ARCH 574 | PARAMETRIC DESIGN
WAH 212 | Friday 12:00-1:50pm
Units: 3
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Course Introduction:

The course aims at investigating the parametric relationship between geometry and architectural elements, in this case, the relationship between the geometry of atrium and the architectural circulation. We will begin by using parametric tools to examine existing architecture examples, which contain atriums and complex circulation systems, with the intention of exploring tensions, functions, and the spatial effects between them. Through this analysis, students will construct their own geometry narratives to express the formal and parametric relationships embraced within the subject of their studies. Thereafter, these geometry narratives will be translated into iterations of physical models.

Atrium, Stair and other circulations

The stair is a highly constrained yet abundant circulation element in architecture - on one hand, internally, it has to perform according to the restrictions of a human body. During the process of moving a body through space from one level to another, specific body movements manifest themselves in the fashion of architecture regulations. For instance, the height of step comes from the movement of leg and the discrete segmentation comes from the need to break a continuous stair apart to provide resting stop for the body. On the other hand, externally, stair reacts to its surroundings. Quarter Landing, Half Landing, Spiral, Winder, Arched, Bifurcated, besides their aesthetic values, all these different types emerge through the negotiation between stairs and its external constraints, functionally, spatially and structurally.

Atrium is where stairs and other circulation elements are contextualized in an architecture. It often performs as the intersection of a building's spatial tensions, a place where different functional spaces meet and get organized. One of the most clear example is Scott Cohen's Tel Aviv museum of art. In this case, on top of the already highly limited condition of the triangular site, different exhibition space on multiple levels with different sizes and degrees of rotation produced a complex atrium across function and space. The atrium is where all the tensions get absorbed and reorganized into a productive spatial sequence. In his lecture "Museum as Genealogy" (Harvard GSD, 2012), Scott Cohen demonstrated how he could blend the linear spatial type of enfilade picture gallery and the vertically stacked diverse exhibition spaces through this careful orchestration of the atrium at Tel Aviv, while exploiting the congruent relationship between the geometry of atrium and the building facade.

Geometry narrative (Fiction)

Architecture has always been a part of the story making, although most of the times it exists in other medias - the physical form of architecture was translated into the form of text, picture, moving images and so on.

If we regard a narrative as an account of connected events - a story, then the relationship between geometries could be constructed into such stories. It could be a process of form-finding movements, such as rotation, shear, bend, scale, cut, fold and so on. They may not be directly related to the actual physical character of the form, but to the characteristics implied in the relationship between forms. These narratives discuss the linearity and relationships of form in space and time. They need to deal with form as well as function. Such narratives should not become reductive geometric abstractions, ignoring things such as the functional limitation of stairs and the critical thicknesses of walls.

This class will try to construct such geometry narratives based on the parametric relationship we find through analysing existing architecture cases. Many cases of our study, when being conceived, might not embody any obvious parametric filiation. This will require us to offer our own interpretations and design input, to produce the “fictional” parametric narrative with self-consistent logic.

Resources:

There are numerous web-based researching parametric design and for learning Grasshopper. All students are encouraged to bring to class the resources they have found independently. Below are a number of sources to be used in conjunction with the curriculum.

Web Resources:

http://www.grasshopper3d.com/page/tutorials-1
http://www.food4rhino.com/?ufh
http://skilltree.gsapp.org/tutorial/gh-form-generation
http://digitaltoolbox.info
http://designreform.net/learning/grasshopper
http://designalyze.com/software/grasshopper
http://www.karamba3d.com/category/tutorials/
...

Software and Hardware:

All students are required to come to class with a laptop that supports and has installed the necessary software and hardware. Students can expect to learn and use the following technologies subject to change: Rhinoceros, Grasshopper and a series of plug-ins and

freeware. Students will also be expected to gain proficiency with digital fabrication technologies such as 3D printing, CNC milling and laser cutting.

Students are expected to acquire these softwares and the instructor will provide/organize student discounts where possible. In most cases these software's will already be owned and used by the students such as Grasshopper and Rhino.

For Autodesk products, Rhinoceros and grasshopper please created student profiles giving yourself access to all the free software, blogs, discussion threads, documents, and numerous plug-ins that we will explore.

*For all installation, licensing and support needs please go through the website support page. The instructor and teaching assistants will not be able to help you.

Learning outcomes:

To gain ability in the use of parametric design technologies.

To gain ability in linking the digital model to physical modeling and prototyping

To test, improve, represent, and effectively communicate to others the specific qualities and potentials of an associative parametric design solution.

To situate and critically appraise parametric design methods and modes of design research, within the current discourse of architecture.

To synthesize, within the given methodology, a parametric design of an architectural and tectonic system.

To respond and incorporate criticism and advice by professors and invited critics.

To conduct independent research and resolve evolving problems.

To indicate understanding and resolve aesthetic, tectonic, structural and material problems.

Grading procedures:

The grading of the course is based primarily on the three assignments and the hand in of 'fully organized' material and a final portfolio. The work will be evaluated in terms of design logic, design description, design exploration, and finally design outcome; these categories are enumerated in each of the detailed handouts. Criteria for the evaluation of student work:

I. General

1, Willingness to generate ideas
2, Willingness to develop ideas
3, Willingness to respond to criticism
4, Degree of participation (attendance, group discussion, etc.)

II. Methodology

1, Ability to generate relevant architectural ideas within the parametric design context
2, Ability to develop ideas in a coherent fashion
3, Ability to express relevant ideas in a graphic format and model form
4, Ability to articulate and present ideas verbally

III. Project evaluation

1, Quality of intentions
2, Quality of ideas
3, Quality of formal resolutions
4, Demonstrated technical awareness
5, Completeness of project
6, Quality of presentation

Grading weights:

Attendance/Participation	10%
Assignment No.1 Geometrical Narrative	30%
Assignment No.2 Parametric Iterations	20%
Assignment No.3 Physical Model	20%
Final Portfolio and Submission	20%

Course Schedule

Week 1:
Lecture

Week 2:
Lecture
Research Session
(Student Presentation) (Atrium Research)

Week 3:

Lecture
Research Session
(Discussion) (Preliminary Rhino Model, Driver Diagram)

Week 4:
Lecture
Research Session
(Student Presentation) (Rhino Model, Driver Diagram)

Week 5:
Lecture
Research Session
(Discussion) (Preliminary Parametric Model)

Week 6:
Work Session

Week 7:
Lecture
Research Session
(Student Presentation) (Parametric Model)

Week 8
Research Session
(Student Presentation) (Assignment No.1 Geometrical Narrative) (Midterm)

Week 9
Lecture
Research Session
(Discussion) (Preliminary Iterations of Parametric Model)

Week 10
Work Session

Week 11
Research Session
(Student Presentation) (Assignment No.2 Parametric Iterations)

Week 12
Lecture
Research Session
(Discussion) (Proposal of Physical Model)

Week 13

Work Session

Week 14
Hand in of Assignment No.3 Physical Model

Week 15
DOCUMENTS HAND-IN AND REVIEW
Hand in of Physical Model

Retention of student work:

The course requires that students document in portfolio form all work completed during the semester. Final grades will not be given before all work from the course is submitted in CD or DVD format and as a printed and bound portfolio including photographs of the models and prototypes. A checklist is provided which must be filled out and signed. The checklist indicates specifically the organization and type of files to be submitted. Please note this requirement if worth 20% of your grade and can adversely affect your final standing in the course.

Course Policies:

1, Attendance: Class meets from 830 to 1020 on Monday. Attendance is mandatory. Unexcused absences are not permitted and will adversely affect your grade. If you cannot attend class because of illness, injury, or some other unavoidable circumstance, please notify me before class if possible. Any student missing two classes will receive a warning letter from the student advisor. A third absence will result in the student being asked to withdraw from the class or receive NC.

2, Preparation: Students are expected to arrive in class fully prepared for each class's work. This means that you have done the appropriate reading, research, and design development to keep your project moving in a forward direction. I expect you to be prepared for tutorials, desk critics, reviews and pin-ups by generating relevant drawings, diagrams, models, etc. Beyond the usual visual material, you should be prepared to describe and defend the current state of your work.

3, Course behavior: The design seminar is a place of active research and production. It is also a communal learning environment. This requires that each member of the design seminar be considerate of each other and work towards creating a setting for stimulating and productive activity.

4, Class discussions: Students are expected to participate actively in all class discussions.

5, Plagiarism: USC policies regarding plagiarism are in effect. Plagiarism will result in an immediate NC for the course and potential dismissal from the school.

Statement on Academic Integrity:

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A:
http://www.usc.edu/dept/publications/SCAMPUS/gov/
Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any
suspicion of academic dishonesty. The Review process can be found at:
http://www.usc.edu/studentaffairs/SJACS/

Statement for Students with Disabilities:

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 am - 5:00 pm, Monday through Friday. The phone number for DSP is (213) 7400776.