Columbia University GSAPP
Architectural Technology Sequence
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A4707

Evolutionary Design

EZCT: Studies on Optimization

This seminar presents evolutionary systems, alongside other iterative design approaches, as pragmatic and open-ended tools for realizing architectural structures. Evolution provides a powerful framework and example of how natural systems can bootstrap to increasingly more sophisticated outcomes. The seminar is an introduction to evolutionary design concepts such as mutation, fitness and selection alongside their potential applications in the world of design and beyond. A combination of lectures, workshops and individual project support are goaled to introduce existing as well as incubate new design methodologies in which evolutionary mechanics are at work.

Seminar Approach

The seminar addresses evolutionary design at a conceptual level through readings and lectures on creative evolutionary systems. A core component of the seminar is a series of workshops exploring digital simulation tools. Simulation is approached as a primary vehicle to realize an active environment of forces and interactions largely ignored in traditional design software. In our workshops we will explore how simulation tools can not only assess shape but also participate in its formation through iterative feedback. Each workshop will introduce key technical explanations of simulation algorithms along with the hands-on demonstrations to help students critically examine the limits of modern simulation tools and methods.

Seminar Project

The seminar project is to illustrate a design methodology that integrates design automation, digital simulation or evolutionary systems. The research will culminate in a short but well-illustrated technical presentation detailing the methodology, its application to prototypical design situations, and relevant results. Successful papers will be encouraged and supported to submit to ACADIA or other similar architectural technology conference for publication.

Course Schedule

Class	Type	Topic
01	Introduction	Introduction, What is Evolutionary Design?
02	Lecture	Principles & Mechanisms, Evolutionary Design
03	Workshop 1	Evolution, Rhino Galapagos
04	Workshop 2	Forces & Time, Physics Based Simulation in Kangaroo
05	Group Meetings	Individual or Group Meetings
06	Workshop 3	Environment, Simulation in Ecotect/Geco #1 (Solar)
07	Workshop 4	Environment, Simulation in Ecotect/Geco #2 (Wind)
08	Group Meetings	Individual or Group Meetings
09	Workshop 5	Formation, & Finite Element Analysis in Solidworks
XX	No Class	Election Day
10	Lecture	Special Topics: Parallel Computing, Crowdsourcing, Biometrics
11	Group Meetings	Individual or Group Meetings
12	Group Meetings	Individual or Group Meetings
13	Presentations	Final Presentations
		Deadline for Technical papers

Readings

Creative Evolutionary Systems, Bentley, Peter
An Evolutionary Architecture, Frazer John
Out of Control: The New Biology of Machines, Social Systems and the Economic World, Kelly, Kevin
Performative Architecture: Beyond Instrumentality, Kolarevic, Branko
Architecture in the Digital Age: Design and Manufacturing, Kolarevic, Branko
Computer Aided Architectural Design, Mitchell, Bill
Class Wiki (workshop materials, shared files)