ARC 4901/5901: Topical Studies in Computational Design: Digital Architectures
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Ornaments and Patterns

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DESCRIPTION

A product or a form can be specified in a variety of ways. Commonly, we describe geometric properties, as we usually do in drawings. Thus, a teapot, a building, a stair can be explained, depicted and constructed. Alternatively, we might describe the behaviours we wish to observe; this we typically do in performance specifications. For example, we might write in a building specification that the "floor tiles are to be of a non-slip type".

It is possible also to describe properties as relationships between entities. In a spreadsheet, you an specify the value of a cell to be the result of a calculation of other cell entries - the weight of a panel is found by multiplying the length, width and height by the density of the material.

These calculations do not have to be explicit. Responsive materials change their properties in reaction to the conditions around them. A thermostat will sense air temperature and control the flow of electric current and hence temperature of supply air. Other materials can be induced to change their properties, for example, electro-chromic glass can be changed from opaque to transparent by manipulating the electric charge. Using such techniques, artists have created reactive sculptures and architects have made sentient spaces, spaces that react to the occupant or other factors. Lights turn on if lux levels fall below a threshold; ventilation starts and stops according to need; walls move as users change location.

Using parametric (computer) design tools, we can create links to a variety of data and use these to generate geometric form. These descriptions can then be used directly in the manufacture of objects by means of e.g. digitally controller devices. When designing architectural space, it is usual to collect some data, from research or from assumptions, of the type of architectural qualities desired. Performance requirements for architectural places can be written, linking the description of the architectural space to experiential, financial, environmental or other factors.

OBJECTIVES

The aim of this course is for participants to become eloquent in the use of parametric architectural design techniques. Participants shall be able to explore ideas, analyze data, present and communicate design concepts electronically in an elegant and aesthetic manner by exploring a variety of parameters of their design.

Participants who complete this course will have a broad knowledge of various architectural design computing instruments and techniques. They will have sufficient practical skills allowing them to immediately apply in design studios and other courses. Fabrication, building information modelling and exhibitions are fields to which this course will contribute with basic knowledge to facility the needs of current architectural environments.

ORNAMENTS AND PATTERNS

OVERVIEW

Innovations in design technologies allow for the departure from stoic Cartesian organizations to the exploration of organic geometries. Design, once restricted by the limitations of traditional tool-sets and the tendency to implement top-down conceptual methodologies, where one over-arching idea drives development from generic to specific, becomes, as well, an organic process. Digital generative processes based on dynamic systems and parametric explorations present new territories for formal and tectonic innovation.

The development of component systems involves an intrinsic understanding of the driving structural logics generating form. Repetition and variation of a specific moment or series of moments become systems become networks. The resultant mutations and idiosyncrasies of the component/system/network enrich a complex surface condition where qualities of performance and ornamentation occur in simultaneity – we will refer to this phenomenon as *integral ornament*. The continuous topological variation throughout the system performs as an index of the process and as a prescription for the generation of larger-scale formal conditions.

Integral ornament operates and informs from the micro, dictating through its particular geometric and topological systems the form of the macro, blurring transitions between otherwise distinct scalar conditions and forming a singular whole from a dense heterogeny of continuous variation. The continuous topological variation throughout the system performs as an index of the process and as a prescription for the generation of larger-scale formal conditions.

By employing a conceptual understanding of the scalar and performative translation between component-system-network as a working methodology for the course, we can create a design that is rich in both density and beauty. In terms of process, the components developed will, through their base geometric logics and operating from the micro-scale, prescribe the development of the system. The propagation of this developed system would then, in turn, become the network. This is a simplistic way of understanding a process for generating digital design; however, it offers a clear and direct set of relationships for understanding a design paradigm based primarily on technique, in contrast to a more conventional top-down conceptual paradigm.

SYSTEM THROUGH PATTERN

Ornament meaning not only surface qualified by human imagination but imagination giving natural pattern to structure… integral ornament is the developed sense of the building as a whole, or the manifest abstract pattern of structure itself.

Ornament meaning not only surface qualified by human imagination but imagination giving natural pattern to structure… integral ornament is the developed sense of the building as a whole, or the manifest abstract pattern of structure itself. […] Interpreted. Integral ornament is simply structure pattern made visibly articulate and seen in the building as it is seen articulate in the structure of the trees or a lily of the fields. It is the expression of inner rhythm of form." By Frank Lloyd Wright, The Natural House

This is to be the first phase of a three-part project, each stage adapting and reconfiguring the explorations of the last. Through the first project, we will develop a component; the second stage will entail the propagation and deformation of that component in the design of a pattern-system. In the third stage, we will fabricate the component for exhibition.

Through this exercise, we will achieve a thorough grasp of basic modeling technique, develop a lexicon for communication on complex geometric forms and be introduced to the nuances involved in the conversion of the digital to the physical.

COURSE FORMAT

There will be interactive seminars or lectures introducing theoretical or practical concepts and ideas followed by practical demonstrations or tutorials of related computer applications. Hereby participants undertake in-depth studies of aspects of the topic of their interests and present their expertise to their colleagues. Participants are expected to supplement lectures and tutorials by completing the relevant software tutorials on their own. Learning goals are reached via self- and peer-learning following academic standards in Higher Education.

This course focuses on the use of *Digital Project, CATIA, Generative Project, ParaCloud* or *Rhino/Grasshopper* as a means of design creation and design thinking. Digital Fabrication (milling, 3d Printing, vacuum forming, laser-cutting, etc) will test the virtual concepts in reality. To assist you in your self-and peer-learning software-tutorials offered. These are voluntary and outside of the course realm.

DESIGN BLOGS

You shall maintain and actively contribute to the online learning platform Facebook: http://www.facebook.com/group.php?gid=127036227345505. This site is for the following purposes:

- The blog allows peers & tutors to comment upon and discuss the progress of your design work in- & outside of teaching hours
- Writing and posting on your blog develops your skills necessary for presenting and reflecting on your work
- The blogs acts as social intelligence and aids peer-learning to inspire and support each other
- Blog postings could be structured around the following points:
    1. What have you been doing?
    2. Why did you do this?
    3. What are the results?
    4. Discuss or write down your thoughts.

FIELD TRIP

Essential part of the course and its learning outcomes is the understanding of computer-aided fabrication. This will be explored in two field-trips.

Trip 1: The first one visiting a factory in Guangzhou that produces large-scale building elements and parts, and how these are applied in a building.

Trip 2: The second explore CNC, RP and other machines within higher educational and research setting (tbc).

CONFERENCE

To embed the learning outcomes in the larger context of the architectural profession the course will arrange participation in the annual *Building Information Modelling (BIM) Conference,* hosted by *Hong Kong Institute of BIM.* Details will be posted in due course.

SCHEDULE

Phase 1: Identify design parameters, dependencies, and rules.
Phase 2: Model and illustrate your vision using parametric instruments
Phase 3: Produce a design that is based on and shows your parametric design language
Phase 4: Curate and set-up a small exhibition that showcase the outcomes as leading architectural design.

Week	Date	Topic	Deliverable
2	Mon 13/9	**Lecture 1: *Introduction to Parametrics*** *MAS*	
	Sat 18/9	Rhino / Grasshopper Tutorials *SC & JB*	
3	Mon 20/9	**Lecture 2: *Super Surfaces*** by *Paul Mui (AEDAS)*	
	Sat 25/9	Rhino / Grasshopper Tutorials *SC & JB*	
4	Mon 27/9	**Presentation 1**	Phase 1
	Wed 29/9	**Guest-Lecture 1: Bodies in Formations** Andrew Kudless	
	Sat 2/10	Rhino / Grasshopper Tutorials *SC & JB*	
5	Mon 4/10	Lecture 3: *(tbc)*	
	Sat 9/10	Rhino / Grasshopper Tutorials (tbc) *SC & JB*	
6	Mon 11/10	**Field-Trip 1:** Guangzhou – Fabrication	
7	Mon 18/10	**Lecture 4: *Smart Wallpaper*** by *Paul Mui (BREAD studio)*	
8	Mon 25/10	**Presentation 2**	Phase 2
9	Mon 1/11	**Lecture 5: *Parametric Realities*** *by Uli Blum (Gehry Technologies) (tbc)*	
	Fri 5/11	**Guest-Lecture 2: *Plastic FORM*** *by Greg Lynn (at HKU)*	
10	Mon 8/11	Field-Trip 2: HKU/PolyU *(tbc)*	
11	Mon 15/11	**Lecture 6: *Fabrication*** *by Stefan Krakhofer (tbc)*	
12	Mon 22/11	**Presentation 3**	Phase 3
	Fri 26/11	**BIM Conference** *by HKIBIM.org*	
13	Mon 29/11	**Exhibition**	Phase 4

ASSESSMENT SCHEME

The final grade will be determined using the average of the four phases of the course. Each phase weights the same:

- Timely and successful completion of phase (80%),
- Contribution to the course and its participants (20%).

All work will be judged based on

- Content (40%)
- Graphic/architectonical quality (40%)
- Technical mastery (20%)

To receive a passing grade, students must

- Successfully complete all phases with >49.99%

According to University Policies, the overall performance of the class will be distributed and adjusted with the *'Gaussian Normal Distribution'.*

REFERENCES

General readings to the topic are summarised at: http://digitalics.tk

Periodicals

AD: Elegance, ed., Ali Rahim, 2007.
AD: Collective Intelligence in Design, eds., Christopher Hight and Chris Perry, 2006.
AD: Techniques and Technologies in Morphogenic Design, ed.,Michael Hensel, 2006.
AD: Programming Cultures, 2006.
AD: Emergence: Morphogenetic Design Strategies, ed., Michael Hensel, 2005.

AD: Architecture and Science, 2001.
AD: Contemporary Techniques in Architecture, 2002.
AD: Versioning, 2002.
Michael Speaks, "Design Intelligence: Thinking in Architecture After Metaphysics," *AD: Versioning*, ed., SHOP, October 2002.
Jeffrey Kipnis, "Toward a New Architecture," *Folding in Architecture*, ed., Greg Lynn (London, 1993), 41-49.
Greg Lynn, "Architectural Curvilinearity: The Folded, The Pliant and the Supple,"*Folding in Architecture*, ed., Greg Lynn (London, 1993), 8-15.
Greg Lynn, "In the Wake of the Avant-garde," *Assemblage 29* (1996), 116-125.

Books

Aranda/Lasch, *Tooling*, 2006.
Bernard Cache, *Earth Moves: The Furnishing of Territories,* 1995.
James Corner, *Taking Measures Across the American Landscape,* 2000.
Ernst Haeckel, *Art Forms in Nature: The Prints of Ernst Haeckel*, 1996.
Alicia Imperiale, *New Flatness: Surface Tension in Digital Architecture*, 2000.
Branko Kolarevic, *Architecture in the Digital Age: Design and Manufacturing*, 2003.
Sylvia Lavin, "What You Surface Is What You Get," *Log*, 2003.
Greg Lynn, *Animate Form*, 1999.
Ellen Lupton, *Skin*, 2002.
Reiser + Umemoto *Recent Projects* 1998
Joseph Rosa, *Next Generation Architecture: Folds, Blobs, and Boxes*, 2003.
Tomoko Sakamoto, *Yokohama Project* (FOA), 2003.
Edward R. Tufte, *Envisioning Information*.

Catalogs

Matthew Barney, The *Cremaster Cycle*, 2002.
Zaha Hadid and Patrick Schumacher, *Latent Utopias*, 2003.
Jeff Kipnis and Annetta Massie, *Mood River*, 2002.
Greg Lynn, *Intricacy*, 2003.
Frederic Migayrou, *Non-Standard Architecture*, 2004.
Frederic Migayrou and Marie-Ange Brayer, *Archilab: Radical Experiments in Global Architecture*, 2001.
Roxy Paine, *Second Nature*, 2003.
Joseph Rosa, *Figuration in Contemporary Design*, 2007.
Joseph Rosa, ROY *Xefirotarch/design series 4*, 2006.

Precedent

Aranda/Lasch, New York
Asymptote (Hani Rashid), New York
Cecil Balmond, London
Tord Boontje, France
Foreign Office Architects (Farshid Moussavi and Alejandro Zaera Polo), London
Gage / Clemenceau, New York
Zaha Hadid, London
Herzog and de Meuron, Basel
Victor Horta (1861-1947)
KOL/MAC (Sultan Kolatan and Bill MacDonald), New York
LOT-EK, New York
Enrique Miralles (1955-2000)
Ocean North, Frankfort/London/Oslo/Rome/Sydney/Tel Aviv
PATTERNS (Marcelo Spina and Georgina Huljich), Los Angeles
Quaviarch (Paul Preisner), Chicago
ROY (Lindy Roy), New York
UN Studio, Amsterdam
Xefirotarch (Hernan Diaz-Alonso), Los Angeles

www

Software Manuals and Tutorials This is the very basic, dry but useful.
http://www.arch.cuhk.edu.hk/server1/staff1/marcaurel/references/

http://digitalics.tk	General Readings
http://area.autodesk.com/	Autodesk 3D Modelling/Animation Community
http://students.autodesk.com/	Student Community Site
http://www.gtwiki.org/mwiki	gtwiki, the Digital Project Collective Intelligence Hub
http://wiki.mcneel.com/rhino/home	wiki , Rhino, Grasshopper
http://www.grasshopper3d.com/	Grasshopper plugin for Rhino 3D
http://www.rhino3d.com/	Rhinoceros Modelling

IMPORTANT NOTE TO STUDENT:

Attention is drawn to University policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details may be found at http://www.cuhk.edu.hk/policy/academichonesty/ . With each assignment, students will be required to submit a statement that they are aware of these policies, regulations, guidelines and procedures.

Sep 3, 2018 - Explore Gonobobel's board "Ornaments and Patterns", followed by 672 people on Pinterest. See more ideas about Textures patterns, Prints, Pattern.Â Anonymous, French, 20th century | Panel with a Pattern of Sunrises and a Central Blue and White Striped Band | The Met. Panel with a Pattern of Sunrises and a Central Blue and White Striped Band, from a group of 158 textile designs from an unidentified French designer. Download 54,751 ornament pattern free vectors. Choose from over a million free vectors, clipart graphics, vector art images, design templates, and illustrations created by artists worldwide!Â ornament pattern Vector. - 54,751 royalty free vector graphics and clipart matching ornament pattern.