

EVOLUTIVE DESIGN

@Texas A&M, College Station. TX. College of Architecture.

Grasshopper Workshop.

Evolutionary Modeling to 3D printing.

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"Some consider it noble to have a method; others consider it noble not to have a method. Not to have a method is bad; to stop entirely at method is worse still. One should at first observe rules severely, then change them in an intelligent way. The aim of possessing method is to seem finally as if one had no method."

Jieziyuan Huazhuan 1679.

Computational design and generative art.

"Over the last two decades computers have come to dominate almost all areas of design, taking over the burden of repetitive tasks so that the designer can focus on the act of creation. As a result designers have become dependent on software, tools that shape both the process and the end result. This dependence invariably becomes a limitation, forcing the designer to adapt her work to the decisions and metaphors chosen by the programmer.

Computational design represents a new approach, an attempt to provide designers and artists with a new literacy in digital media. Understanding that true literacy means being able to "write" as well as "read", the creator is positioned as designer of computational processes. In this way she is able to question existing models of space and interaction, fully exploring the possibilities of electronic media." Computational Design. Künste University, Berlin. 2009. <http://workshop.evolutionzone.com/old/>

--Workshop will focus on the nature of information processing and how it can be used to manipulate data, stream inputs from various sources and use data feeds to inform geometry or data structures from the very simple up to more complex ones. The aim is to give an understanding of information and data articulation as already a spatial and architectural operation. Results may range from pure data communication protocols, dataviz or data-driven geometries.

KEY TOPICS: Basis of **grasshopper parametric plug-in** for rhinoceros; tracking design constraints, flow paths, particles, etc.; understanding the inherent **craft** of data-collection; data flow – **parametric modeling & analysis**; understanding of **data management** through grasshopper; 3d printing into **digital fabrication**.

PROGRAM.

Day 1.

1. **Introduction to computational design.**
 - Generative Design.
2. **Visual scripting and programming theory.**
3. **Object Oriented Programming.**
4. **Why Grasshopper as interface?**
5. **Grasshopper Basics.**
 - a. **Introduction:** interfaces, canvas, navigation.
 - b. **Components:** structures, colors, menu, wires.
 - c. **Data flow basics:** geometry types, data types.
 - d. **Geometry creation:** points, planes and vectors, curves, surfaces.
 - e. **Data flow intermediate.** Lists management: domain, interval, range, series; pre-rationalization: constraints, range definition, domain mapping and modulation.

Day 2.

- f. **Data flow intermediate:** conditional operations, data visualization and control (text tags, panel).
- g. **Data flow advanced:** data tree & pathmapping; geometry instantiation (component to proliferation environment); attractor logics (one and multiple points, curves); informing geometries: colors & tagging.
- h. **Example & case studies.**

6. **Parametric Analysis.**
7. **Simulation and Iterative scripting.**
8. **Manifolds.**
 - Grids.
 - ◆ Triangular.
 - ◆ Quad.
 - ◆ Hexagonal.
 - ◆ Variable.
 - ◆

Day 3.

9. **Mesh.**
 - ◆ Metaballs.
 - ◆ Complex geometry.

10. Evaluation & Evolutionary functions.

- Modeling optimization.
- Evolutionary Solvers.
- Genomes.
- Fitness
- Galapagos.

11. Data mining.

12. Dimensions.

13. Digital Fabrication.

- Mesh optimization
- 3D printing.
- Structural Joints.
- Text tags.

References:

Digital resources.

- <http://bigthink.com/ideas/39884> (**Industrial Evolution**)
- <http://archimorph.wordpress.com/2012/08/08/innovations-in-construction/> **Innovations in construction.**
- http://www.ted.com/talks/lang/en/neil_gershenfeld_on_fab_labs.html **FABLABS TED Lecture.**
- <http://money.usnews.com/money/careers/articles/2010/12/06/the-50-best-careers-of-2011> **Best Careers of 2011.**
- http://www.emergentarchitecture.com/pdfs/LOG_17.pdf (**Talk about architecture perception**). Tom Wiscombe, Lisa Iwamoto, Elena Manfredini, Heather Roberge, Peter Zellner y Kivi Sotamaa.
- <http://www.strategy-business.com/article/11307?gko=63624> **A Strategist Guide to Digital Fabrication.**
- <http://www.economist.com/node/18114221> **The Printed World: Three-dimensional printing from digital designs will transform manufacturing and allow more people to start making things.**
- <http://www.economist.com/node/21541382> **The Shape of Things to come.**
- http://www.nytimes.com/2011/01/13/technology/personaltech/13basics.html?_r=2 **The Wow Factor of 3-D Printing.**
- <http://www.kickstarter.com/projects/printrbot/printrbot-your-first-3d-printer> **New Digital Fabrication Business.**
- <http://pinterest.com/jdraper/skins/> **Natural Patterns. Skins.**

Publications.

- **Computational Design Thinking: Computation Design Thinking**
[Achim Menges](#), [Sean Ahlquist](#)

ISBN: 978-0-470-66570-1

- **Digital Surfaces.** <http://xahlee.info/surface/gallery.html>
- **Computational Design Modeling:** Proceedings of the Design Modeling Symposium Berlin 2011

<http://books.google.com.mx/books?id=diiTjiV8eewC&lpg=PR1&hl=es&pg=PR1#v=onepage&q&f=false>

- **Expressive Form: A Conceptual Approach to Computational Design**

ISBN-10: 0415317444 | ISBN-13: 978-0415317443 | Publication Date: November 15, 2003 | Edition: 1

- <http://cdl.engr.uconn.edu/publications.html> **Computational Design Laboratory Universidad de Connecticut (Publicaciones selectas)**
- <http://andregraziano.blogspot.com/> **Andrea Graziano, Digital Journal. Computational Design developer.**
- <http://designplaygrounds.com/> **Rodrigo Medina, Investigación y noticias del Diseño Computacional y Fabricación Digital. Diseño Industrial, Ingeniería y Arquitectura.**

Research and Development centers.

- <http://www.arch.columbia.edu/labs/fablab> **Columbia US, FabLAB.**
- <http://code.arc.cmu.edu/> **Computational Design LAB Carnegie Mellon**
- <http://cadlab.mit.edu/> **Computational Design LAB MIT**
- <http://fab.cba.mit.edu/about/faq/> **(Protocolo del MIT para la generación de un FABLAB)**
- <http://www.arch.tamu.edu/inside/services/digital-fabrication/> **Digital Fabrication Facility. Texas A&M, Riverside Campus.**
- http://www.tcaup.umich.edu/digital_tech/digital_fablab/ **Taubman College FabLAB**
- http://www.sciarc.edu/portal/about/resources/robotics_lab.html **SCI ARC. Robothouse. Robotics in Architecture.**
- <http://www.design.upenn.edu/facilities/fabrication-lab> **UPENN FabLAB.**
- <http://fabacademy.org/> **Red Internacional de FABLABS.**
- <http://www.robotsinarchitecture.org/> **Applied Robotic Technology in Architecture.**

- <http://www.i-m-a-d-e.org/> **Institute of Digital Fabrication.**
- <http://curvlabs.com/> **Design / Fabrication / Architecture / Robotics.**

Digital Toolbox.

- <http://download.rhino3d.com/Grasshopper/1.0/wip/download/> **Grasshopper Installer.**
- <http://download.rhino3d.com/Rhino/5.0/evaluationtimed/download/> **Rhino 5.0 Evaluation 90 Days.**
- http://www.probotix.com/FireBall_Comet_cnc_router/ **(CNC Router)**
- <http://botmill.com/index.php/glider.html> **(3D Printer)**
- <http://store.makerbot.com/replicator-404.html> **Economic 3D Printer, MakerBot Replicator.**
- http://www.precix.com/CNC_routers_industrial.htm **Precix CNC Company.**
- http://reprap.org/wiki/Main_Page **(REP-RAP 3D Replicant Printers)**
- <http://parasite.usc.edu/?p=453> **(3D Printing)**
- <http://vimeo.com/18539129> **Arduino, opensource hardware documentary.**
- <http://www.arduino.cc/> **Arduino, open-source electronics.**
- <http://processing.org/> **Processing. Open-source programming language.**
- <http://antonioturiello.blogspot.mx/2012/05/generation.html> **Generation DIGIFAB**
- <http://whatrevitwants.blogspot.mx/2012/09/three-ways-to-go-from-grasshopper-to.html> **Grasshopper to Revit. Plug-ins resources.**