STS 166-01   Prof. Paul N. Edwards
MW 3-4:30   Encina C-226
Encina West 202   Office hrs: Thurs 12:30-3:30

KNOWLEDGE AND INFORMATION INFRASTRUCTURES

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, classification systems, 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.

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 infrastructures. Interfaces or *gateways* between systems and modes are crucial to infrastructure formation and function. For example, containers act as the gateway technology linking shipping with trucking and rail. The gateway concept finds 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.

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 library catalogs, classification systems, TCP/IP, HTML, and scientific metadata standards, as well as changing social structures and knowledge practices, such as scientific disciplines, professional societies, and universities.

Prerequisites: none

Learning objectives

Students will emerge with a theoretical understanding of infrastructure dynamics in both "hard" and "soft" infrastructures, as well as a grasp of contemporary issues surrounding how human knowledge is created, communicated, and contested.

You will also develop the following skills:

- Taking a "long view" and applying it to critical thinking about current events
- Understanding path dependence in infrastructure
- Critiquing historical writing

- Making persuasive arguments, both orally and in writing
- Analytic and synthetic reasoning

Requirements and assignments

Summary

- Attendance (miss no more than 2 sessions after intro)
- Participation (25 pct)
- Reading log (20 pct, must be turned in before class, minimum 10 logs required)
- Pair/group meeting report (5 pct) - March 5
- Pair/group presentation (15 pct) - March 12 or 14
- Term paper/project (35 pct) - due dates: prospectus Feb 5, extended prospectus Feb 26, final March 22

Details

- ***Class participation* (25 percent of 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. 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" (Canvas) and "How to Give an Academic Talk."

  - **Cold calls:** Your professor will occasionally "cold call" students (ask you direct questions on the readings). I expect answers to demonstrate your knowledge of the material and your ability to draw interesting connections among the readings. This practice is not intended to single out or embarrass anyone. 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 class sessions during the quarter will negatively affect your final grade, since you can't participate if you're not there. 2 sessions is more than 10 percent of the course.

- ***Reading log* (20 percent of grade).** A short reading log entry is due **before** each class session. See the assignment for details. These entries cannot be turned in after the session. *You must complete at least 10 of the 14 possible log entries in order to pass the course.*

- ***Pair/group project.*** Working in pairs or groups of three, create a case study comparing two or three **dissimilar** knowledge or information infrastructures, based on your term paper research. The project has 3 parts:

  1. Meeting report (**5 percent of grade**). Meet with your partner(s) and decide on a topic and approach. Write up notes from the meeting (can be sketchy and brief). Due by March 5.

2. A class presentation **(15 percent of grade),** delivered during one of the last two class sessions (March 12 and 14). All participants receive the same grade.

- ***Term research paper* (35 percent of 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). The assignment has four parts.

    1. A 400-500 word prospectus, clearly describing your topic, your approach, and the sources you plan to use, is due February 5.

    2. Meet with the instructor to discuss your idea (February 6-14).

    3. An extended prospectus (1000-2000 words), further elaborating your topic and showing evidence of additional research, is due February 26.

    4. A final version, thoroughly revised and proofread, is due by midnight on March 22. NO LATE PROJECTS.

Required books

Lawrence Busch, *Knowledge for Sale: The Neoliberal Takeover of Higher Education* (MIT Press, 2017)

Alexander Klose, *The Container Principle* (MIT Press, 2015)

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

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

Week 1 — What are infrastructures? What is information? What is knowledge?

January 8

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

Lawrence Busch, Knowledge for Sale: The Neoliberal Takeover of Higher Education (MIT Press, 2017), pp. xi-xviii ("Preface to the English Language Edition"). The link will take you to page 1; use the navigation arrows at top right of the page to back up to page xi. Only part of this book is available for free online, so you will still need to buy it for later in the course.

January 10

Alexander Klose, *The Container Principle* (MIT Press, 2015), Chapters 2 and 4. Recommended: Chapters 1 and 3.

Videos (please watch in order):

"The Longshoreman," Frith Films, 1947 documentary set in Los Angeles (11 min)

"Trucks & Trains - 1950's Road-Rail Piggyback Trains of the Pennsylvania RailRoad," documentary (13 min)

"The Seaport," 1962 WDTV documentary set in San Francisco (31 min)

"Port Of Rotterdam Documentary," 2005, National Geographic Megastructures series (45 min)

Recommended:

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

Week 2 — How infrastructures form and grow

January 15 — no class (MLK Day)

January 17

Klose, *The Container Principle*, Chapters 5-6. Recommended: Chapter 8.

Paul N. Edwards, Steven J. Jackson, Geoffrey C. Bowker, and Cory P. Knobel, *Understanding Infrastructure: Dynamics, Tensions, and Design*. Report of the NSF Workshop on History & Theory of Infrastructure: Lessons for New Scientific Cyberinfrastructures (Ann Arbor, 2007). Focus especially on Parts I-II.

Week 3 — Creating and organizing knowledge

January 22

Alex Wright, *Glut: Mastering Information Through the Ages* (Cornell University Press, 2008), chapters 8-10

David Weinberger, *Too Big to Know*, Chapters 1-2.

January 24 — no class

— use this time to begin research for your final project —

Week 4 — Creating and organizing knowledge; standards and standardization

January 29

Peter Burke, *A Social History of Knowledge II: From the Encyclopaedia to Wikipedia* (Polity, 2012), Chapters 1-2

Alex Wright, "The Web Time Forgot"

January 31

Lawrence Busch, *Standards: Recipes for Reality,* Introduction and Chapter 1

Standards 101, American Society for Quality. Explore some of the links on this short webpage. Know the meanings of these acronyms: ASQ, ISO, ANSI. Explore a few of the standards in this list. Try to figure out what is meant by "quality" in this context.

Week 5 — Standards and the Internet

February 5

Lawrence Busch, *Standards: Recipes for Reality,* Chapter 2

US National Bureau of Standards, "Weights and Measures of the United States: A brief history" (1963/75)

"Frank and Lillian Gilbreth" (video, 3 min)

— Term project: prospectus due —

February 7

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

Paul N. Edwards, "Some Say the Internet Should Never Have Happened." In W. R. Neuman (Ed.), *Media, Technology and Society: Theories of Media Evolution* (2010), pp. 141-160

Michael Froomkin, "The Internet as a Source of Regulatory Arbitrage" (1997). The technical details of Internet message transmission are only of historical interest in this 20-year-old article. Focus on the introduction and the second half, where regulatory arbitrage is defined and discussed.

Week 6 — Wikipedia, the crowd, and the cloud

February 12

David Weinberger, *Too Big to Know*, Chapters 3-5

Busch, *Standards*, Chapter 3

February 14

Wikipedia, History of Wikipedia. This page is poorly organized but informative; be sure to read through to the end.

Wales, 2005. TED talk, "The Birth of Wikipedia" (video, 20 min)

Wales, 2014. "The Future of Wikipedia" (video, 16 min)

Week 7 — Science and standards

February 19 — no class (Presidents' Day)

February 21

Busch, *Standards*, Chapter 4 and Conclusions

Weinberger, *Too Big to Know,* Chapter 7

Week 8 — Scientific knowledge infrastructures

February 26

Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (MIT Press, 2010), Introduction and Chapter 1

Weinberger, *Too Big to Know,* Chapter 9

— Term project: extended prospectus due —

February 28

"Jim Gray on eScience: A Transformed Scientific Method," from *The Fourth Paradigm* (Microsoft Research, 2009), pp. xvii-xxxi. I've given you the entire book, in case the rest is of interest.

Bruno J. Strasser and Paul N. Edwards, "[Big Data is the Answer… But What is the Question?](#)" *Osiris* 32 (2017), pp. 328-45

Week 9 — The future of knowledge infrastructures

March 5 — Busch, *Knowledge for Sale: The Neoliberal Takeover of Higher Education,* pp. 1-30 and 49-108. The rest is optional. You may want to review the preface, which we read for the first class and which puts this short book into an infrastructure perspective.

— Pair/group project: meeting report due —

March 7 — Edwards, Paul N. "[Knowledge Infrastructures for the Anthropocene](#)," *The Anthropocene Review* 4, no. 1 (2017): 34–43. I've given you a PDF of the manuscript because it includes graphics that weren't available in the published version.

Week 10 — Pair/group project presentations (no reading)

March 12

March 14

March 22 — Term project due by midnight. NO LATE PROJECTS.