DIGITAL PROVOCATIONS
http://digitalprovocations.wordpress.com

PREMISE

This course will investigate how digital technologies are transforming the practice of architecture.

At a time when architects have a wide array of new digital tools at their disposal, there are—as in any period of rapid technological innovation—conflicting notions of how the new technology should be implemented, and to what end. This course, a hybrid seminar/studio, will use an array of tools to explore the possibilities and potentials and pitfalls of integrating digital processes into architecture.

This course will focus primarily on techniques of parametric design. Parametric design can loosely be defined as implementing a relational model that is able to both accommodate and produce dynamic factors within the design process. At the core of this concept is the idea that the computer can help us analyze, manage, calculate, represent, and communicate large amounts of information—and seamlessly incorporate that information into the design process. It is, on the most basic of levels, an informational approach to design. Whether applied to structural logics, detailing methods, or performative strategies of ornamentation, parametric design tools can enable the architect to have new and unprecedented levels of control over parts of the design and fabrication process that previously were left to others. But it also requires knowledge and grounding in fields as diverse as computer programming and network theory, areas that perhaps traditionally were seen as outside the discipline but that are now central to contemporary architectural production. The goal of this seminar is to formulate an understanding—through reading, writing, modeling, and fabricating—of how such a digital paradigm works, and what it could possibly mean for architecture.

COURSE STRUCTURE / MODES OF INQUIRY

We will operate under the assumption that in order to adequately critique the role of digital processes in architectural design, one must first understand and master those processes. Accordingly, the class will have two parallel components: a critical inquiry into contemporary architectural and cultural strategies of digital design, and a hands-on studio that will develop a full range of digital design and parametric modeling techniques. The design component will intensively utilize the School’s Digital Fabrication Laboratory to test the material, spatial, and architectural implications of the digital studies.

Readings for seminar discussions will range from historical texts on network theory to contemporary discourse on digital architectural design to broader cultural examples of a digital mindset (economic, scientific, artistic, etc.). Throughout the course of the semester, students (in pairs) will research and present a contemporary architectural example of parametric design, explaining its process but also critically assessing it for cultural and historical relevance. Each student will be responsible for presenting one assigned reading during the seminars throughout the semester. Students will also be expected to contribute regularly to the class blog and are encouraged to use the blog as an informal venue for discussion, provocation, and speculation.

Parallel to the seminar component, we will also be developing a catalog of digital design techniques, primarily through experimenting with our own parametric, relational models. We will utilize the Rhino 3D software package and the Grasshopper plug-in, which provides an intuitive, graphic interface for creating dynamic, parametric models from simple relationships between objects within the three-dimensional Rhino environment. The priority will not be using the software to represent, but rather using it to generate. The format will be similar to a design studio, with desk-crits, regular pin-up discussions, and reviews for final presentations. There will be weekly exercises, each of which will focus on a specific method of parametric modeling. As the semester progresses, we will begin to translate the virtual models into physical constructions using the laser cutter, and students will learn how this process of translation, by addressing issues of tolerance, scale, and materiality, can feedback into the design of the model itself. Three separate design projects throughout the semester will tackle specific challenges related to how digital tools can facilitate this feedback loop.

All digital and physical model studies will be documented throughout the semester and posted regularly by each student on the blog.
PREREQUISITES

No previous knowledge of Grasshopper is required, but familiarity with Rhino and AutoCAD is encouraged. Basic knowledge of AutoCAD, Adobe Photoshop, Adobe Illustrator, & Powerpoint is expected.

LEARNING OBJECTIVES

At the end of this course, students should be able to:
1. Understand the historical and theoretical contexts for the use of digital technologies in the architectural design process.
2. Use Grasshopper to generate rich, fully parametric models.
3. Work seamlessly between 3D and 2D software to produce output for the laser cutter. This translation between digital and physical should demonstrate an understanding of materiality, scale, and tolerance.
4. Communicate design intent verbally and visually, using drawings, diagrams, and models that clearly articulate goals and process.
5. Formulate individual, clear positions with regard to the role digital technologies can and should play within architectural design.

COURSE REQUIREMENTS

+ Case Study presentation: Presentation (with a partner) of a contemporary architectural project that incorporates digital processes in its design process. Students will select from a given list of projects and will give a 10-15 minute PowerPoint presentation showing a full understanding of the design process, how it relates to specific performance criteria, and how technology has impacted the fabrication and construction process. Presentations should be not just descriptive, but also critical, with the goal of stimulating seminar discussion and debate.
+ Weekly reading: Students will be expected to complete each assigned reading and to post responses and/or questions to the blog prior to the start of the seminar session.
+ Presentation of assigned reading: Each seminar session will be led by a team of two students who will be tasked with presenting the week’s readings and leading the class discussion.
+ Project 1: Material Parameters. Through a highly iterative process, students will develop a system of operations (cutting, perforating, scoring, etc.) to be applied to a generic 2D material using the laser cutter. Through rigorous testing, students will catalog how these operations enable the 2D material to transform and take on new material qualities.
+ Project 2: Reverse Engineering. Students will design an analog component, model it in the Grasshopper environment, and array the unit into a field condition. The component will then be reverse engineered parametrically so that the field becomes a working relational model that can accommodate dynamic, variable behaviors. Physical iterations will be digitally fabricated.
+ Final Project: Students will design, fabricate, and build an assembly of components at an architectural scale that demonstrates an understanding of tolerance, scale, detail, and materiality in the translation from digital to physical. Parametric variation will be incorporated such that each project engages in both the quantitative and qualitative aspects of design.
+ Regular postings to the class blog, to include weekly responses to readings, weekly modeling assignments, progress images of midterm and final projects, and miscellaneous musings on digital design.

EVALUATION

Standard expectations for full attendance and completion of all assignments apply. Grades will be based upon a combination of the three design projects, participation both in seminars and workshop critiques, and a general commitment to engaging in debate and discussion about the subject matter. Grading will be as follows:

10% Case study presentation
10% Reading presentation
15% Project #1
15% Project #2
25% Final project
25% Class participation & blog contributions
SCHEDULE

The class will meet on Tuesdays and Thursdays from 2:30pm to 5:30pm. Tuesday sessions will begin with seminar discussions and will end with informal group review of progress on the design projects. Thursday sessions will consist of tutorials and design critiques.

SYLLABUS

[* = optional readings]

September 6  INTRODUCTION
September 8  Lab Workshop #1: Grasshopper Introduction
Prior to Class:  1. Read Grasshopper Primer pages 1-35 and familiarize yourself with the sample files that can be downloaded with the Primer.
2. For those unfamiliar with Rhino, complete the "Flashlight" and "Rubber Duck" Rhino tutorials (access via Help menu). Familiarize yourself with the Rhino modeling interface. Complete "Getting Started" Tutorial on Design ReForm: http://designreform.net/2008/06/23/rhino-getting-started/

[PART ONE: ROOTS OF DIGITAL DESIGN & PARAMETRIC THOUGHT]

September 13  Discussion: Networks & Fields
Reading:  Mark Wigley, “Network Fever” in Grey Room 4 (Summer 2001)
Stan Allen, "From Object to Field" in AD: Architecture After Geometry (1997)
UN Studio, "Design Models" (2006)
Assignment: Write a one sentence manifesto on what role you believe the computer should play in the design process. Post on blog before class meets.
Presentation: Case Study Presentation #1

September 15  Laser Cutter Orientation / Lab Workshop #2 / Assign Project #1

September 20  Discussion: Understanding Complexity
Reading:  Mark C. Taylor, "From Grid to Network" in The Moment of Complexity (2001)
Presentation: Case Study Presentation #2

September 22  Lab Workshop #3 / Desk Cirts

September 27  Discussion: Computation & Complex Geometry
Reading:  Greg Lynn, "Animate Form" in Animate Form (1999)
Benjamin Aranda and Chris Lasch, Tooling (2005)
Presentation: Case Study Presentation #3

September 29  Lab Workshop #4 / Desk Cirts

[PART 2: BEYOND FORM VS. FUNCTION]

October 4  Discussion: Parametrics & Performance
Presentation: Case Study Presentation #4
October 6  REVIEW: PROJECT #1

October 11  Discussion: Pattern & Ornament I / Assign Project #2
Reading: Robert Venturi, Denise Scott Brown, Steven Izenour, from “Ugly and Ordinary Architecture” in Learning from Las Vegas (1972)
*Adolf Loos, “Ornament and Crime” (1908)
*Robert Venturi, “A Definition of Architecture as Shelter with Decoration on It, and Another Plea for a Symbolism of the Ordinary in Architecture” (1978)
Presentation: Case Study Presentation #5

October 13  Lab Workshop #5 / Desk Crips

October 18  Discussion: Pattern & Ornament II
Reading: Alejandro Zaera-Polo, “Patterns, Fabrics, Prototypes, Tesselations” in AD: Patterns of Architecture (2009)
Dave Hickey, “Pontormo’s Rainbow” in Air Guitar (1997)
Presentation: Case Study Presentation #6

October 20  Lab Workshop #6 / Desk Crips

October 25  Discussion: Fabrication
Presentation: Case Study Presentation #7

October 27  Lab Workshop #7 / Desk Crips

November 1  Desk Crips

November 3  REVIEW: PROJECT 2

[PART 3: IMPLICATIONS & CONSEQUENCES]

November 8  Discussion: Parametrics in Practice / Assign Final Project
Presentation: Case Study Presentation #8

November 10  Lab Workshop #8 / Pinup
November 15  \textbf{Discussion: Parametrics Outside Architecture – Economics, for example.}
John Lanchester, “Melting Into Air” in the \textit{New Yorker} 11/10/2008
“In Plato's Cave”, in \textit{The Economist} 1/22/2009
Presentation: Case Study Presentation #9

November 17  \textbf{Lab Workshop #9 / Desk Cirts}

November 22  \textbf{Discussion: Theorizing Parametric Design / Conclusions}
Reading: Mario Carpo, “Tempest in a Teapot” in \textit{Log} 6 (2005)
Patrik Schumacher, “Parametricism as Style - Parametricism Manifesto” (2008),
\url{http://www.patrikschumacher.com/Texts/Parametricism%20as%20Style.htm}
Sam Jacob, “The Ruins of the Future” in \textit{Strange Harvest} (2008),
\url{http://www.strangeharvest.com/2008/12/the-ruins-of-the-future.php}
\url{http://places.designobserver.com/entry.html?entry=10757}

November 24  \textbf{THANKSGIVING / NO CLASS}

November 29  Pinup
December 1  Desk Cirts
December 6  Desk Cirts
December 8  Desk Cirts
December 13  \textbf{FINAL REVIEW}

\textbf{RESOURCES}
\url{http://www.rhino3d.com}
\url{http://grasshopper3d.com/}
Grasshopper Primer and other tutorials: \url{http://www.grasshopper3d.com/page/tutorials-1}
Firefly: \url{http://www.fireflyexperiments.com}

\textbf{Grasshopper Blogs / Websites}
Design ReForm / \url{http://designreform.net/}
Designalyze / \url{http://www.designalyze.com/}
Digital Toolbox / \url{http://www.digitaltoolbox.info}
Live Architecture Network / \url{http://www.livearchitecture.net/}
Atelier nGai / \url{http://www.tedngai.net/}
Eat-a-Bug / \url{http://eat-a-bug.blogspot.com/}
Giulio Piacentino / \url{http://www.giuliopiacentino.com/}
Open Systems / \url{http://www.opensysdesign.com/}
Made in California / \url{http://www.madeincalifornia.blogspot.com/}
Space Symmetry Structure / \url{http://spacesymmetrystructure.wordpress.com/}
Rhino 3DTV / \url{http://web.mac.com/rhino3dtv/GH/GH.html}
Fancy Wires / \url{http://fancywires.com/}
Co-de-iT / \url{http://www.co-de-it.com/wordpress/code/grasshopper-code}
COMMON SYLLABUS / BDA WORKSHOPS

Credit Hours:
2 or 4 credits (A/F)

Prerequisites: ARCH 2281, BDA or BA major (junior standing)

Catalog Description:
Course provides a hands-on introduction to the processes, conditions, and principles of design as it relates to architecture.

A. Course Objectives
The general objectives of this course are to expose students to a broad-based understanding of the design process as it relates to architecture but not necessarily tied to traditional building scale or building systems. All workshops involve hands-on projects involving an iterative design process. Students will be required to develop a rigorous way of thinking and inventive graphic means of communicating their explorations. Work should be suitable for portfolio.

B. General Rules Regarding Deadlines
All work will be collected the night before each final project review. This is a Department policy, not the policy of individual instructors and there should be no exceptions. The individual instructors will determine the time the work is to be collected.

C. Late Work Policy
No late work will be accepted, except in the case of bona fide emergencies. Giving some students extension is unfair to them and to others.

D. Attendance Policy
There is a zero unexcused absence policy for studios and workshops. The final course grade will be lowered for even one unexcused absence, or for repeated late arrivals/early departures. In case of an emergency, contact your instructor immediately (ideally before the class period missed.) Absence from any scheduled review is very serious and should be avoided. Any students with three or more excused absences may be asked to withdraw from the course if the instructor feels they are falling too far behind. This decision will be left to the discretion of the faculty and the studio coordinator.

E. General Grading Standards for the Program
In order to provide fairness across the workshops, grading procedures and final grades will be reviewed by the workshop coordinator for grading consistency.

The nature of design work is highly dependent on evaluations that can only be done when the work is complete. While every attempt will be made to identify and warn students who are working at a level below that required for a passing grade, a passing midterm grade implies only the expectation of a passing final grade, not a guarantee.

A Excellent work not only fulfills the stated objectives of the studio syllabus and project statements, but extends them through new discoveries, insights and proposing issues beyond their stated scope. Students who earn this grade demonstrate through their work a high degree of professional dedication, rigor, a love of exploration, open-mindedness and resourcefulness. They also demonstrate that they have developed the ability to build upon a variety of feedback and excel independently. Their resultant work is rigorously thought through, well-crafted and clearly communicates the breadth and depth of their daily investigations.

B Very good work not only fulfills the stated objectives of the studio syllabus and project statements, but also further expands the stated issues by allowing those issues to direct their investigations and developments in their work. Students who earn this grade demonstrate a medium degree of professional dedication, inquisitiveness, systematic rigor and limited resourcefulness. They show that they are developing the ability to build upon a variety of feedback and their emerging independent voice. Their resultant work is competently thought through, well-crafted and clearly communicates the breadth and depth of their daily investigations of the issues presented in the projects.

C Adequate work fulfills and clearly demonstrates the stated objectives of the workshop syllabus and project statements. The department expects that everyone entering a given workshop is capable of this level of performance. Students who earn this grade demonstrate a lower degree of professional dedication that those earning A or B grades. Their work indicates less self-confidence and its development requires constant guidance on what to do next. C work lacks personal authorship manifested through additional and related contributions to
the investigations of a project. The adequate student’s work demonstrates an understanding of the problem but show deficiencies in basic design or communication skills, time management, or the lack of breath and depth of daily investigations.

D  Deficient work does not demonstrate how the stated objectives of the studio syllabus and project statements have been fulfilled. The work is fragmentary, not synthesized, incomplete, and presented only as an assigned “project” due on a particular day. As is any professional office, deficient work is not acceptable. D work may be the result of a lack of self-confidence, a closed-minded attitude, a lack of time management skills, lack of basic professional dedication, or outside personal problems.