scientific software production: incentives and collaboration." *Proceedings of the ACM 2011 conference on Computer Supported Cooperative Work,* pp. 513-522 (CTools) - Pei-Yao

Recommended:

Steve Easterbrook, "Serendipity, or, What has Software Engineering got to do with Climate Change?" (blog)

Nov. 13 — **Changing Knowledge Infrastructures - Joseph, Paul, Rebecca**

Stephen Graham and Simon Marvin, *Splintering Urbanism*, Chapter 6 and Conclusion. - Joseph

David Weinberger, *Too Big to Know*. Review Chapters 1 and 2, then read the rest of the book. Focus especially on chapters 3-4 and 7-9. - Paul

741/661 required:

Clay Shirky (2010), *Cognitive surplus: creativity and generosity in a connected age*, Chapters 5-6 (CTools) - Rebecca

Recommended (all):

Clay Shirky, *Here Comes Everybody: The Power of Organizing Without Organizations* (Penguin Group USA, 2009), Chapter 7 (CTools)

Lawrence Busch, *Standards: Recipes for Reality,* Chapter 6 and Conclusion

Paul N. Edwards, Steven J. Jackson, Melissa Chalmers, Geoffrey C. Bowker, Christine L. Borgman, David Ribes, Matt Burton, and Scout Calvert, Knowledge Infrastructures: Intellectual Frameworks and Research Challenges. Report of a workshop sponsored by the National Science Foundation and the Sloan Foundation (Ann Arbor: Deep Blue, May 2013). Web version of report is here.

Monday Nov. 18 — *Extended prospectuses due by 5:00 pm —*

Nov. 20 — **Research Workshop**

Nov. 27 — **NO CLASS — Thanksgiving holiday**

Dec. 4 — **Class presentations**

Dec. 11 — **Class presentations and conclusion**

Saturday, Dec. 14 — *Group/pair project paper due. NO LATE PROJECTS.*

Wednesday, Dec. 18 — *Final draft of term project due. Give yourself, and me, a real Christmas vacation: NO LATE PAPERS.*