COLUMBIA
GSAPP

AT1 Environments in Architecture

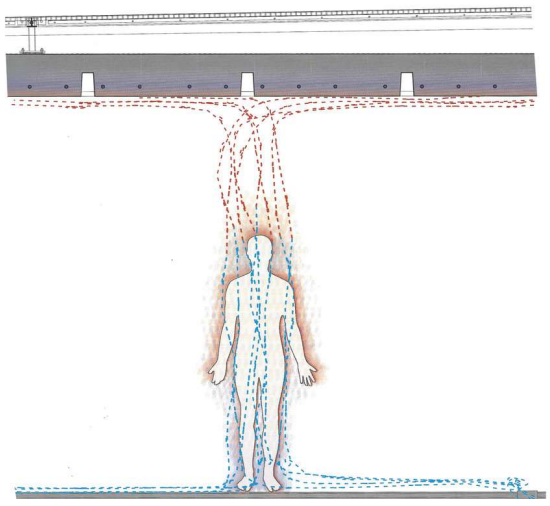
Fall 2019

Syllabus

1. Course Description

Architecture at its most basic is about providing comfort to the human condition. No other element of architectural design is so influential in creating essential architectural performance and yet so misunderstood. Office workers will not be productive in a building with too much glare. A student's ability to learn is diminished with lack of access to natural air and ventilation. Your home should be warm and welcoming when you want it to be, or a cool respite from the elements when you most need it.

While the fireplace has always been the first and maybe most influential environmental technology discovered, the modern era of buildings from 1900 onwards has seen rapid and disruptive change in systems that alter and control our environment. Electric lighting, air conditioning, vertical transportation are all systems that now define the human comfort condition in a building. And yet these technology improvements have had severe consequences that after more than a century are still being discovered. Buildings now account for nearly 50% of the energy consumed by society, driving up energy use around the world. In densely populated cities, buildings use more than 75% of the energy supply and create an equal share of carbon emissions. Globally, buildings are also built in many diverse environments, once hostile to environmental conditions, and now just simply centers of commerce needing efficient office buildings, schools and other critical infrastructure. Modern building systems are at once enabling and yet destructive to our overall environment.



How Do We Perceive Heating and Cooling?

Developments in the past 30 years in architectural design have pointed to another way that architects must now conceive of systems. NOT as pieces of equipment to specify a space to keep hot or cool, but compliments to a more sophisticated understanding of how environmental forces can shape design and how buildings can be efficiently constructed for lower energy use and better productivity of inhabitants.

As a first class in the technology sequence at Columbia GSAPP, ***AT1 Environments in Architecture*** will challenge you to tackle fundamental aspects of environments and put them to test in class projects and ultimately in your studio and professional work. The course will be based on three modules. The first module will be an introduction to building physics – how we must look at air, light, sound and thermal comfort in both basic scientific ways and also as they apply to how buildings are constructed. The second module will focus on systems – how

Integrated Approach to Environments in Architecture

buildings today tackle the challenges of providing heating and cooling to occupants, how these systems can be efficiently and passively considered, and how energy can be generated on site and in renewable fashion. Standard system elements will be identified as well as technologies that are driving the new renaissance of low energy buildings. Finally the class will look at how environment can shape design. How do we develop and implement architectural solutions? Energy and resource benchmarking, such as LEED and WELL, will be reviewed. Future approaches to low energy design and environmental conditioning will be presented.

Assignments

How do you design what you cannot touch? We will explore how architects must grasp the technology of building physics and elemental understanding of how air, light, sound and thermal comfort are measurable design elements in any building. The class will start with observing spaces, including historic atrium in New York City. How spaces feel and understanding the design behind these are critical.

We will next move to analysis and simulation. Computational tools provide todays architect with something older generations did not have – a way to explore environmental design without real life testing. While intuition may continue to drive idea generation, simulation allows testing of shape and form in environments. We will explore tools to assist with climate analysis, thermal modeling and finally light modeling. These tools will be used in the second assignment and provide you with an understanding of the use of simulation methods.

Environmental Design Project – 1 of 5 Assignments

Our final assignment will put your skills to the test in designing a project that will be tested for its environmental efficiency. The "Contest" will involve student groups building room prototypes that will be subject to heat gains and then measured for how effectively they retain heat through use of materials, construction methods and overall shape.

Class Case Study

The class will have a case study element that will be a semester long project. Teams will be formed after the first class. Groups will be provided with systems to research precedents and choose a specific key project to illustrate the system. Two presentations will be required in class through the semester. The first will focus on the precedents and the project and designer background. Key technology breakthroughs will be researched and systems and design approaches identifies that enabled these advances. The second presentation will focus on the detail of these systems and will develop a more detailed understanding of the selected project in the form of a graphic or computational analysis. High quality systems drawings, analytical models and/or physical models indicating key system attributes will be required.

2. Course Hours

Content	Date	Location
Lectures	Tuesdays 9:30 – 11	114 Avery
Lab	Tuesdays 11:00 - 12:30	114 Avery
TA Office Hours	TBD	TBD

3. Instructors & Critics

Professor: Craig Schwitter, craig.schwitter@burohappold.com

Teaching Assistant: Maxime St Pierre Ostrander, ms5509@columbia.edu

Lead Instructors: Craig Schwitter, Buro Happold craig.schwitter@burohappold.com
Emir Pekdemir, Buro Happold. Emir.pekdemir@burohappold.com
Sigal Shemesh, Buro Happold. Sigal.Shemesh@BuroHappold.com
Lighting: Chris Coulter, Buro Happold. Chris.Coulter@Burohappold.com
Acoustics Terence Caulkins, Arup. Terrence.caulkins@arup.com

4. Course Content

a. Lectures **TUE 9:30 – 11**

First part of class will focus on weekly lectures to introduce key concepts.

b. Lab/Case Study Research and Presentation **TUE 11 – 12:30**

The second part of class will be hands on focus for students with instructors to learn analysis tools, discuss case study approaches, and present case studies. Available time may also be used for team coordination.

c. Guest Lectures **TUE 11 – 12:30**

Several guest lectures from contemporary architects will be arranged throughout the semester to discuss how current firms are harnessing ideas in environmental systems to drive design.

5. Grading

In this course, every effort is made to grade impartially and to the best of our knowledge about performance. Assignments will be graded individually for assignments 1-4. Assignment 5 and cases studies will be group projects. Since project development is a team effort, grades are assigned to teams. On rare occasions, individual grades may be awarded for exceptional or deficient performance within a group. Grading is based on the following criteria:

Criteria	Description	%
Assignments	Assignment 1 Assignment 2 Assignment 3 Assignment 4 Assignment 5 Part 1 Assignment 5 Part 2	5% 5% 10% 10% 5% 15%
Case Study	Case Study 1 Presentation Case Study 2 Presentation	20% 20%
Lecture Attendance and Participation	NOTE: MISSING MORE THAN 2 CLASSES IS GROUNDS FOR WITHDRAWAL	10%

Final grades are assessed based on the following %:

High Pass	>90%
Pass	60 – 90%
Low Pass	50 – 60%
Fail	<50%

6. Policies

- Attendance is mandatory for all classes and for all presentations and reviews. Please inform the instructor or TA if you will be missing class for an unforeseen personal issue or illness. Class attendance will be taken at all classes and, with class participation, influence 20% of your grade. If you miss more than 2 classes you will be subject to an unofficial withdrawal (U/W) status from the class.
- If you require an accommodation for a disability, please let me know as soon as possible. Some aspects of the course may be modified to facilitate your participation and progress.
- All students are held to the academic policies of the University.

- Plagiarism is knowingly presenting another person's ideas, findings, images or written work as one's own by copying or reproducing without acknowledgment of the sources. It is intellectual theft that violates basic academic standards. In order to uphold an equal evaluation for all work submitted cases of plagiarism will be reviewed by the individual faculty member and/or the Dean. Punitive measures will range from failure of an assignment to expulsion from the University.
- Students who miss deadlines due to valid extenuating circumstances may submit the required work at a later date, as agreed upon with the instructor. University regulations limit such circumstances to serious personal illness and death in the immediate family. Unexcused late projects will not be accepted, incomplete projects will be evaluated in relation to their degree of completion, and a student will be allowed to present such work only with instructor approval. Lectures and demonstrations cannot be repeated. There is no excuse for late submittals, late attendance at reviews or pin ups, due to printer or computer problems. You have to organize your output ahead of time or find other resources outside the college to complete your work on time. Late work will be accepted only at the discretion of the instructors and is subject to a 5% grade deduction for every 24 hours past the deadline.
- The final course evaluations are important to the quality of instruction. Please take the necessary time to critically and constructively evaluate the course as well as the instructor's quality of instruction and guidance in relation to your own participation in the course, engagement in the subject matter as well as your interaction with your peers and your instructor.
- Digital Devices. Phone are to be switched off during class lectures. Laptops are allowed for note taking only. Students not abiding by the digital device policies may be asked to leave the class.

7. References

a. Reference Text(s)

Class Required Text:

1. Lechner, Norbert. *Heating, Cooling, Lighting,* 4th Edition. 2015.

Recommended additional texts:

1. Allen, Edward and Iano, Joseph. The Architects Studio Companion. 5th Edition. 2012.
2. Silver, Pete and Mclean, Will and Whitsett, Dason. *Introduction to Architectural Technology,* 2nd Edition. 2008.
3. Grondzik, Walter, et al. *Mechanical and Electrical Equipment for Buildings,* 11th Edition. 2010.
4. McDonough, William and Braungart, Michael. *Cradle to Cradle.* 2002.
5. McDonough, William and Braungart, Michael. *The Upcycle.* 2013.
6. Moe, Kiel. *Thermally Active Surfaces in Architecture.* 2010,
7. Cotterell, Janet and Dadeby, Adam. *The Passivehaus Handbook*. 2012.
8. Heschong, Lisa. *Thermal Delight in Architecture*. 1979

b. Lecture Material

Lecture material will be posted on courseworks after the lecture.