



CIEE Barcelona, Spain

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| Course name: | Science, Engineering and Technology Workshop: Designing Associations |
| Course number: | ARCH 3004 BASP |
| Programs offering course: | Barcelona Global Architecture and Design |
| Language of instruction: | English |
| U.S. Semester Credits: | 3 |
| Contact Hours: | 45 |
| Term: | Fall 2019 |

Course Description

This course seeks to introduce participants to the role of computational design and digital fabrication in the architectural creative process. Through technical and practical exercises students will learn different strategies that will allow to take a digital model towards a built output.

The course is divided into 2 phases: During the 1st phase participants will work with Rhinoceros 3D to learn about procedural modelling, followed by an introduction to parametric design with Grasshopper 3D. On the 2nd phase students will be taught the principles of digital fabrication and rapid prototyping, which will help to conceive performative prototypes and physical models with advanced manufacturing methods.

Learning Objectives

The workshop module seeks to address several objectives in parallel:

- To give a perspective and spark discussions on the designer's roles in the current age of digital tools;
- To transmit strategies for appropriate procedural modeling and parameter associativity;
- To introduce new tools (both hardware and software) which aid in the collection and processing of data relevant for parametric design.
- To learn new methods of fabrication through research and investigation.

Course Prerequisites

No previous knowledge of Rhinoceros and Grasshopper is required (although an introductory knowledge is welcome). Participants must bring their own laptops with a pre-installed software. The software package needed has no additional cost for the participant (Rhino can be downloaded as evaluation version, Grasshopper and plugins are free). These software packages are subject to frequent updates, so a download link to the version used in the workshop will be sent to the participants a few days before the workshop



Methods of Instruction

In-class digital tools tutorials, brief thematic lectures as an overview and extension of any important topic, hands-on fabrication tutorials, and project reviews.

The course will be divided into four sections sections, each associated to a specific assignment and evaluation:

- Introduction to Rhinoceros (4 classes)
- Introduction to parametric design (3 classes)
- Introduction to Digital Fabrication (3 classes)
- Form finding exploration (5 classes)

In addition, each week there will be 1 hour dedicated to student support

Assessment and Final Grade

The final grade will be based on the following:

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| 1. | Participation in Class | 15% |
| 2. | Urban Object Modeling | 15% |
| 3. | Parametric Design Assignment | 15% |
| 4. | Digital Fabrication Assignment | 15% |
| 5. | Project prototype development | 40% |

Course Requirements

Participation in Class (15%)

Active participation during class, understanding of technical knowledge and demonstration of imaginative and critical thinking skills.

Urban Object Modeling (15%)

Exercise submission: Create a digital model with Rhinoceros 3D of an urban infrastructure object that can be found in the city. Students will be graded according to the model development and complexity.

Parametric Design Assignment (15%)

Exercise submission: Create a parametric model with grasshopper3D and generate a cross referenced catalogue with selected design variables. Students will be graded according to the model development and complexity.

Digital Fabrication Assignment (15%)

Exercise submission: Design and produce a digitally manufactured object with fabrication techniques learned in class. This assignment will be done in groups. Students will be graded according to the model development, complexity and execution.



Project prototype development (40%)

Studio prototype development and final submission: Studio groups will design and produce a prototype related to their studio project. During the last 5 sessions, we will focus on studio group descripts and project revisions. Students will be graded according to the model development, complexity and execution.

CIEE Barcelona Attendance Policy

Students are expected to attend all scheduled class sessions on time and be prepared for the day's class activities. CIEE does not distinguish between justified or unjustified absences, whether due to sickness, personal emergency, inevitable transportation delay and/or other impediments. You are considered responsible of managing your own absences. Please keep in mind that exams, paper submission dates, presentations and any other course work deadlines cannot be changed.

No academic penalty will be applied if students miss up to 1 class session. If students miss up to 3 class sessions, students' final course grade will drop 5 points out of 100 on the CIEE grade scale for each additional absence beyond 3 (for example a 95 will become a 90 if they reach the 2nd absence, and an 85 if they reach the 3rd absence). **Students will automatically fail the course if they miss more than 20% of total class hours (i.e. if they exceed 3 absences).**

For students who miss up to 20% of the total course hours due to extenuating circumstances, the Academic Director may allow for exceptions to the local attendance policy based on documentation such as proof of bereavement, religious observances, hospitalization etc.

Students arriving more than 10 minutes late to the class will be considered absent for a day.

Weekly Schedule

Week 1

- 1.1 Rhinoceros 3D module
Introduction to procedural modeling.
[Rhinoceros tutorials](#)

Week 2

- 2.1 Rhinoceros 3D module
Surface and solid descriptions
Release date assignment #1

Week 3

- 3.1 Rhinoceros 3D module
Transformation tools

Week 4

- Rhinoceros 3D module
Meshes and other topologies



Week 5

grasshopper 3D module
Introduction to parametric design.
[Grasshopper getting started by David Rutten](#)
Due date assignment #1

Week 6

Grasshopper 3D module
Data matching and data management.
Release date assignment #2

Week 7

Grasshopper 3D module
Data visualization and animations

Week 8

7Digital Fabrication module
Digital Fabrication strategies presentation and FabLab presentation
Due date assignment #2

Week 9

Digital Fabrication module
Work session in groups.
Release date assignment #3

Week 10

Digital Fabrication module
work session in groups.

Week 11

Project prototype development
Studio prototype development. Group descrits and project revisions.

Week 12

Project prototype development
Studio prototype development. Group descrits and project revisions.

Week 13

Project prototype development
Studio prototype development. Group descrits and project revisions.

Week 14

Project prototype development
Studio prototype development. Group descrits and project revisions.

Week 15

Project prototype development



Studio prototype development. Group descirts and project revisions.

Course Materials

Recommended Readings

AAD_Algorithms-Aided Design. http://www.arturotedeschi.com/wordpress/?page_id=6691

Adaptive Ecologies, London, 2013. <http://aabookshop.net/?wpsc-product=adaptive-ecologies>

Schumacher, Patrik. Parametricism as a Style.

<http://www.patrikschumacher.com/Texts/Parametricism%20as%20Style.htm>

Silver, Mike, ed. Programming Cultures: Art and Architecture in the Age of Software. London: Wiley-Academy, 2006. Print.

Trummer, Peter. "Engineering Ecologies." Versatility and Vicissitude: Performance in Morpho-ecological Design Ed. Michael Hensel and Achim Menges. London: Wiley, 2008. 96-101. Print.

Software

[Rhinoceros 6](#) for Windows

[Grasshopper 3D](#)

Hardware

8 GB memory (RAM) or more

At least 600 MB space in the hard drive

We recommend a compatible video card for OpenGL 4.1.

Operational System

Windows 10, 8.1 or 7 SP2 (Grasshopper 3D is only currently available for the Windows operating system. For this reason, every student is required to have an installation of Windows).

Note: If you have an Apple computer, it is recommended that you install Windows on Boot Camp which will perform better than Parallels or VMWare.