

**CourseNo:** ARCHA4801\_001\_2013\_3

**Meeting Location:** [BUELL HALL 200](#)

**Meeting Time:** T 01:00P-03:00P

**Instructor Information:** [Ezio Blasetti](#)

This workshop will be devoted to the design and prototyping of architectural immersive environments via computational generative methods. At present computational techniques are predominantly employed in the optimization, rationalization or surface decoration of more traditionally created forms and spaces. This research rather, will focus on the inherent potential of computation to generate space and of algorithmic procedures to engage self-organization in the design process. Participants will engage closely with computational processes in order to develop an aesthetic and intuition of complexity that resides in a balance between design intent and emergent character. During the workshop, participants will work in small teams and create their own custom algorithms appropriate to the research trajectories of choice. The output of the workshop will be a series of boards, prototypes and animations.

"Encoded matter" will run primarily under python programming language for Rhinoceros 3D 5.0, Grasshopper & Autodesk Maya. The application of python as the cross-software coding platform opens up a new set of possibilities for the development of cutting edge techniques of digital representation, abstract and spatial organization as well as intricate geometric precision for robotic fabrication. "Encoded matter" will test python for rhinoceros/maya in an intensive format and will seek to produce innovative intersections between advanced explicit modeling and algorithmic logics.

The focus is not merely on a demonstration of proficiency in various skills and techniques, but rather the positioning of the project as a contribution to the larger architectural discussion, which supports the value of computational craftsmanship methodologies. The critical parameter in this workshop will be to develop the potential beyond finite forms of explicit and parametric modeling towards more non-linear algorithmic processes. This workshop will accommodate both introductory and advanced levels. No previous scripting experience is

necessary. It will consist of a series of introductory sessions, obligatory intensive workshops, lectures followed by suggested readings, and will gradually focus on individual projects.

The seminar is organized into a series of topics, some of which will be covered in the tutorials, and others that will suggest potential areas of student research. “Encoded Matter” is seeking to propose a parallel study between material behavior and computational systems. The materialization of the research is non-linear: the computational system is not predefined with a singular fabricated manifestation. The participants will be encouraged to conduct and document a series of material ‘experiments’ in dialogue with their computational research.

### Workshop I: Algorithmic and Material Analysis & Self-Organization

This session will look closely in parallels between the animate behavior of matter and the emergent phenomena in simple software. Algorithmic procedures will be developed for the analysis and simulation of analog experiments. The output will aim at two and three dimensional drawings as well as animations that capture the expressive character of the self-organizing system in question.

### Workshop II: Non-Linear Computational Tectonic Language

The second session of encoded matter will build upon the research developed in the first half. Students with prior scripting knowledge are welcome to participate regardless if they enroll in the first session. The tutorials will focus on advanced algorithmic techniques oriented towards metaheuristic methods and non-linear combinatorial systems for design. Participants will work towards the development of a research specific tectonic language. These investigations will lead to the design of a temporary construct/pavilion through constant feedback between programming and prototyping.

### Topics & Bibliography :

### Monadologies | Variables, Loops, Functions, Classes

Emergence: The Connected Lives of Ants, Brains, Cities, and Software by Steven Johnson

Godel, Escher, Bach: An Eternal Golden Braid by Douglas Hofstadter

Non-Organic Life by Manuel Delanda

Complexity: A Guided Tour by Melanie Mitchell

The Storm in the Computer by Manuel Delanda

Monadology by Gottfried Leibniz

## Epiphenomena | Gradients, Patterns, Textures, Colors & Rates of Change

Thermodynamics and Language by Michel Serres

Landscapes of Change by Sanford Kwinter

The Turing Dimension by Karl Chu

A New Kind of Science by Stephen Wolfram

Cellular Automata and Patterns of Flow by Manuel Delanda

Shapes: Nature's Patterns: A Tapestry in Three Parts by Philip Ball

Calculus-Based Form: An Interview with Greg Lynn by Ingeborg M. Rocke

## Fields | Forces, Attractors & Intensities of Flow

Animate Form by Greg Lynn

On Growth and Form by D'Arcy Wentworth Thompson

Matter and Motion by James Clerk Maxwell

From Object to Field by Stan Allen

## Feedback | Fractals, Recursion & Substitution

The Computational Beauty of Nature by Gary William Flake

AD Vol76 Issue 2 Techniques and Technologies in Morphogenetic Design by Michael Hensel

Branches: Nature's Patterns: A Tapestry in Three Parts by Philip Ball

Hidden Order by John Holland

The Fractal Geometry of Nature by Benoît Mandelbrot

The Smooth and the Striated by Gilles Deleuze and Felix Guattari

## Shadows | Quasicrystals, Polytopes & Hyper-Dimensional Geometry

Flatland by Edwin A. Abbott

Pamphlet Architecture 27: Tooling by Benjamin Aranda, Chris Lasch, Cecil Balmond, and Sanford Kwinter

Shadows of Reality: The Fourth Dimension in Relativity, Cubism, and Modern Thought by Tony Robbin

The Graphic Work of M. C. Escher

Introduction to Graph Theory by Richard J. Trudeau

A Topological Picturebook by George K. Francis

## Anima | Agents, Boids, Crowds, Swarms & Slime Mold

Crowds and Power by Elias Canetti

Simulations by Jean Baudrillard

Flow: Nature's Patterns: A Tapestry in Three Parts by Philip Ball

AD Vol76 Issue 5 Collective intelligence by Chris Perry and Christopher Hight

## Equilibria | Spring Systems, Minimal Surfaces, Relaxation & Structural Optimization

Structural Stability And Morphogenesis by Rene Thom

The Function of Form by Farshid Moussavi

Infinite Periodic Minimal Surfaces without Self-Intersections by Alan H. Schoen

Evolutionary Topology Optimization of Continuum Structures by X. Huang and Y. M. Xie

## Speculatis | Stochastic, Evolutionary, Genetic Algorithms & Ghost Diagrams

Music and Architecture by Iannis Xenakis & Sharon Kanach

Deleuze and the Use of the Genetic Algorithm in Architecture by Manuel De Landa

Metaphysics of Genetic Architecture and Computation by Karl Chu

Far From Equilibrium by Sanford Kwinter