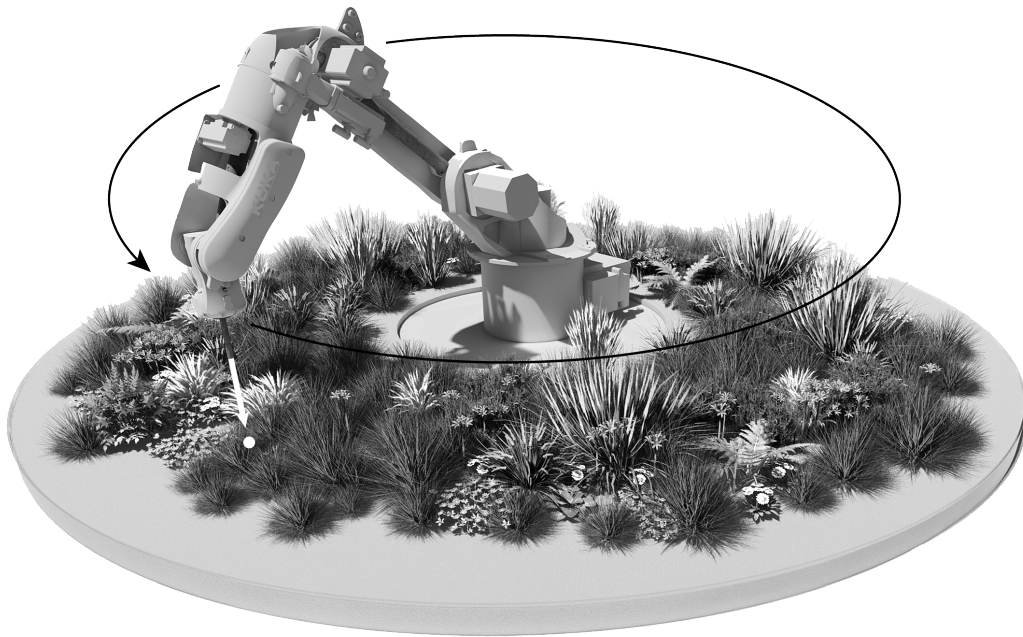


LA 4008 & LA 7051 | **Ecological Robotics**

Brendan Harmon
baharmon@lsu.edu

Design 304
Monday, Wednesday, & Friday
1:30pm–5:30pm
Fall 2021





LA 4008 & LA 7051 | **Ecological Robotics**

Brendan Harmon
baharmon@lsu.edu

Design 304
Monday, Wednesday, & Friday
1:30pm–5:30pm
Fall 2021

Course Description

This studio will explore ecological applications for robots. In this studio you will learn how to program industrial robots, design your own robotic tools, and robotically plant a landscape. Through a series of projects you will design a robotic process for algorithmic planting and test it both in the studio and in the field. The field site will be a set of plots at Burden where you will conduct a controlled planting experiment. As an introduction to robotics for designers, this studio will cover topics such as visual programming, generative design, robotic operations, 3D printing, 3D scanning, and drone photogrammetry.

Topics

Robotic Sandbox

- 1 Robotic Operations
- 2 Robotic Programming
- 3 Robotic Tools
- 4 Visual Programming
- 5 Robotic Sandbox

Robotic Planting

- 6 3D Printing Seeds
- 7 Laboratory Planting
- 8 Algorithmic Seeding
- 9 Algorithmic Landforms
- 10 3D Scanning

Robotic Landscape

- 11 Site Preparation
- 12 Field Planting
- 13 Drone Mapping
- 14 Documentation
- 15 Exhibition

Projects

Post your project work on Discord: <https://discord.gg/sn92G8sJSb>

Robotic Sandbox Design and fabricate a customized robotic tool for sculpting sand. Use a collaborative, industrial robotic arm to sculpt algorithmically generated terrain in a sandbox. Record your models with 3D scans.

Robotic planting Design, fabricate, and test a robotic process for planting. In the studio use a collaborative, industrial robotic arm to plant a set of trays with seeds. Experiment with different algorithmic planting patterns. Record your plants as they grow with a series of 3D scans.

Robotic Landscapes Plant a set of square meter plots at Burden as a controlled field experiment to compare hand sown seeds with robotic seeding. Use drone photogrammetry to record the start of the experiment.

Hardware

UR10e Robot | <https://www.universal-robots.com/products/ur10-robot>

UR5e Robot | <https://www.universal-robots.com/products/ur5-robot>

Faro Focus 3D | <https://www.faro.com/en/Products/Hardware/Focus-Laser-Scanners>

DJI Matrice 600 Pro | <https://www.dji.com/matrice600-pro>

FireFly 6 Pro | <https://www.birdseyeview.aero/products/firefly6>

3D PotterBot | <https://3dpotter.com/>

Software

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

Machina | <https://github.com/RobotExMachina>

Metashape | <https://www.agisoft.com/>

Scene | <https://www.faro.com/>

Grading

Robotic Sandbox	30%	Robotic Landscape	30%
Robotic Planting	35%	Course Portfolio	5%

Resources

Grasshopper Primer | <http://grasshopperprimer.com>

Machina Tutorials | <https://www.youtube.com/c/garciadelcastillo>

Readings

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.

Policies

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.