Course Syllabus

United Atmospheres (ARCHA6686)

Fig1. National Oceanic and Atmospheric Administration (NOAA) GOES-West satellite views atmospheric river in the Pacific Ocean (https://www.nesdis.noaa.gov/news/goes-west-views-atmospheric-river-the-pacific-ocean)
Mir.Studio Hotel in Norway Jensen & Skodvin visualization (https://www.mir.no/)

Course description and objectives

The word atmosphere (ατμόσφαιρα) etymologically originates from the Greek words “ἀτμός – meaning vapor or steam- and σφαῖρα – meaning sphere. Atmosphere ranges from tangible physical measurements -such as the unit of air pressure at sea level-, to abstract sensations -like the physio-psychological footprint of a conversation.

In this course, we will investigate architectural atmospheres through a range of topics that span from the physical aspects of air quality, to spatial nuances as experienced by subjects. We will discuss how we measure air pollution (AP), the sources of AP, and what safety thresholds exist in the industry in relation to human health standards created by different international governmental agencies and private organizations. We will also discuss socioeconomic variables associated with air quality and negative environmental externalities and investigate building system approaches and solutions to some of these problems. Overall, the objective of this course is to understand the fundamental science behind air quality in the built environment and to analyze/associate different air quality parameters entangled in the production of built environments.

An important topic of study that will be investigated throughout the course is the need for energy conservation and the subsequent structures developed to conserve energy and limit thermal loss. Building envelopes that seal indoor environments from atmospheric flows will be analyzed, as well as the implications of these strategies on building energy requirements and Indoor Environmental Quality (IEQ). IEQ includes air quality and other factors such as lighting, thermal conditions, and ergonomics, which are closely associated with the design decisions and approaches of building designers. We will study airflow in natural and mechanically ventilated buildings, their correlation with global factors affecting the production and transportation of building components, and manufacturing procedures, which regulate the market of the building industry. State-of-the-art in environmental design and passive and active heating, ventilation, and air conditioning (HVAC) technologies will be introduced in lectures and further analyzed in presentations, discussions, readings, and assignments.

The learning intent behind “United Atmospheres” will be for the students to understand the fundamental science behind air quality and related topics; to understand principal concepts around natural and mechanical ventilation systems in relation to energy and air quality requirements; to associate global socioeconomic factors that influence architectural production and design strategies; to analyze current projects based on characteristics and variables of energy consumption, passive and active systems, embodied energy, natural and mechanical ventilation, life cycle analysis, and other aspects of the design decision-making process.

Although there is a standardized consensus for what constitutes “good” indoor air quality and thermal comfort, the way in which these standards are materialized and achieved -relative to the experience of safety, harmony, health, and inclusivity- is a subject of debate. By the end of the class, it should be more apparent that AP, IEQ, and other architecture and building systems-related metrics, data, and analysis are based on two major components in their examination and interpretation. The first component relates to metrics: data, the inputs, and outputs of metrics, quantities, volumes, and other tangible metrics. The second component relates to the cultural context and mindset that narrates to data creates hierarchies and priorities, which primarily impact decision-making and the idea of what constitutes a healthy, fit environment.

Course Organization

Each class will be divided into three sections.

- The first section will be a 45-minute lecture-discussion on the weekly theme (see course schedule)
- The second part will be a semester-long term project analysis of existing regions, cities, neighborhoods, and buildings regarding their design aspects related to air quality.
- The third part will be a 20-40 minute group discussion on subjects related to the presentation and the readings, followed by project-specific "QNA" and exercise analysis.

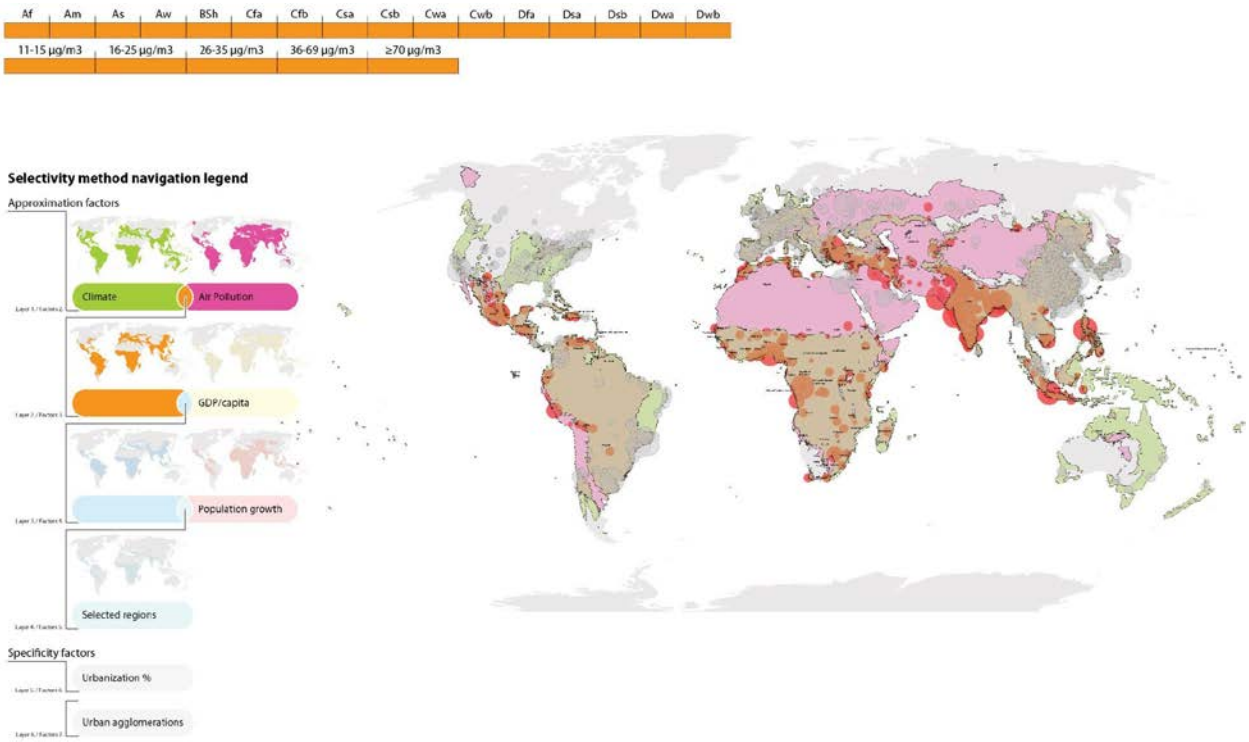

Fig2. Global map of regions that could promote natural ventilation building systems and strategies if there were not prevented by ambient air pollution

Project objectives and outcomes

The term assignment for the United Atmospheres elective class consists of the graphic documentation and analysis of a single building or your studio project. The goal of the assignment is to present an analysis in primarily graphic form which will identify the intentions and values of the architect; the formal strategies by which the building is organized; the roles played (or not played) by the building's technical systems in manifesting those intentions, values, and strategies;

and the ways in which each system performs its nominal tasks. Materials, assemblies, components, and off-site and on-site processes will also be addressed. This work will be performed using construction documents from which the building-structure has been (or will be) produced.

For the purposes of this project, four primary categories of building systems will be considered:

- Structure
- Environmental conditioning
- Exterior envelope
- Interior enclosure

In some cases, a single component may operate as part of more than one of these systems. Each of these systems will be documented and analyzed at three scales:

- Overall configuration
- A partial or intermediate scale
- Details, joints, or connections

The degree of emphasis to be placed on any one of these systems and/or scales may vary, depending on the project analysis and the character of the building itself. The investigations of each system must have substance and coherence on their own terms as well as on the terms of the larger narrative of which they are parts. The visual representation of this investigation should be entirely self-contained and self-explanatory. It should speak for itself through drawings, diagrams, text, photographs, and object models. The primary representational technique to be used will be three-dimensional images of the entire building, its systems (both in isolation and in relation to each other), and detailed conditions. Finally, small devices – appliances or system components will be developed and produced to regulate air quality on a scale that would make their distinctive properties more apparent. More details in the methodologies requirements of production will follow, as long as instructions for the final deliverables.

Course Readings

Gardiner, B. (2019). *Choked: Life and Breath in the Age of Air Pollution*. University of Chicago Press.

Lechner, N. (2015). *Heating, cooling, lighting: Sustainable design methods for architects* (Fourth edition). John Wiley & Sons, Inc.

Banham, R. (1984). *The architecture of the well-tempered environment* (2nd edition). The University of Chicago Press.

Brimblecombe, P. (2003). *The Effects of Air Pollution on the Built Environment* (Vol. 2). Published by Imperial College Press and Distributed by World Scientific Publishing CO.

Burroughs, H. E., & Hansen, S. J. (2011). *Managing Indoor Air Quality* (5th edition). River Publishers.

Digital References

https://www.unep.org/news-and-stories/story/air-pollution-hurts-poorest-most
https://www.unep.org/news-and-stories/story/after-landmark-un-declaration-hope-cleaner-air
https://news.un.org/en/story/2021/09/1099042
https://www.un.org/en/observances/clean-air-day
https://gispub.epa.gov/air/trendsreport/2020/#effects
https://urbanomnibus.net/2021/05/air-grievances/
https://insights.sustainability.google/labs/airquality

Reference texts

Will be online on the google drive file named… and organized by week

Course Meetings

Day / time:	Monday 11:00 am - 13:00 pm
Location:	Avery Hall (Room 505) Additional work-based meetings may be scheduled with the instructor if needed.

Instructor Access

Instructor's E-mail:	theodoridis.andreas@gmail.com
Instructor office hours:	By appointment

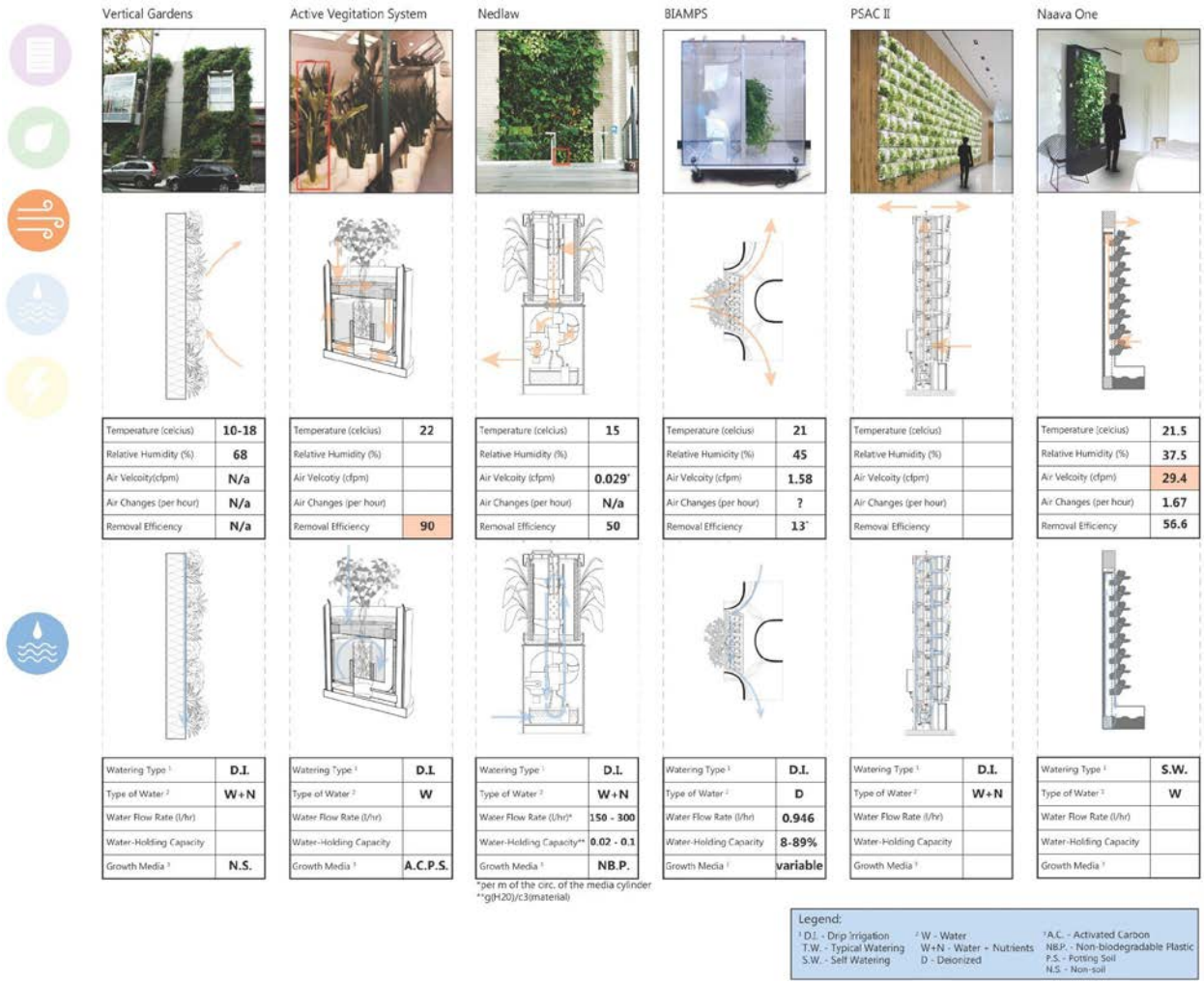

Fig3. Analysis and diagrammatic representation of air pollution bioremediative systems based on energy, air, water requirements, volume materiality adaptability to space, and typology of building structure and other variables.

Student Works Archive

Students will be required to prepare and upload digital versions of select course work to an internet cloud-based online file for archive and future outreach purposes. Work selection, file-naming protocols, and software use will be explained during the semester in time to prepare and upload digital formats of required assets. These may include tiff scans of hand-drawn originals, .jpg images of physical models, .pdf images of plotted or submitted drawings, papers, PowerPoint presentations, etc., or high resolution tif's, jpg's, vid's, or other formats of digital originals (drawings, models, films, etc.) Submittal of requested materials will be considered to be a major part of the grading criteria for this course. Non-submittal will result in the issuing of a "placeholder" grade of "F" until the missing materials are received.

Academic Integrity & Plagiarism

The following is excerpted from the "Honor System" webpage of Columbia University's GSAPP website.

"The Graduate School of Architecture, Planning and Preservation has historically resolved that maintaining academic integrity is the preserve of all members of our intellectual community—including students, faculty and staff. As a consequence, all GSAPP community members must abide by the principles of academic honesty. In this way, we seek to build an academic community governed by our collective efforts, diligence, and Code of Honor. These principles are the cornerstone of educational integrity at Columbia. They also reflect GSAPP's professional obligations of self-regulation. As such each member of this community is expected to uphold such standards and abide by all policies set forth (e.g. plagiarism and appropriate acknowledgment of sources, prerequisites, mandatory workshops, etc.). Academic dishonesty—attempted or actual—will not be tolerated."

For more information, you can also refer to the "Plagiarism Policy" webpage for more details.

Accommodations for Students with Disabilities

If you have a disability and are registered with Columbia University's Disability Services, please use their online system to notify me of your accommodations and discuss your needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with Disability Services, I encourage you to contact them in this email.

Statement of Support for Students' Health and Well-being

I encourage you to take care of your health and wellbeing. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, applying the recommended COVID-19 precautions, avoiding drugs and alcohol, getting enough sleep, and taking some time to relax. This will help you achieve your goals and cope with stress. If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, I strongly encourage you to seek support here: Counseling and Psychological Services (CPS)

Course Schedule

United Atmospheres - Class academic calendar

Week no.	Date	Time	GSAPP academic calendar		First section of the class (45-50 min lectures on the related subjects)
Week 01	Monday, January 16	11am to 1pm	First Day of Classes	Tuesday, January 17	
Week 02	Monday, January 23	11am to 1pm			Air Quality / Air Pollution Basics: What is the difference AQ and AP
Week 03	Monday, January 30	11am to 1pm			Monitoring and Measuring: How we monitor and measure air pollution - Stationary sensors - Portable sensors - Biosensors
Week 04	Monday, February 6	11am to 1pm			Microclimates: Why AQ is important to architects and how it is related to spatial perception
Week 05	Monday, February 13	11am to 1pm			Research approaches: How to establish a research methodology in building science - Form a hypothesis, define variables, conduct tests, evaluate and assess results, organize citation tools
Week 06	Monday, February 20	11am to 1pm	Arch. Midterm Reviews	Monday, February 20 – Friday, March 3	MIDTERM REVIEW: Project Presentations
Week 07	Monday, February 27	11am to 1pm			Guest Lecture: "FutureAir's approach to indoor air data and why design matters!" by Simone Rothman (FutureAir sensing technology)
Week 08	Monday, March 6	11am to 1pm			Standards and Norms: What kind of standards we use globally to characterize polluted air - National standards - International standards - Regulatory agencies
Week 09	Monday, March 13	11am to 1pm	Spring Break	Monday, March 13 – Friday, March 17	
Week 10	Monday, March 20	11am to 1pm			Environmental Inequality: How air quality standards are linked to poverty and affect disenfranchised population groups
Week 11	Monday, March 27	11am to 1pm			Ambient and Indoor Air Quality: Why is indoor and outdoor quality measured, sourced and evaluated in different ways and platforms
Week 12	Monday, April 3	11am to 1pm			Socio-Economic Contexts and Air Pollution: What are the regions with the most intense AP problems globally - What socio-economic factors affecting the intensification of air pollution
Week 13	Monday, April 10	11am to 1pm			Guest Lecture: "Air Quality and urban community-based policies and strategies" by Leonel Lima Ponce (Pratt - GCPE)
Week 14	Monday, April 17	11am to 1pm	Last Day of Architecture Classes	Wednesday, April 19	Building Systems and Air Quality: Contemporary building systems related to Air Quality State and air remediation in vernacular settings
Week 15	Monday, April 24	11am to 1pm	Final Review Week	Thursday, April 20 – Friday, April 28	FINAL REVIEW: Presentation of Final projects
			Last Day of HP, UP, and RED Classes	Monday, May 1	
			Last Day Work Due	Friday, May 5	Submission of final deliverables