ARCH506-03
Taubman College of Architecture and Urban Planning
University of Michigan

Seminar: Thursday 7pm - 10pm rm. 2108
Instructor: Daubmann

PARAMOD

Structural Density

Parametric practices suggest a mode of thinking beyond software, toward a way of defining explicit relationships, complex behaviors, and unforeseen responses. New computational tools and network thinking reveal emergent behaviors, which challenge traditional notions of hierarchy in part-to-whole relationships. Given new thinking and new tools, designers are able to define multiple relationships that can be varied and are able to mutate throughout the duration of the design process.

The seminar begins with a series of tightly framed skills exercises. The series of tutorials / assignments will introduce various methodologies, techniques, and modes of structuring parametric models. Digital Project allows designers to operate in both top-down and bottom-up modes, both of which will be addressed in the first half of the course.

The second half of the seminar will involve a directed design / research project that applies the skills and ideas from the first half. This semester the seminar will explore the relationship between organizational logics (the diagram) and the spatial / structural definition of structural frameworks. Gothic structures offer insight on this interrelated condition of structure and space. Many generations of craftspeople honed their skills and material knowledge to push stone to its absolute limit. The stone structures become weightless, organic, bifurcated organizations allowing maximum light while also tracing the loads in bundled columns to the ground. The bottom-up material knowledge of construction is then pressured in a top-down way from the church defining the dogmas, rituals, and organization. The combination of the two modes of thinking result in an affected set of spatial relationships. The Gothic involves a vernacular evolution developed from cathedral to cathedral. The seminar will develop a series of structural networks / frameworks able to evolve digitally in a very short period of time.

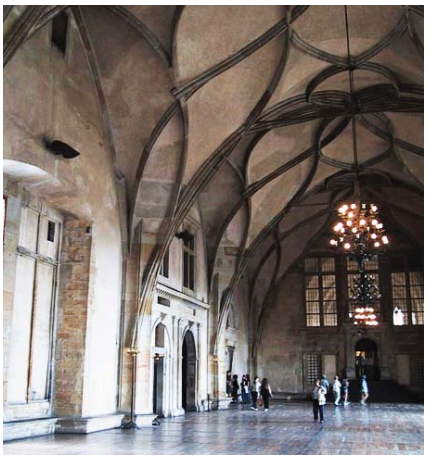
//Prerequisites//

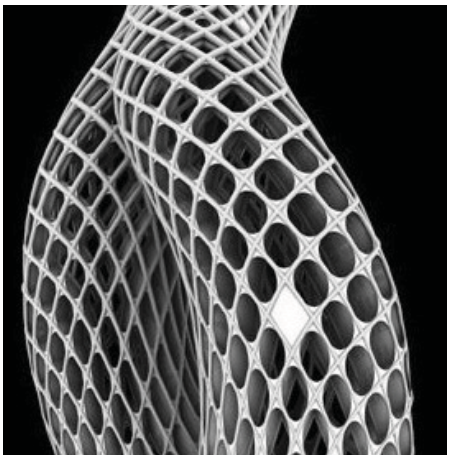
Students should have a strong familiarity with 3D modeling, but not necessarily parametric modeling

//Enrollment//

The course is limited to 10 students. Interested students should add their name to Wolverine Access “wait list” but more importantly students must attend the first class to be considered. Preference will be given to students with graduate standing.

ATTENDANCE AT THE FIRST CLASS IS MANDATORY. (7pm, Sept 7, 2108)





Images (l to r): Vladislav Hall - Prague Castle; PSI Courtyard - n Architects; Tower Study - Neri Oxman

//Structure//

The course will meet Thursday evenings. Class attendance (and punctuality) is mandatory, as much of the content involves hands-on demonstrations and smaller group discussions that will define the trajectory of the seminar. More than three absences will result in a failing grade. Design review presentations will occur during class time, projects not presented will result in a substantial lowering of the grade.

//Objectives//

PARAMOD is a course in advanced computation that exposes students to parametric modeling and operates within a design / research framework that does not differentiate between concept and practice. To be more clear, this is not a software class, it is a graduate design / research seminar that happens to make use of a specific software. Students will learn about diagramming and graphically representing ideas as a means to develop complex geometric relationships and parametric associativity.

//Readings and Texts//

There will be a concise set of required readings with each assignment. They will be available as a PDF from CTools. In addition to the required readings, additional resources such as recommended readings, software tutorials, and relevant links will also be provided.

//Software//

PARAMOD 506 will be using Digital Project developed by Gehry Technologies. Digital Project is a set of tools developed for the architecture, engineering, and construction industries that is built on Dessault's CATIA engine. Digital Project products support the life cycle of construction projects from design and engineering to fabrication and construction project management.

Parametric modeling technology is an integral part of all Digital Project operations. While Digital Project has advanced BIM capabilities, we will be primarily focusing on issues related to parametric modeling such as:

- Parts to Whole Relationships
- Relations, Parameters, Formulas, Associativity
- Surface Definition & Editing
- Solid Modeling
- Assemblies
- Knowledgeware – Scripts, Clauses, Macros, Design Tables
- Reuse – Power Copies, Document Templates

The software can be purchased through Gehry Technologies at a cost of $150 for a one year license. This is worth doing if you have your own computer that meets the minimum specs. The BET Lab also has the software loaded for your use.

//Format//

The course has been broken into three general groupings that attempt to link the research content directly to design potential raised by the software. Skills based exercises makeup the first third, then two design / research projects complete the semester. Each part will include readings, discussion, in-class tutorials and presentations, and a series of exercises that will add to the discussion.

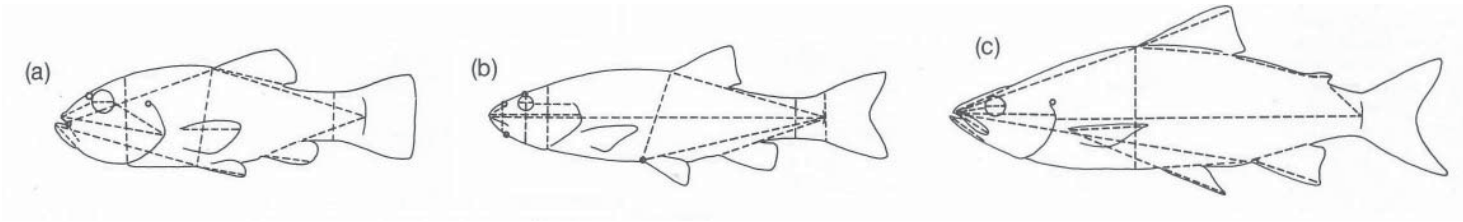
Production formats will be standardized as a means to evaluate collective work of the class, as well as continuing to build a bigger and broader base of knowledge. In addition, this standardization of output will make that aspect of the assignment easier and quicker to produce, giving you more time to develop the models. Templates will be uploaded to the course website and will be discussed further with the first assignment.

//Grading//

Tutorials I - 5	The Skills	20%
Project I	Field Variation	30%
Project 2	Interactive Choreography	40%
Attendance		I0%

//Schedule//

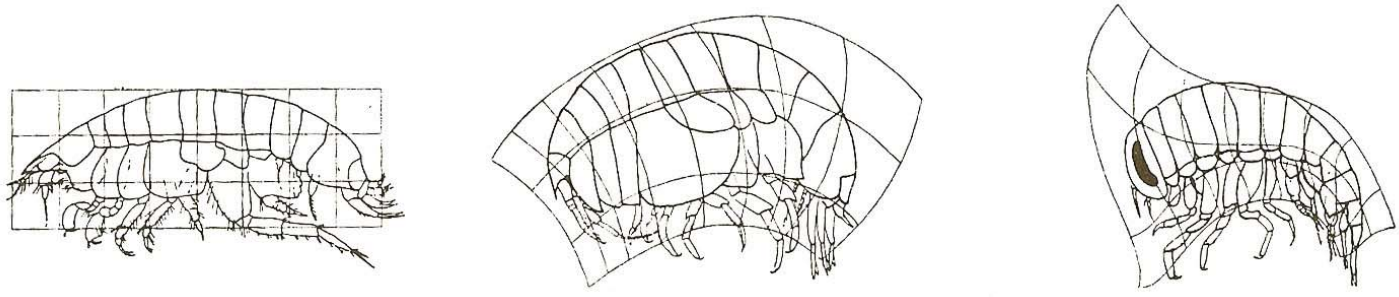
Sept 4	First Class – The Set-Up - Intro to the Software - Demo I
Sept II	Tutorial I Due / Demo 2
Sept I8	Tutorial 2 Due / Demo 3
Sept 25	Tutorial 3 Due / Demo 4
Oct 2	Tutorial 4 Due / Demo 5
Oct 9	Tutorial 5 Due / Introduce Project I
Oct I6	
Oct 23	
Oct 30	Project I Due / Introduce Project 2
Nov 6	
Nov I3	
Nov 20	
Nov 27	Thanksgiving - No Class
Dec 4	Last Class - Review / Exhibition / Discussion



Morphometrics in Evolutionary Biology. I985

//Tutorials//

Week	Concept	Primary Skill	Secondary Skill
Week I	Dynamic Diagram	The Sketch	Constraints
Week 2	Translation to 3D	Surfaces / Solids	Formulas
Week 3	Bottom-Up	Part / Product	Defining Relationships
Week 4	Smart Parts	Powercopy	Advanced Replication
Week 5	Smart Solids	Document Template	Rules



On Growth and Form by D'Arcy Wentworth Thompson

//Tutorial I - From Cathedral to Terminal//

//Intent//
The intent of tutorial I is to introduce basic navigation and basic organization for the CATIA environment. Almost everything developed within CATIA (and other parametric software) is driven by the sketch. The sketch is defined by a flat plane whose location can be clearly defined. Three dimensional surfaces and solids can then be created using various sketches in multiple locations.

//Low Level Skill Acquisition//
This first tutorial will introduce the tree structure and the organization using "geometric sets". You will define a sketch plane, create a sketch and then reference points to additional sketches (similar to layers of trace paper). You will use two types of elements: construction vs. actual. You will also be required to use constraints as a means to define your sketch.

//Higher Level Skill Acquisition//
Beyond dealing with the CATIA environment you must think about how to structure your sketch. Limiting yourself to geometric relationships how can you define associations?

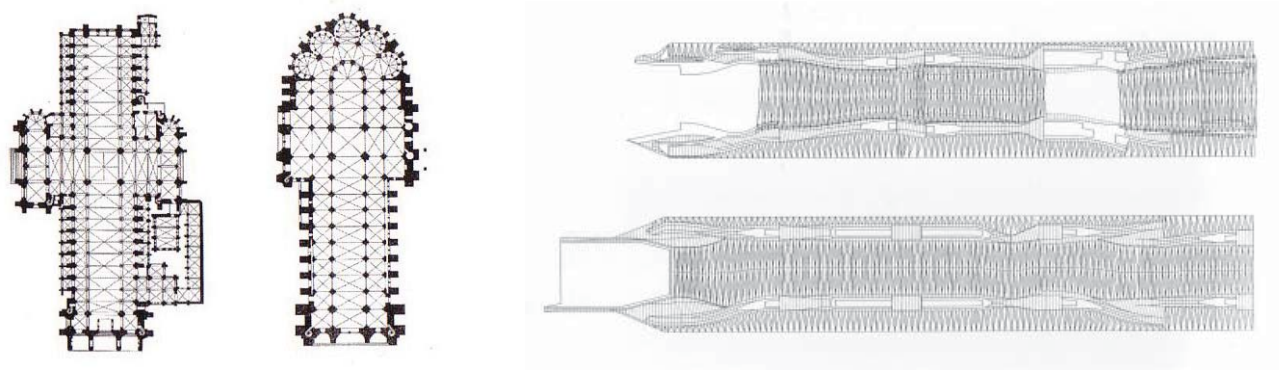
//Tasks//
You are to create a "plan" that is defined by 5 bays. The 5 bays will vary along their length. All 5 bays will fit in a rectangle that is 3 times longer than its width running the long direction. You are then asked to subdivide the long bays into cellular parts.

Similar to the Borromini plans discussed in class, you must draw a diagram that shows the rules / logics of the bays and of the cellular divisions.

You must also show 3 variations of the plan.

All the drawings should be placed on the template provided on CTools.

//Deadline//
The pages laid out using the template are to be printed out for the start of class on Thursday September 11th.



(L)Gothic Cathedrals Laon, Amiens (R) Yokohama Terminal

//Tutorial 2 - From Flat to Form//

//Intent//
The intent of tutorial 2 is to introduce the translation from a flat sketch / shape to 3D form. This assignment will also attempt to create a parametric form where the plan geometry results in varied but controlled and associated form.

//Low Level Skill Acquisition//
For this tutorial you will use both sketches and 3D geometry to make surfaces and solids. The multisection surface tool will be introduced including the various sub options available. Output features will also be covered so that parts of complex sketches can be used for various functions.

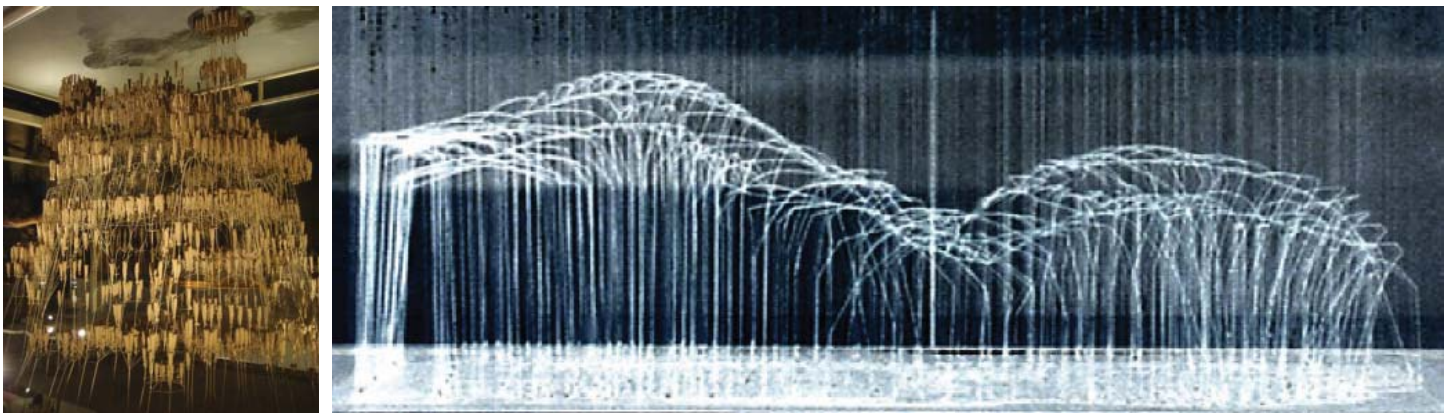
//Higher Level Skill Acquisition//
Through the introduction of measures and formulas, your 3D form will be the direct result of your 2D planning.

//Tasks//
Using your work from Tutorial 1, you are asked to develop a roof / shelter for the plan diagram.
Step 1 - Set up a series of measures.
Step 2 - Project points from key locations of the plan, devising a system that uses the measures.
Step 3 - Connect the projected 3D points to define multi-section surface inputs.
Step 4 - Create a multi-section surface with plan driven penetrations.

You must also show 3 variations based on plan deformations.

All the drawings should be placed on the template provided on CTools.

//Deadline//
The pages laid out using the template are to be printed out for the start of class on Thursday Septemer 18th.



(L)Gaudi Hanging Chain Model (inverted) (R) Reiser + Umemoto Catenary Experiments