

SYLLABUS

BIOSYNERGIES: Bringing the Ecodistrict Vision to Life
Prof. Nancy Yen-wen Cheng

Winter 2012, MWF 1:00-4:50pm, 8 credits

Prerequisites: 4/584 design studios and 4/507 Thesis Prep



Amphibian Carpet by Selah Au, Hims Cheung, Bart Chui, & Lewis Chui

The challenge of this design studio is to develop a clear architectural concept for a building that addresses a thesis inquiry and fits its natural and urban context. From the premise that buildings must function within larger natural and constructed systems, the class will explore design ideas from the **urban** scale (top-down) to the **component** scale (bottom-up). At the **urban** scale, we investigate how the site forces, ecology, culture, and history make each location unique. We will consider how EcoDistrict principles inform the site organization, building massing, movement connections and program distribution. At the **building** scale, we will consider biophilic approaches to healthy environments and use the Autodesk Sustainability Workshop to develop strategies and knowledge for high-performance building design. At the **component** scale, we will use a Biomimicry lens to look how natural structures, organisms and mechanisms can inspire designs that fit specific climatic and ecological conditions. Using the materials and visual textures of each location as inspiration, we will conjecture how a fresh look at connections and components can generate innovative building systems.

The class will challenge students to try new design methods that integrate rational and imaginative thinking in a productive process. Each student must translate site constraints and program requirements into architectural terms, defining the character of the proposed place using qualities of light | dark; dense | open; compressed | open; soft | hard; skeletal | massive; translucent | opaque; layered | cellular; etc. Students will

LEARNING OBJECTIVES

- Develop a robust design process through iterative creative experimentation and rational evaluation
- Design with nature, considering Ecodistrict, Biophilic and Biomimetic principles
- Demonstrate competency in National Architectural Accreditation Board's student performance criteria
- Develop communication skills for engaging others in architectural design ideas

NATURE AND ARCHITECTURE

Think critically about the relationship of the built and the natural environment, considering on-site resources (i.e. sun, wind, water, vegetation), the building's requirements and existing resource flows. Using the Biomimicry approach, reflect on how natural strategies or metaphors can spur design innovations such as:

- Strategies for capturing rainwater,
- Shielding or welcoming solar exposure
- Efficient structural solutions

For EcoDistrict synergy, can your building contribute to or benefit from what is happening on adjacent sites? Move between scales of the city, district, building, room and architectural details so that discoveries at one scale can inform the others.



Section through a christmas rose leaf showing round chloroplasts from Michael Hensel's (Synthetic) Life Architectures: Ramifications and Potentials of a Literal Biological Paradigm for Architectural Design, Architectural Design journal, v.76 no.2, p. 20

Every site context possesses unique spatial conditions that give cues to a thoughtful design. This studio heavily emphasizes constant design explorations through **sectional studies**. A design process utilizing site sections will reveal the spatial relationship between the inhabitants, built forms and nature. For example, in a seaside site, the movement of the waves and the shifting tide has implications for horizontal and vertical movement. Mapping the 10-, 25- and 50-year flood lines in plan and section can provide marks on the landscape that can be a starting point for a design that ties to natural phenomena.

While the project should be anchored in reality, actual constraints can act a point of departure for the imagination. The site needs to be documented through sections, plans, a physical model and a digital model that will necessarily abstract the on-the-ground conditions. Design ideas will be created by making intelligent assumptions based on available and then establishing clear design parameters.

PROCESS

FOSTERING DESIGN DEVELOPMENT

The class will consider what is innovation, how design processes can stimulate creativity, and how to refine and communicate design ideas. Students will be encouraged to try new approaches and set a personal agenda for honing specific design skills. A structure of weekly themes, scheduled charrettes and assignments will give unity to the individual explorations and maximize dialogue.

Students will be encouraged to generate explore design alternative to understand implications and develop the best option. Designers need to efficiently create 3D sketches and study models in order to consider extremes and find the boundaries of possibilities. The studio will encourage initial development through physical means: lots of sketches on trace paper and quick models to foster fast ideation. As the ideas progress, digital studies will be important for studying, refining and communicating the work.

Class time will be used for presentations, individual desk crits, small group discussion, internal pin-ups and formal reviews. Each student needs to take responsibility for pushing boundaries in design exploration and production.

REQUIREMENTS AND EVALUATION

Students are expected to come to all classes prepared and on-time. Fulfilling assignments in a complete and timely manner is critical to academic advancement, and critical for professional practice. Pinups and reviews serve as benchmarks to evaluate competency and readiness for the next phase.

ANALYTIC BLOG WRITING: Along with presentations, the student blog provides an opportunity to demonstrate competency at architectural design to an external audience. Writing thoughtful, concise (~200 words) notes on your blog about your progress, challenges, questions and next steps will help your instructors and peers respond to your needs. This is your opportunity to develop a professional network to provide feedback on your work. You can make specific entries private with our common password. Every student will have a minimum of six posts on their blog for Winter term, with a summary of each pinup and review.

FINAL DOCUMENTATION: The end of the term, a project presentation summary as an Adobe PDF file plus a **3 minute video introduction** must be accessible from the course website.

At the end of the Winter Term, the project's urban design and architectural conceptual design exploration should be completed at the level of an excellent comprehensive 4/584 studio project. A quality Winter Term project delivery sets a strong foundation developing the tectonics and building systems in the Spring term. By the June final review, all UO terminal studio projects must successfully address these National Architectural Accreditation Board's student performance criteria:

B. 1. Pre-Design: Ability to prepare a comprehensive program for an architectural project, such as preparing an assessment of client and user needs, an inventory of space and equipment requirements, an analysis of site conditions (including existing buildings), a review of the relevant laws and standards and assessment of their implications for the project, and a definition of site selection and design assessment criteria.

B. 3. Sustainability: Ability to design projects that optimize, conserve, or reuse natural and built resources, provide healthful environments for occupants/users, and reduce the environmental impacts of building construction and operations on future generations through means such as carbon-neutral design, bioclimatic design, and energy efficiency.

B. 6. Comprehensive Design: Ability to produce a comprehensive architectural project that demonstrates each student's capacity to make design decisions across scales while integrating the following SPC:

A.2. Design Thinking Skills

A.4. Technical Documentation

A.5. Investigative Skills

A.8. Ordering Systems

A.9. Historical Traditions and Global Culture

B.2. Accessibility

B.3. Sustainability

B.4. Site Design

B.5. Life Safety

B.8. Environmental Systems

B.9. Structural Systems

C. 1. Collaboration: Ability to work in collaboration with others and in multidisciplinary teams to successfully complete design projects. (The department will provide resources for terminal studio faculty to bring in consultants who can work with studios and provide students with the opportunity to collaborate with experts from other disciplines)

C. 6. Leadership: Understanding of the techniques and skills architects use to work collaboratively in the building design and construction process and on environmental, social, and aesthetic issues in their communities.

SPECIAL NEEDS

In the first week of class, students should alert the instructor of any requirements for an optimal learning situation.

STUDENT CONDUCT

All students are required to familiarize themselves with the UO Student Conduct Code (<http://conduct.uoregon.edu>) and follow academic honesty, copyright and fair use requirements. (http://w2.eff.org/IP/eff_fair_use_faq.php)

STUDENT ENGAGEMENT INVENTORY

Activity	Undergrad	Grad
Course attendance	113	113
Assigned Readings	18	18
Design homework	80	108
Writing assignments	10	15
Field work / experience	7	14
Independent Research	12	20
Total hours:	240	288

GRADUATE STUDENTS

Graduate students are expected to research and develop their work more thoroughly than undergraduates by spending more time and by using prior educational and professional experience. This will be reflected in stricter standards for grading graduate students as well as differences in specific requirements.

MATERIAL STUDY: Graduate students are required to give a verbal and visual presentation about a structural system or finish material relevant to their project. The material should relate to the site through a conceptual metaphor, visual properties or local origin. The report should describe design considerations, showing cutting-edge aesthetic possibilities and summarize technical constraints. The latter should explain performance characteristics, such as structural properties, and give an overview of assembly methods. It could provide background such as how the manufacture of the material shapes standard units or describe how new fabrication and assembly technology is changing contemporary practice. The report will be **posted online** with citations.



Material Report deadlines:

Outline Wed 1/23

Draft Report Wed 1/30

Present Final Report Wed 2/6

Catalan vaulting, Mapungubwe Interpretive Centre, South Africa by Michael Ramage, John Ochsendorf & others.
http://www.atdforum.org/IMG/pdf_RamageATDF2010.pdf

WEEKLY SCHEDULE

1 1/7-11	<p>DESIGN WITH NATURE</p> <p>1) Investigate the local eco-system and micro-climate to find vulnerabilities and threats. Identify resources and waste streams. 2) Examine how one organism thrives to reveal strategies for architectural design.</p> <p>Reading: Gruber. Recommended: Biomimicry.net, Lim, Hensel, Benyus BPAC: Climate Analysis <i>to understand what passive strategies are most appropriate.</i></p>
2 1/14-18	<p>SITE / LANDSCAPE DESIGN</p> <p>Develop role of building in city and nature through design criteria and conceptual metaphors. Develop natural (Green) and built (Grey) networks. Check codes. Create, test and document how solid / void options work with sun, wind, water and greenery.</p> <p>Reading: Girling & Kellett. Recommended: McHarg, Sporn BPAC: Sun and Shadow Studies (<i>foundation for the solar loads and daylighting topics</i>) BPAC: Wind Analysis (<i>how to use wind and natural ventilation to inform your design</i>)</p>
3 1/23-25	<p>FUTURE FORWARD: Case study</p> <p>Imagine utopian and dystopian prospects for nature and the city. Analyze an innovative project that addresses a key issue, w principles and approaches. <u>Material outline due 1/23.</u></p> <p>Reading: Holcim awards. Recommended: Rising Water, Design for the Other90%, Archiprix ---- REVIEW SITE DESIGN ---- Friday Jan 25 or Monday Jan 28</p>
4 1/28-2/1	<p>ORGANIZATION: Study how structure can generate form, generating a spatial order that expresses the architectural concept. <u>Material draft due 1/30.</u></p> <p>Reading: Allen Form & Forces. Recommended: Active Statics, Laseau, Maki, Zumthor BPAC: Conceptual Energy Analysis (CEA) (<i>whole building analysis</i>) BPAC: Energy Loads (<i>how the climate impacts a building and how that informs the design</i>)</p>
5 2/4-8	<p>TECTONICS: Investigate how material properties, components and connections can generate a building system. Graphically analyze a precedent. <u>Material Presentations 2/6.</u></p> <p>Reading: Rice. Recommended: Menges, Borden, Oxman</p>
6 2/11-15	<p>FACADE: Explore how the building presents its urban identity to the public and mediates the indoor-outdoor relationship. Iteratively create variations or develop a parametric definition. Develop images to scale with shadows.</p> <p>BPAC: Solar Loads Analysis (<i>solar radiation analysis for passive heating and cooling</i>)</p>
7 2/18-22	<p>Facade Kit of Parts: Zoom-in to show how the construction can bring together structure, enclosure, and light, considering material qualities. Model a corner of your building that includes floor, ceiling, walls and aperture. Show the system in context w 3D diagrams.</p> <p>Reading: Ford ---- REVIEW - Friday Feb. 22</p>
8 2/25-3/1	<p>SPACE + TIME: Show site evolving over time in terms of the architectural character and ecosystem development through sequential views or animation. Render perspective images with light and color to show daily and seasonal changes through user eyes.</p> <p>BPAC: Daylighting</p>
9 3/4 -8	<p>INTEGRATION & COMMUNICATION: Urban, building and materials together. Dress rehearsal for refining visual and verbal communication. 3-minute elevator talk for website.</p>
10	<p>---- Review FINAL ---- tentatively Wed Mar 13</p>
11	<p>Final PDF project summary and 3-minute video must be posted by Monday, March 18. Exit Interviews.</p>

BIBLIOGRAPHY

Searchable annotated weblinks at <http://www.diigo.com/user/nywcheng>

• **ARCHITECTURAL THEORY**

Frampton, Kenneth and John Cava, Studies in Tectonic Culture. Cambridge, MA: MIT Press. NA642 .F72 1995

Maki, Fumihiko, Nurturing Dreams: collected essays on architecture in the city. Cambridge, MA: MIT Press, 2008. NA1559.M24 A35 2008

Zumthor, Peter, Thinking Architecture, Birkhauser, 2006 NA1353.Z86 A35 2010

• **ART & ENVIRONMENTAL PERCEPTION**

Eliasson, Olafur and SF MoMA et. al. Take your time : Olafur Eliasson. San Francisco ;New York: San Francisco Museum of Modern Art ;;Thames & Hudson, 2007.

• **GREEN BUILDINGS**

Autodesk Building Performance Analysis Certificate using the Sustainability Workshop.

<http://sustainabilityworkshop.autodesk.com/bpac>

International Living Futures Institute, The Living Building Challenge. <https://ilbi.org/lbc/standard>

• **BIOMIMICRY & BIOPHILIA**

Ball, Philip. The Self-Made Tapestry : Pattern formation in Nature. Oxford University Press, 1999. QH491 .B35 1999

Benyus, Janine. Biomimicry: Innovation Inspired by Nature, Harper Perennial, 2002. T173.8 .B45 2002

Eggermont, Marjan et. al., Zygote Quarterly. Online Biomimcry journal <http://zqjournal.org/>

Marcus, Claire Cooper, Healing Gardens: Therapeutic Benefits and Design Recommendations.

http://books.google.com/books/about/Healing_Gardens.html?id=YRY1WejQok8C

Kellert, Steven and Judith Heerwagen, Martin Mador. Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life, Wiley, 2011.

http://books.google.com/books?id=FyNer_nQrW4C

Lim, Joseph, Bio-structural analogues in architecture, Amsterdam : BIS Publishers, c2009. NA2543.B56 L55 2009

• **BUILDING TECTONICS**

Allen, Edward and Waclaw Zalewski. Shaping Structures: Statics. Wiley,1998. TA648 .Z35 1998

Allen, Edward and Waclaw Zalewski. Form and Forces: Designing Efficient, Expressive Structures. Wiley, 2009. <http://bks6.books.google.com/books?id=IGIWtYc5NO0C>

Ford, Edward R. The details of modern architecture. MIT Press, 1990 NA2840 .F67 1990 v.1 & 2 <http://books.google.com/books?id=ExLGeB05GosC>

Greenwold, Simon. Active Statics. Interactive website for Allen & Zalewski's Shaping Structures: Statics. <http://acg.media.mit.edu/people/simong/statics/data/>

Rice, Peter. An Engineer Imagines, Artemis, 1998. TH140.R5 E44 1994

• **CODE COMPLIANCE**

Oregon Structural Specialty Code 2012

http://ecodes.biz/ecodes_support/free_resources/oregon/10_structural/10_orstructural_main.html

Allen, Edward & Joseph Iano. Architect's Studio Companion: rules of thumb for preliminary design Wiley. 2012 e-book available via UO Library.

<http://books.google.com/books?id=CyjCm2RGkawC>

• **DIGITAL + PHYSICAL DESIGN METHODS**

Architectural Design journal, London: (illustrated full-text PDF's online via UO Library)

- Hensel, Michael and Achim Menges and Michael Weinstock.,. NA2750 .M655 2006

Hensel, Michael and Achim Menges and Michael Weinstock., Versatility and vicissitude : performance in morpho-ecological design, London : Wiley, 2008. NA2542.35 .V47 2008

- Gissen, David. Territory: Architecture beyond Environment, April 2010, v.80 no.3.

- Menges, Achim. Material Computation – Higher Integration in Morphogenetic Design, v.83 no.2 Wiley, 2012.

- Oxman, Rivka and Robert Oxman. The New Structuralism: Design, Engineering and Architectural Technologies, July-Aug 2010, v.80 no.4.

- Spiller, Neil and Rachel Armstrong, Protocell Architecture, March 2011, v. 81 no.2

Borden, Gail Peter and Michael Merideth (eds.), Matter: Material Processes in Architectural Production. Routledge, 2011. ISBN-13: 978-0415780292

Fox, Michael, and Miles Kemp. Interactive Architecture. New York: Princeton Architectural Press, 2009. <http://www.interactive-architecture.com/>. NA2543.T43 F69 2009

Hensel, Michael and Achim Menges and Michael Weinstock. Emergent Technologies and Design: Towards a Biological Paradigm for Architecture, Routledge, 2010. NA2543.T43 H46 2010

Iwamoto, Lisa. Digital Fabrications: Architectural and Material Techniques, Princeton Architectural Press, 2009. NA2728 .I93 2009

Laseau, Paul. Graphic Thinking for Architects and Designers. Wiley, 2001. NA2705 .L38 2001 <http://books.google.com/books?id=KRCyqDjYsIAC>

• **LANDSCAPE & URBAN DESIGN**

Girling, Cynthia and Ronald Kellett, Skinny Streets and Green Neighborhoods: Design for Environment and Community, Island Press, 2005.

McHarg, Ian. Design with Nature. Natural History Press, 1969. HC110.E5 M33 1971

Meinig, D.W. "The Beholding Eye: Ten versions of the Same Landscape" in Meinig, D.W. and John Brinckerhoff Jackson The Interpretation of Ordinary Landscapes: Geographical Essays. New York : Oxford University Press, 1979 GF90 .I57

Oppenheimer, Michael and Barry Bergdorf and Judith Rodin: Rising Currents: Projects for New York's Waterfront, New York: Museum of Modern Art, 2011. Videos: <http://www.moma.org/explore/multimedia/videos/92>

Spirn, Anne Whiston. The Language of Landscape, Yale, 1998. SB472 .S685 1998

Trancik, Roger. Finding Lost Space, New York: Van Nostrand Reinholdt, 1986. NA9031.T73 1986

Lynch, Kevin. Site Planning. Cambridge, MA: MIT Press, 1984. NA2540.5.L9 1984 <http://books.google.com/books?id=arS3vn6DfYIC>