

## ARCH 744, **Digital Fabrication**

Monday 6:00-9:00pm. MEYH B5 + B6

Instructors: Ferda Kolatan & David Ruy

*This seminar course investigates the fabrication of digital structures through the use of rapid prototyping (RP) and computer-aided manufacturing (CAM) technologies, which offer the production of building components directly from 3D digital models. Work focuses on the formal and material limits of current fabrication technologies and develops digital modeling techniques to support contemporary design problems. The elimination of the intermediary step of shop drawings and the challenge of transitioning to a digital standard of construction documentation is presented as a locus for experiments. The two sections of the course are tightly integrated with coordinated lectures by the instructors and guest speakers.*

### **Scope of Work**

This year, students will conduct experiments and develop expertise for the design of a temporary pavilion that is to be fabricated entirely out of digital methods. Projects are expected to demonstrate technical fluency and a well developed design sensibility relative to the specific technologies presented during the course of the semester. The goal is to produce a thorough demonstration of the potential of digital fabrication techniques that simultaneously speculates on possible changes to our current models of architectural practice.

Students will initially engage a set of exercises to develop a knowledge base. The instructors will conduct group presentations and discussions combining both sections. Among the topics covered will be:

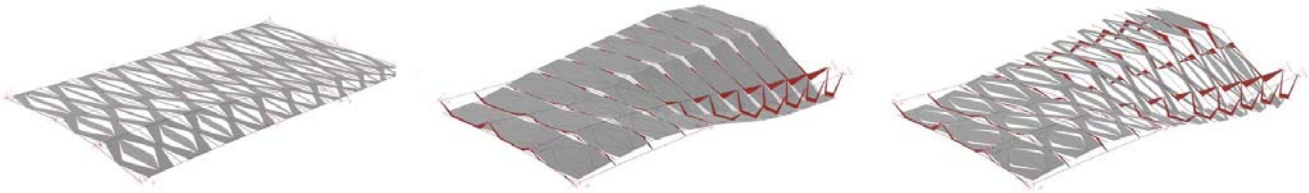
- Parametric modeling techniques
- NURB vs Subdivision geometry
- File formats and technical protocols
- Formal and geometric categories (folding/unfolding flat patterns, positive/negative molds and casts, sectional lamination, and path-based subtraction)
- Materials and finishes
- Documentation and workflow

After the initial period of skill building, design teams of 3 students will be formed within each section to apply knowledge towards the design of the pavilion. Each design team will be responsible for a complete proposal that is to include digitally fabricated prototypes as well as a system of organizing digital files for project documentation.

This year, two theoretical concepts will be introduced by the instructors to guide projects:

- Pluripotent Structures: Adaptability and Design Finesse
- Ornamentation and Individuation

## Pluripotent Structures: Adaptability and Design Finesse



*"Think of the design process as involving first the generation of alternatives and then the testing of these alternatives against a whole array of requirements and constraints"*

*-Herbert A. Simon (1916-2001)*

*Pluripotent: not fixed as to developmental potentialities : having developmental plasticity*

*-Merriam Webster*

*Pluripotency: in the broad sense refers to "having more than one potential outcome".*

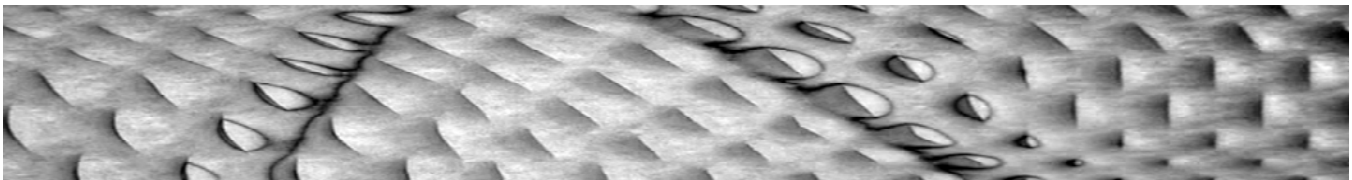
*-Wikipedia*

The sections will investigate pluripotent techniques directed towards two specific aspects of the design project:

1. **Adaptability:** A system that harbors multiple potential expressions will display a higher degree of flexibility in confronting constraints. Conventional categories such as structure, volume and surface are substituted with systems that can express each one of those without breaching the coherence of an overall behavior.
2. **Design Finesse:** Pluripotent systems enable limitless refinement across different scales and regions of the model thus allowing for a much higher level of delicacy than conventional modeling techniques.

The students will design a number of pluripotent systems in GC (Generative Components) and develop strategies to fabricate them through digital means. (Lasercutter, 3d prints, CNC mill, etc.) The fabrication and material constraints are understood as "generative" information, which will be folded back, nonlinearly, into the overall design process.

## Ornamentation and Individuation



The inefficiency of producing the "one of a kind," is one of many factors that contributed to the demise of architectural ornamentation. Nonetheless, as we continue to grapple with the desire to make an architecture individual and specific, the limits of the economies of means at our disposal stand out as a determining factor. Whether the individuation is specific to a place, or a people, or to architectural history itself, the desire for individuation is steadily superseded by the obvious economic benefits of efficient production. While keeping this in mind, an issue in the work of the seminar is how the economies of means brought forth by industrialization is now being reconfigured by the economies of means brought forth by computation and digitization.

As the forces of industrialized production reached maturity and sophistication, the necessity for standardizing production unexpectedly receded. Every year, mass production comes closer to being synonymous with mass customization. The CNC mill doesn't care how many of the same you make, it just adds up the milling time. Not everything is possible, and no magic tool has appeared. What's changing is the logic of production and the terms of efficiency. Today, architects are grappling with the facts of digital production. The CNC mill, the 3D printer, et cetera, all promise to be as influential as the assembly line was in the last century. It is within context that we can revisit some of the persistent desires for an architecture that is individuated and possessed of a deep ornamentation.