



LSU | College of Art + Design

LA 7032 | **Computational Design**

Brendan Harmon

baharmon@lsu.edu

Spring 2023.

Tuesday & Thursday

1:00–3:30pm

Design 308

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Design 308

Course Description

This course is an introduction to computational design for landscape architects. In this course you will learn how to algorithmically model landscapes, numerically simulate physical processes like the flow of water and sediment, and digitally fabricate landforms. You will conduct surveys with drones and terrestrial lidar, use point clouds to model and visualize terrain and planting, parametrically model variations on landscapes using visual programming, and computer numerical control (CNC) mill landforms. In this course you will learn creative approaches to computational design and apply emerging technologies to landscape architecture.

Keywords

- Algorithmic architecture
- Laser scanning
- Visual programming
- Generative design
- Lidar analytics
- Digital fabrication
- Parametric modeling
- Drone photogrammetry
- Robotics

Schedule

Sensing

- 1** Laser scanning I
- 2** Laser scanning II
- 3** Drones I
- 4** Drones II
- 5** Terrain Analysis

Computation

- 6** Visual programming
- 7** Randomness
- 8** Noise
- 9** Attractors
- 10** Physics

Fabrication

- 11** Grading
- 12** Digital Fabrication I
- 13** Digital Fabrication II
- 14** Robotics
- 15** Robotic Wall

Logistics

During our regularly scheduled class period on Tuesdays and Thursdays from 1:00-3:50 pm, we will meet in person, while also posting on our Discord server at <https://discord.gg/6kNkp2PSsu>. The discord server will be used for posting announcements, student work in progress, reading responses, projects, and troubleshooting. All course content including tutorials, lectures, and datasets will be published on the course website at: <https://baharmon.github.io/generative-landscapes>.

Course website | <https://baharmon.github.io/generative-landscapes>

Discord | <https://discord.gg/6kNkp2PSsu>

Youtube | <https://www.youtube.com/@baharmon>

Essays

Essay: Cloudism Read Christophe Giroit's essay *Cloudism* and write a 500-word critical response. What potential do you see in point clouds as a medium for landscape architecture? What makes point clouds different from other modes of representation?

Giroit, Christophe. "Cloudism." In *Routledge Research Companion to Landscape Architecture*, ed. by Ellen Braae and Henriette Steiner. London: Routledge, 2019. <https://doi.org/10.4324/9781315613116>.

Essay: The Alphabet and Algorithm Read Mario Carpo's *The Alphabet and Algorithm* and then in response write a 500-word critical essay. How have digital tools and processes transformed the practice of landscape architecture and how do you think they will shape the future of the discipline? How do you envision using digital design tools and processes in your work?

Carpo, Mario. *The alphabet and the algorithm*. Cambridge, MA: MIT Press, 2011.

Projects

Point Cloud Library Use laser scanning to capture a library of plants as point clouds. Publish the point cloud to the web in an interactive viewer.

Drone Survey Conduct a topographic survey of the landform at Hilltop Arboretum with a drone. Use real-time kinematic GNSS to establish ground control points. Use structure-from-motion photogrammetry to generate a point cloud, digital surface model, and orthophoto.

Parametric Landscape Use visual programming to generate variations of landforms, plantings, and paving. CNC mill, thermoform, and then cast an algorithmically generated terrain model.

Parametric Wall Program a robotic arm to assemble a parametrically modeled, curvilinear wall from bricks.

Grading

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|---------------------|-----|----------------------|-----|
| Essays | 15% | Parametric Landscape | 20% |
| Point Cloud Library | 20% | Parametric Wall | 20% |
| Drone Survey | 20% | Course Portfolio | 5% |

Software

Rhinoceros | <https://www.rhino3d.com/>
 Metashape | <https://www.agisoft.com/>
 Faro Scene | <https://www.faro.com/>
 CloudCompare | <https://www.danielgm.net/cc/>
 GRASS GIS | <https://grass.osgeo.org/>
 QGIS | <https://www.qgis.org/>

Plugins

Snapping Gecko | <https://www.food4rhino.com/app/snappinggecko>
 Bitmap+ | <https://www.food4rhino.com/en/app/bitmap>
 Docofossor | <https://www.food4rhino.com/app/docofossor>
 RhinoCAM | <https://mecsoft.com/rhinocam-software/>

Resources

Grasshopper Basics | <https://vimeo.com/channels/basicgh>
 Grasshopper Primer | <http://grasshopperprimer.com>
 Hydrology in GRASS GIS | https://grasswiki.osgeo.org/wiki/Hydrological_Sciences

Required Readings

Giro, Christophe. "Cloudism." In *Routledge Research Companion to Landscape Architecture*, ed. by Ellen Braae and Henriette Steiner. London: Routledge, 2019. <https://doi.org/https://doi.org/10.4324/9781315613116>.

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

Carmo, Mario. *The alphabet and the algorithm*. Cambridge, MA: MIT Press, 2011.

Recommended Readings

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

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

Neteler, Markus, and Helena Mitsova. *Open source GIS: a GRASS GIS approach*. Vol. 689. Springer Science & Business Media, 2013.

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

Picon, Antoine. *Digital culture in architecture: an introduction for the design professions*. 224. Boston, MA: Birkhaeuser, 2010.

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.

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-semester-year-username.pdf. Example: LA7032-S2023 -baharmon.pdf.