



**LSU** | College of Art + Design

LA 7051 | **Generative Fabrication**

Brendan Harmon

baharmon@lsu.edu

Fall 2020 Design 324.  
Monday, Wednesday, & Friday  
1:30pm–5:20pm.

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### Course Description

This studio will explore non standard construction in architecture and landscape architecture. You will use generative processes for the design and fabrication of complex architectural forms. In the first section of this studio you will learn how to program 3D printers and industrial robots and then design, render, and fabricate a small ceramic vessel. In the second section you will design a ceramic structure for a free standing green wall. Use a generative design process to model and analyze a family of variations on your design. Fabricate scale models of your designs. In the third section of the course you will make a detailed design, renderings, and construction documentation for your green wall. This studio will be conducted online. You will have either remote or in person access to digital fabrication tools such as industrial robots and fused deposition modeling (FDM) , stereolithography (SLA), and ceramic 3D printers.

**Required Textbook** | Diego Garcia Cuevas and Gianluca Pugliese. *Advanced 3D Printing with Grasshopper: Clay and FDM*. 2020

### Keywords

- 3D printing
- Robotics
- Parametric modeling
- 3D rendering
- Ceramics
- Generative fabrication

### Topics

Fabrication		Families of Form		Detailed Design	
1	Introduction	6	Ideation	11	Design
2	3D printing	7	Paneling	12	Fabrication
3	Generative sys.	8	Analysis	13	Assembly
4	Prototyping	9	Variations	14	Documentation
5	Review	10	Review	15	Review

## Online

This studio will be taught online. All course content including tutorials, lectures, and datasets will be published on the course website at: <http://baharmon.github.io/generative-fabrication>. During our regularly scheduled class period on MWF from 1:30-5:20 pm, we will meet on our Discord server at <https://discord.gg/B3Y5SDK> for live streamed lectures, critiques, discussions, student presentations, and troubleshooting. Post your design work on your channel on the Discord server. Tutorials will be posted on the course website with videos on both Youtube and Vimeo. There will be either remote or in person access to digital fabrication equipment such as fused deposition modeling (FDM) , stereolithography (SLA), and ceramic 3D printers and collaborative robots.

Course Website | <http://baharmon.github.io/generative-fabrication>  
Discord | <https://discord.gg/B3Y5SDK>

## Projects

**Ceramic Vessel** 3D model, 3D rendering, and 3D print a small ceramic vessel with a complex geometric form.

**Greenwall Design** Design a non standard ceramic structure for a greenwall. Model and analyze variations on the greenwall. 3D print scale models of the greenwall.

**Greenwall Prototype** Develop a detailed design for a greenwall. Develop documentation including construction drawings, 3D renderings, plant lists, materials, and cost estimates.

**Course Portfolio** Collect your work in a course portfolio for the school's accreditation archive. *Due: 12/11/2020*

## Grading

Ceramic Vessel	30%	Greenwall Prototype	35%
Greenwall Design	30%	Course Portfolio	5%

## Software

Rhinoceros | <https://www.rhino3d.com/>

Thea Render for Rhino | <https://www.thearender.com/>

## Resources

**Design 324** | UR10e, Ender FDM 3D Printer, & 3D PotterBot Micro 9

**FabLab** | 3D PotterBot, Delta WASP 3D Printer, CNC Routers, etc.

**Additive FabLab** | Form 2 SLA 3D Printers

**Art + Design CxC Lab** | Prusa 3D Printers

## Readings

Cuevas, Diego Garcia, and Gianluca Pugliese. *Advanced 3D Printing with Grasshopper: Clay and FDM*. 2020.

Choma, J. *Morphing: A Guide to Mathematical Transformations for Architects and Designers*. Laurence King Publishing, 2015.

Menges, A. *Material Synthesis: Fusing the Physical and the Computational*. Architectural Design. Wiley, 2015.

Stevens, J., and R. Nelson. *Digital Vernacular: Architectural Principles, Tools, and Processes*. EBL-Schweitzer. Taylor & Francis, 2015.

Gramazio, F, and M Kohler. *Made by Robots: Challenging Architecture at a Larger Scale*. Architectural Design. Wiley, 2014.

Tedeschi, A. *AAD Algorithms-aided Design: Parametric Strategies Using Grasshopper*. Le Penseur, 2014.

Beorkrem, C. *Material Strategies in Digital Fabrication*. Taylor & Francis, 2013.

Dunn, Nick. *Digital Fabrication in Architecture*. Laurence King Publishing, 2012.

Carmo, Mario. *The Alphabet and the Algorithm*. Cambridge, MA: MIT Press, 2011.

Thompson, R. *Manufacturing Processes for Design Professionals*. Thames & Hudson, 2007.



## Policies

**Accreditation Expectations** As an accredited Landscape Architecture program LSU's Robert Reich School of Landscape Architecture (RRSLA) must meet the accreditation requirements as stated by the Landscape Architectural Accreditation Board (LAAB) to ensure RRSLA is meeting the expectations of the field. The LAAB requires programs to provide digital copies of student work as part of this process. Students in this course will be expected to comply with the following requirements as 5% of their course grade: (1) Students must provide a course portfolio with work samples specified by the instructor before the end of the grading period. (2) Each student's course portfolio must be saved as a single, high resolution PDF file with multiple pages. (3) Files must follow the naming convention established by the school: department-coursenumber-semesteryear-username.pdf. Example: LA7051-F2020-baharmon.pdf.

**Time Commitment Expectations** LSU's general policy states that for each credit hour, you (the student) should plan to spend at least two hours working on course related activities outside of class. Since this course is for three credit hours, you should expect to spend a minimum of six hours outside of class each week working on assignments for this course. For more information see: <http://catalog.lsu.edu/content.php?catoid=12&navoid=822>.

**LSU student code of conduct** The LSU student code of conduct explains student rights, excused absences, and what is expected of student behavior. Students are expected to understand this code: <http://students.lsu.edu/saa/students/code>.

**Disability Code** The University is committed to making reasonable efforts to assist individuals with disabilities in their efforts to avail themselves of services and programs offered by the University. To this end, Louisiana State University will provide reasonable accommodations for persons with documented qualifying disabilities. If you have a disability and feel you need accommodations in this course, you must present a letter to me from Disability Services in 115 Johnston Hall, indicating the existence of a disability and the suggested accommodations.

**Academic Integrity** According to section 10.1 of the LSU Code of Student Conduct, "A student may be charged with Academic Misconduct" for a variety of offenses, including the following: unauthorized copying, collusion, or collaboration; "falsifying" data or citations; "assisting someone in the commission or attempted commission of an offense"; and plagiarism, which is defined in section 10.1.H as a "lack of appropriate citation, or the unacknowledged inclusion of someone else's

words, structure, ideas, or data; failure to identify a source, or the submission of essentially the same work for two assignments without permission of the instructor(s)."

**Plagiarism and Citation Method** Plagiarism is the "lack of appropriate citation, or the unacknowledged inclusion of someone else's words, structure, ideas, or data; failure to identify a source, or the submission of essentially the same work for two assignments without permission of the instructor(s)" (Sec. 10.1.H of the LSU Code of Student Conduct). As a student at LSU, it is your responsibility to refrain from plagiarizing the academic property of another and to utilize appropriate citation method for all coursework. In this class, it is recommended that you use Chicago Style author-date citations. Ignorance of the citation method is not an excuse for academic misconduct.

**COVID-19 Statement** We remain under pandemic conditions and expect to be in this state for the entire semester. In order to consistently provide the highest quality LSU education, all students should follow current LSU guidelines. These include the following:

1. If you have any signs of illness, do not come to class.
2. In order to protect all campus community members, the University requires everyone to wear facemasks/cloths on campus. Failure to do so is a violation of the code of student conduct.
3. Wash hands with soap and water or clean with sanitizer frequently, and refrain from touching your face.
4. If you have to cough or sneeze unexpectedly, please be mindful of others nearby and cough or sneeze into your elbow or shield yourself the best you can.
5. If you have been exposed to others who have tested positive for COVID-19, self-quarantine consistent with current CDC guidelines.

**Unexpected Changes to Courses** Due to the unpredictable nature of the situation, the format of the course and/or requirements may be forced to change. If this is the case you will be given appropriate notification.