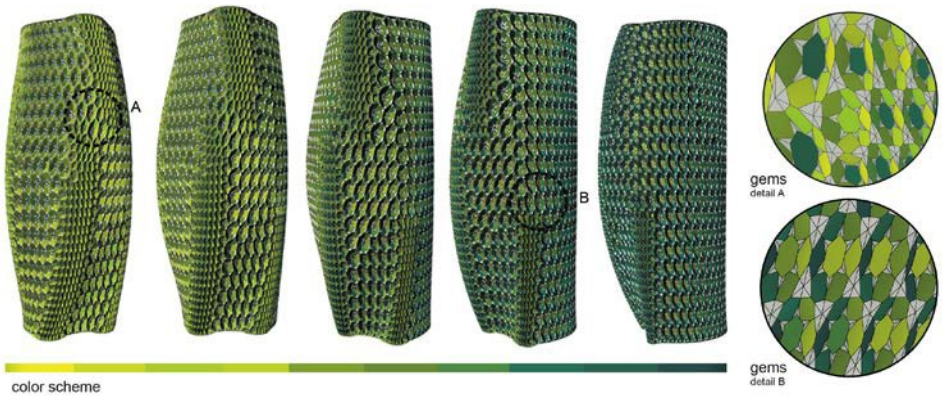
ARCH 4507 PARAMETRIC DESIGN – VISUAL PROGRAMMING WITH GRASSHOPPER AND DYNAMO

Fall 2014, Tu + Th 1:25pm - 2:55 pm, room 358, Instructor: Ass. Prof. Daniel Baerlecken
Credit Hours: 3



Office Hours

Tuesday and Thursdays, 11:00 a.m. – 12:00 p.m. or by appointment.

Course Description

Parametric modeling, scripting and advanced fabrication technologies have become an integral part of contemporary architectural practice, in which architects use an amalgam of mixed skills reaching out to other disciplines such as computing, engineering, art and design. This class teaches techniques in parametric modeling and explores digital tools as design instruments for building envelops.

Course Objectives

The class introduces parametric modeling and design. The software introduction builds the necessary skills to address technical challenges in order to inform design strategies in form generation and optimization/fabrication using Grasshopper and Dynamo. Grasshopper integrates with Rhinoceros and Dynamo with Revit. Both operate as extensions of the existing platform (Rhino/Revit) allowing to integrate and explore their algorithmic potential. Visual programming allows for a more intuitive design exploration than text based programming.

Students will gain knowledge in both platforms, that include the following categories: Interface/Components/Parameters/Data Management, Scalar Component Types, Operators Conditional Statements, Range / Series / Interval , Functions, Lists, Weaving Data, Shifting Data, Export to Excel, Vectors, Attractor, Curves, Surface Structuring, Families with Sequences, Ranges, Lines and Grids, Nested Lists and Basic Data Management, Advanced Family Placement: Adaptive Components, Family Instance Parameters, Basic Math with the Formula Node, Color / Data , Attractor Pattern, Python, Fabrication tools, Catenary, Mesh based tools, Solar Analysis, Lunchbox, Loops, Conditionals, Functions, Recursion.

[2] Form Generation, Optimization and Fabrication

Geometric systems are analyzed to inform a design system for envelopes. The analyzed material system is translated into a parametric model and further optimized in terms of fabrication using Dynamo or Grasshopper. The final project will focus on digital design processes, which will be explored through digital fabrication tools. Each student is expected to develop a geometric system that has its own logic for construction and assembly.

Prior basic skills in Rhinoceros and Revit are recommended, but programming knowledge is not necessary.

Learning Outcomes

1. Students will be able to use advanced parametric design technologies to understand complex architectural geometry and to implement their design proposals in a parametric model.
2. Students will be able to produce physical constructions from their digital representations.
3. Students will be able to use Grasshopper and Dynamo, and other modeling techniques in Revit to produce various digital prototypes.
4. Students will be able to evaluate, synthesize and conceptualize software functions and methods of parametric modeling.

Assignments

All assignments have to be submitted to T-square. Submissions via email are not accepted.

Project

All students will be required to do a project in the second half of the semester. The topics of each projects will be based on a research assignment and develop together by the instructor and students as the semester progresses.

Handouts

All tutorials will be posted on T-Square under "Resources". Assignments will be handed out in class.

Schedule

Week 1

TU AUG 19 Grasshopper Interface, Components, Parameters, Data Management [Assignment 1 100pts]

TH AUG 21 Scalar Component Types, Operators Conditional Statements, Range / Series / Interval, Functions [Assignment 2 100pts]

Week 2

TU AUG 26 Grasshopper Lists, Weaving Data, Shifting Data, Export to Excel [Assignment 3 100pts]

TH AUG 28 Grasshopper Vectors, Attractor [Assignment 4 100pts]

Week 3
TU SEPT 2 Grasshopper Vectors, Attractor [Assignment 5 100pts]
TH SEPT 4 Autodesk lecture: Intro into Dynamo [Assignment 6 100pts]

Week 4
TU SEPT 9 Grasshopper Surfaces: Diagrid [Assignment 7 100pts]
TH SEPT 11 Grasshopper Surfaces: Srf Morph [Assignment 8 100pts]

Week 5
TU SEPT 16 Galapagos [Assignment 9 100pts]
TH SEPT 18 Kangaroo: Catenary [Assignment 10 100pts]

Week 6
TU SEPT 23 Kangaroo: Mesh based [Assignment 11 100pts]
TH SEPT 25 Kangaroo: Mesh based

Week 7
TU SEPT 30 Ladybug
TH OCT 02 Ladybug [Assignment 12 100pts]
Week 8
TU OCT 07 Dynamo: MathSrf , Interface [Assignment 13 100pts]
TH OCT 09 Dynamo: Attractor Pattern Families, Sequences, Ranges, Lines and Grids [Assignment 14 100pts]

Week 9
TU OCT 14 Fall Break
TH OCT 16 Dynamo: Family Types [Assignment 15 100pts]

Week 10
TU OCT 21 Dynamo: Advanced Family Placement: Adaptive Components [Assignment 16 100pts]
TH OCT 23 Dynamo: Advanced Family Placement: Adaptive Components [Assignment 17 100pts]

Week 11
TU OCT 27 SATS
TH OCT 30 SATS

Week 12
TU NOV 04 Excel/Dynamo- Images [Assignment 19 100pts] TH
NOV 06 Research presentations 1 [Assignment 20 100pts]

Week 13
TU NOV 11 Perkins and Will research / meet 1.45pm@Perkins Wills
TH NOV 13 Research presentations 2

Week 14
TU NOV 18 Final project with Grasshopper or Dynamo
TH NOV 20 Michael Bergin's second visit,

Week 15
TU NOV 23 Final project with Grasshopper or Dynamo [final project, 750pts]
TH NOV 25 Thanksgiving break

Week 16
Final review week – no class

TU DEC 9, 1.30-3pm final project presentations

Grading:

Weekly assignments 100 PTS/200PTS (-10/20 PTS for late submissions).
See schedule
Final project 750 PTS

Points	Grade	Description
90-100	A	Excellent
80 - 89	B	Good
70 - 79	C	Satisfactory
60 - 69	D	Minimally Passing
0 - 59	F	Failing

There will be no incompletes awarded without appropriate reason nor without a prior meeting, in person, of the student and the instructor. All assignments must be completed in order to receive a passing grade in the class.

Literature

1) Patrik Schumacher, The Autopoiesis of Architecture, Volume 1, A New Framework for Architecture, published by John Wiley & Sons, 2010.
2) Patrik Schumacher, The Autopoiesis of Architecture, Volume 2, A New Agenda for Architecture, published by John Wiley & Sons, March 2012.
3) Philip Ball ,The Self-Made Tapestry: Pattern Formation in Nature, 2001.
4) Ernst Haeckel, Kunstformen der Natur, 1899-1904.
5) D'Arcy Wentworth Thompson, On Growth and Form.
6) Andy Payne, Grasshopper Primer.
7) Zubin Khabazi, Generative Algorithms with Grasshopper version 2.0.

8) Arturo Tedeschi, Parametric Architecture with Grasshopper - Primer guide.

Attendance

Attendance at all class meetings is mandatory and crucial to successful completion of the class. Attendance will be taken at every meeting and I expect punctual arrival, so that I can begin class on time. Late arrivals will be counted as absences; more than two unexcused absences or three total absences will be grounds for reduction of your course grade. Absences will be excused only for medical or family emergencies documented in writing. Don't jeopardize your overall performance and course grade by skipping class.

Academic Integrity

Georgia tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.

Accommodation of Disabilities

Any student with a disability that may require accommodation should contact ADAPTS (Access Disabled Assistance Program for Tech Students) at (404) 894.2564 or http://www.adapts.gatech.edu/ to make an appointment to discuss his or her special needs and obtain an accommodations letter. He or she should also schedule an appointment to speak with the instructor.

Emergencies

In case of emergency (e.g., fire, accident, or criminal act), please call the Georgia Tech Police at (404) 894.2500. Please note that Perry Minyard, IT Support Administrator for the College of Architecture, is also a firefighter and an Emergency Medical Technician (EMT) certified in performing CPR.