

ARCHITECTURE, NATURE, AND TECHNOLOGY BEFORE THE INDUSTRIAL REVOLUTION

AHIS 429: Studies in Art, Science, and Technology

Units: 4.0

Spring 2018

Tuesday and Thursday, 11:00am – 12:30pm, SOS B37

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Course Description

At no other point were the exchanges between architecture, nature, and technology more fruitful (and at times more fraught) than during the early modern period (1450-1800). This seminar examines the many ways that architects and craftsmen engaged the living world around them by the use of machines, materials, and technical instruments. How did different methods of handling materials inform the way that architects conceived building in theory and practice? In what ways did advancements in hydraulics, mechanics, and even drawing/printing technology signal broader changes in society, religion, and philosophy? What were the ramifications of the natural world's "demystifying," and how did architecture work both with and against this effort?

We begin by questioning the philosophical importance of technology for art and architecture before the Industrial Revolution. From here, we study the ways that period hands and minds worked with materials like stone, metal, wood, and glass. The remaining sessions are organized around different approaches to engaging nature by means of engineering and technology. Figures to be studied include Filippo Brunelleschi, Leonardo da Vinci, Domenico Fontana, Galileo Galilei, Guarino Guarini, René Descartes, Claude Perrault, Christopher Wren, Robert Hooke, among others. The seminar ends by speculating on architecture and technology during the modern period, including the importance of industrialization and the role of the digital.

Course Learning Objectives

- Students will become familiar with key architects, philosophers/scientists, buildings, theories, and practices during the early modern period, as well as their relationship to period theories of nature and technology.
- Students will learn the various techniques that architects and craftsmen employed when engaging the raw materials of the natural world.

- Students will understand how the technical act of building initiated an intimate and deeply philosophical relationship between man and nature.
- Students will learn to conduct original research and marshal different types of evidence—both theoretical and practical (“thinking” and “doing”)—and, in the process, come to a better understanding of the various and profound meanings of architectural making during the early modern period.

Course Policies

Attendance. Seminars require active engagement and discussion. Your presence in class is essential, and you are expected to complete the assigned readings and be prepared to discuss them in class. Two unexcused absences are allowed; after that point, your final grade will drop by one increment (for example, an A will become an A-). Three late arrivals are considered as one absence. If you will not be in class, please email the instructor beforehand.

Computers and mobile phones. The use of computers and mobile phones is prohibited during class. Please print out a copy of the readings or bring detailed notes with you to the seminar. The class may not be recorded or taped.

Readings. All readings will be available online as PDFs on Blackboard.

Papers. Papers must be submitted by the deadline. It is your responsibility to make sure that you have sent the correct file and that the file opens correctly. Late papers will be marked down one grade increment for each day they are overdue. Plagiarism, in any form, is not allowed and will be reported to USC Student Judicial Affairs and Community Standards.

Assignments

1. **Class participation.** Students are expected to have completed the weekly reading by the first class of the week and come to class ready to participate in a discussion. Students should identify and assess the author’s argument, comment on how it contributes to our understanding of the relationship between architecture, nature, and technology, and be prepared to offer a critique.
2. **Discussion Forum Posts.** Students are expected to post short responses (250-500 words) to the week’s readings on the online Discussion Forum (to ensure that these comments are read by everyone, the deadline for posting them is **10:00pm on Monday before class**). A response is neither a summary nor an expression of one’s personal opinion. Rather, it should make an argument concerning the broader theme of the week by, for example, analyzing how the texts frame their subject or by highlighting the dialogue between individual readings: *What common issues do they address? How do they differ in their approaches?* Students must complete a total of **nine** responses during the semester.

3. **A critical presentation of assigned readings.** This should be a brief review of the readings: concise, analytical rather than descriptive, and lively enough to stimulate discussion. It may consist of a few carefully formulated questions (no longer than **10 minutes**). Students do not write a Discussion Forum post the week they present.
4. **Paper 1.** Students will have one short paper (5-7 pages) due based on an object housed at an area museum. Details to follow. **Due February 23, 2018.**
5. **Final paper project.** The bulk of this course is a research paper of a building, instrument, machine, or technological practice (from 1450 and 1800) that explores the relationship between architecture, nature, and technology. This is to be a substantial piece of research, 15-20 pages, that you will work on throughout the semester. The instructor will distribute detailed instructions in class, including potential project ideas.

The final paper project will have four components.

1. **A 2-3 page topic proposal.** This proposal will briefly describe your chosen project and the issue you wish to explore. Students must meet with the instructor before submitting the proposal for project approval. **Due March 9, 2018.**
2. **Bibliography and outline.** Bibliography must include 2–3 primary sources and a minimum of 8 secondary sources. At least 3 of your secondary sources should come from printed material (i.e., a book). Wikipedia and blogs do not count as sources. **Due April 6, 2018.**
3. **An oral presentation.** These presentations should be a focused examination of the project and the historical issues that it raises. They are expected to be polished but are also meant to be exploratory. Use them to raise questions, explore problems, and point to ways you might address them as you continue your research. To ensure class feedback, presentations will be no longer than **20 minutes. Dates to be assigned in class.**
4. **Final paper. Due May 8, 2018.**

Grading

Participation	10%
Discussion Forum posts	10%
Critical presentation of readings	5%
Paper 1	20%
Topic Proposal	5%
Bibliography and Outline	10%
Paper Presentation	5%
Paper 2	35%

Course Schedule (subject to change)

Week 1. January 9 and 11. Introduction

- Pamela O. Long, “Architecture and the Sciences” in ed. Alina Payne, *The Companions to the History of Architecture, Volume 1: Renaissance and Baroque Architecture* (Chichester, West Sussex: John Wiley & Sons, Inc., 2017), 191-219.
- Antoine Picon, “Architecture, Science, and Technology,” in eds. Peter Galison and Emily Thompson, *The Architecture of Science* (Cambridge: The MIT Press, 1999), 309-336.

Week 2. January 16 and 18. Mathematics and Geometry

- Robin Evans, “The Trouble with Numbers,” *The Projective Cast: Architecture and its Three Geometries* (Cambridge: The MIT Press, 2000), 240-271.
- George L. Hersey, “The Light of Unseen Worlds,” *Architecture and Geometry in the Age of the Baroque* (Chicago and London: University of Chicago Press, 2000), 52-77.
- Denis Cosgrove, “Ptolemy and Vitruvius: Spatial Representation in the Sixteenth Century Texts and Commentaries” in eds. Antoine Picon and Alessandra Ponte, *Architecture and the Sciences: Exchanging Metaphors* (Princeton: Princeton Architectural Press, 2003), 20-51.

Week 3. January 23 and 25. Nature and Technology

- Catherine Wilson, “Aesthetic Appreciation of Nature in Early Modern Science” in ed. Alina Payne, *Vision and Its Instruments: Art, Science, and Technology in Early Modern Europe* (University Park: Penn State University Press, 2015), 49-68.
- Lorraine Daston and Katharine Park, “Wonders of Art, Wonders of Nature,” *Wonders and Order of Nature, 1150-1750* (New York: Zone Books, 1998), 255-302.
- Dalibor Vesley, “Creativity in the Shadow of Modern Technology,” *Architecture in the Age of Divided Representation* (Cambridge and London: The MIT Press, 2004), 281-315.

Field Trip: The Museum of Jurassic Technology (tentative)

Week 4. January 30 and Feb. 1. Craft

- Leon Battista Alberti, “Book Two: Materials,” *On the Art of Building in Ten Books*, trans. Joseph Rykwert, et al. (Cambridge: The MIT Press, 1988), 33-60.
- Alina Payne, “Materiality, Ornament, and Media Overlaps: Architecture Between Art and Building Science” in ed. Alina Payne, *The Companions to the History of Architecture, Volume*

1: Renaissance and Baroque Architecture (Chichester, West Sussex: John Wiley & Sons, Inc., 2017), 136-159.

- Pamela O. Long, “Art, Nature, and the Culture of Empiricism,” *Artisan/Practitioners and the Rise of the New Sciences, 1400-1600* (Corvallis: University of Oregon Press, 2011), 30-61.

Field trip: J. Paul Getty Museum (tentative)

Week 5. February 6 and 8. Drawing and Technical Instruments

- Filippo Camerota, “Renaissance Descriptive Geometry: The Codification of Drawing Methods” in ed. Wolfgang Lefèvre, *Picturing Machines, 1400-1700* (Cambridge: The MIT Press, 2004), 175-208.
- Anthony John Turner, “New Instruments and ‘New Philosophy’: Instrument Making in the Scientific Revolution,” *Early Scientific Instruments: Europe, 1400-1800* (London: Sotheby’s Publication by Philip Wilson Publishers, 1987), 87-170.
- J.A. Bennett, “The Mechanics’ Philosophy and the Mechanical Philosophy,” *History of Science* 24 (1986): 1-28.

Field Trip: The Huntington Library (tentative)

Week 6. February 13 and 15. Construction and Building Science

- Leon Battista Alberti, “Book Three: Construction,” *On the Art of Building in Ten Books*, trans. Joseph Rykwert, et al. (Cambridge: The MIT Press, 1988), 61-91.
- Barry Jones, Andrea Sereni, and Massimo Ricci, “Building Brunelleschi’s Dome: A Practical Methodology Verified by Experiment,” *Journal of the Society of Architectural Historians* 69:1 (March 2010): 39-61.
- Salvatore Di Pasquale, “Leonardo, Brunelleschi, and the Machinery of the Construction Site” in *Leonardo da Vinci: Engineer and Architect* (Montréal: The Montréal Museum of Fine Arts, 1987), 163-181.

Week 7. February 20 and 22. Vaults and Domes

- Federico Bellini, “Vaults and Domes: Statics as an Art” in ed. Alina Payne, *The Companions to the History of Architecture, Volume 1: Renaissance and Baroque Architecture* (Chichester, West Sussex: John Wiley & Sons, Inc., 2017), 220-252.
- Robin Evans, “Drawn Stone,” *The Projective Cast: Architecture and its Three Geometries* (Cambridge: The MIT Press, 2000), 178-239.

Paper 1 due Friday February 23, 2018

Week 8. No class

Week 9. March 6 and 8. Fortifications and War

- Marion Hilliges, “The City at War and the Semantic Armament of Renaissance Architecture” in ed. Alina Payne, *The Companions to the History of Architecture, Volume 1: Renaissance and Baroque Architecture* (Chichester, West Sussex: John Wiley & Sons, Inc., 2017), 282-308.
- Pamela O. Long, “Openness and Authorship I: Mining and Metallurgy: Mining, Metallurgy, and the Military Arts,” *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance* (Baltimore and London: The Johns Hopkins University Press, 2001), 175-209.
- Janis Langins, “French Fortifications in the Age of Vauban,” *Conserving the Enlightenment: French Military Engineering from Vauban to the Revolution* (Cambridge: The MIT Press, 2004), 39-84.

Proposals due Friday March 9, 2018

Week 10. Spring Recess

Week 11. March 20 and 22. Infrastructure

- Leon Battista Alberti, “Book Four: Public Works,” *On the Art of Building in Ten Books*, trans. Joseph Rykwert, et al. (Cambridge: The MIT Press, 1988), 92-116.
- Katherine Rinne, “Surveying the City, Distributing the Water,” *The Waters of Rome: Aqueducts, Fountains, and the Birth of the Baroque City* (New Haven and London: Yale University Press, 2010), 56-82.
- Chandra Mukerji, “Techniques of Material Mobilization,” *Territorial Ambitions and the Gardens of Versailles* (Cambridge: Cambridge University Press, 1997), 147-197.

Week 12. March 27 and 29. Machines

- Giovan Pietro Bellori, “Life of Domenico Fontana,” *The Lives of Modern Painters, Sculptors and Architects*, trans. Alice Sedgwick (New York: Cambridge University Press, 2005), 139-155.
- Nicoletta Marconi, “Tradition and Technological Innovation on Roman Building Sites from the 16th to the 18th Century: Construction, Machines, Building Practice and the Diffusion of Technical Knowledge” in ed. Hermann Schlimme, *Practice and Science in Early*

Modern Italian Building: Towards an Epistemic History of Architecture (Milan: Electa, 2006), 137-152.

- Pamela O. Long, “Picturing the Machine: Francesco di Giorgio and Leonardo da Vinci in the 1490s” in ed. Wolfgang Lefèvre, *Picturing Machines, 1400-1700* (Cambridge: The MIT Press, 2004), 117-142.

Week 13. April 3 and 5. Claude Perrault and the France of Louis XIV

- Extracts from Claude Perrault, *Ordonnance for the Five Kinds of Columns after the Method of the Ancients*, trans. Indra Kagis McEwan (Santa Barbara: The Getty Center for the History of Art and the Humanities, 1993).
- Antoine Picon, “The Freestanding Column in Eighteenth-Century Religious Architecture” in ed. Lorraine Daston, *Things that Talk: Object Lessons from Art and Science* (New York: Zone Books, 2004), 66-99.
- Anita Guerini, “Perrault, Duverney, and Animal Mechanism,” *The Courtier’s Anatomist: Animals and Humans in Louis XIV’s Paris* (Chicago: University of Chicago Press, 2015), 165-200.

Bibliography and Outline due Friday April 6, 2018

Week 14. April 10 and 12. Christopher Wren and Restoration England

- J.A. Bennett, “The Mathematical Sciences,” “Mechanics, Microscopy, Surveying,” “From Astronomy to Architecture,” and “The Natural Causes of Beauty,” *The Mathematical Science of Christopher Wren* (Cambridge: Cambridge University Press, 1982), 6-13, 71-76, 87-117, and 118-124.
- Anthony Gerbino and Stephen Johnson, “Vision, Modeling, Drawing: Christopher Wren’s Early Career” and “Structure and Scale: The Office of Works at St. Paul’s,” *Compass and Rule: Architectural as Mathematical Practice in England, 1500-1750* (New Haven: Yale University Press, 2009), 83-96, 97-110.
- Matthew Hunter, “The Architecture of Science and the Science of Architecture,” *Wicked Intelligence: Visual Art and the Science of Experiment in Restoration England* (Chicago: University of Chicago Press, 2013), 188-221.

Week 15. April 17 and 19. Industry and Enlightenment

- Antoine Picon, “The Impact of the Enlightenment on Architecture,” *French Architects and Engineers in the Age of Enlightenment* (Cambridge: Cambridge University Press, 1992).

- Daniel L. Purdy, “Science or Art? Architecture’s Place Within the Disciplines,” *On the Ruins of Babel: Architectural Metaphor in Germanic Thought* (Ithaca: Cornell University Press, 2011), 29-52.
- Lorraine Daston and Katharine Park, “Enlightenment and the Anti-Marvelous,” *Wonders and Order of Nature, 1150-1750* (New York: Zone Books, 1998), 329-363.

Week 16. April 24 and 27. Conclusion. Industrialization and the Digital

- Antoine Picon, “Construction History: Between Technological and Cultural History,” *Construction History* 21 (2005/2006), 13-33.
- Antoine Picon, “People, Computers, and Architecture: A Historical Overview,” *Digital Culture in Architecture: An Introduction for the Design Professional* (Basel: Birkhauser, 2010), 15-58.

Paper 2 due Tuesday May 8, 2018

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Support Systems:

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. engemannshc.usc.edu/counseling

National Suicide Prevention Lifeline – 1 (800) 273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime. Provides overall safety to USC community. dps.usc.edu