LSU | College of Art + Design

LA 7032 | Generative Landscapes

Brendan Harmon
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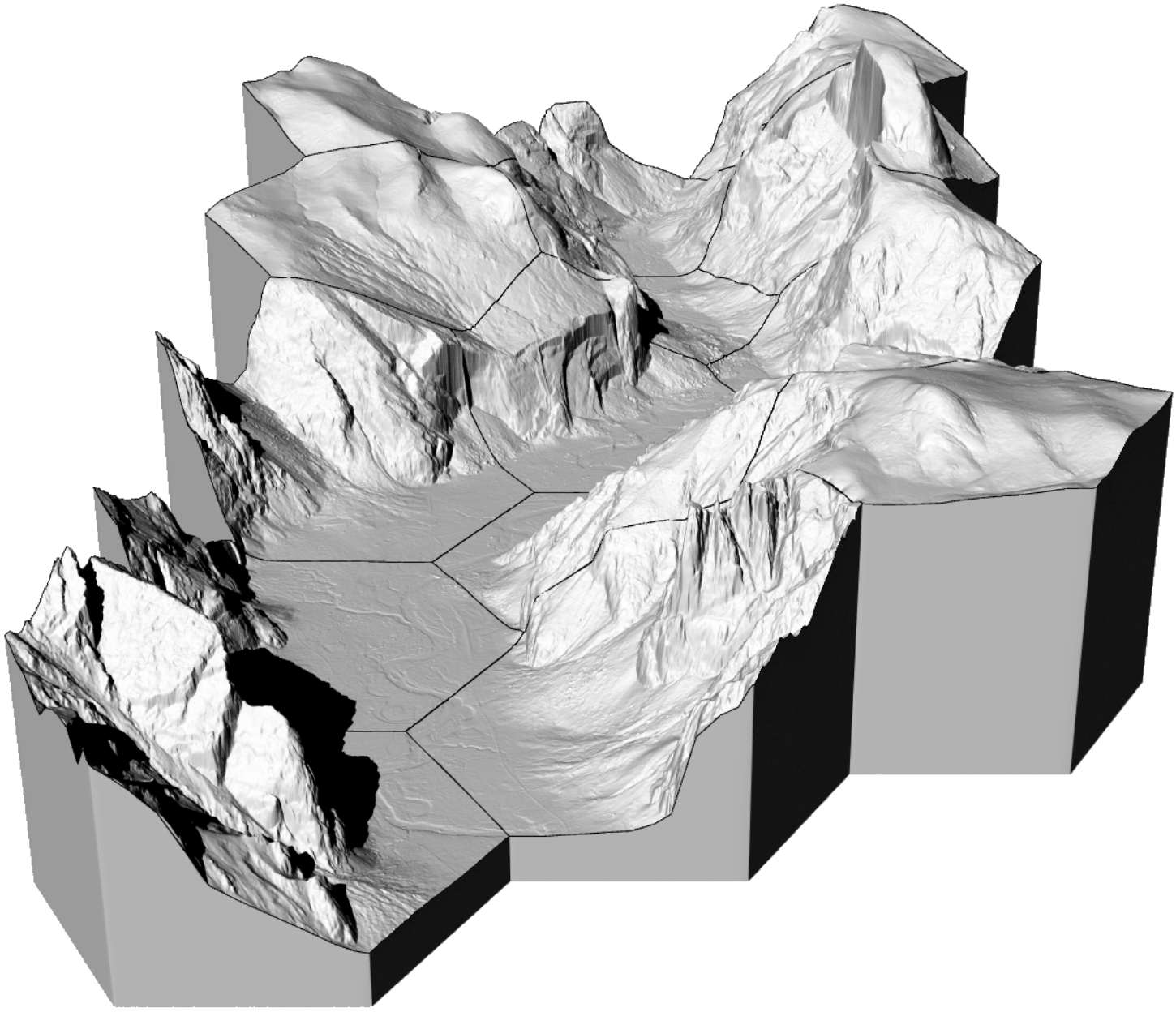
Spring 2020. Design 217.
Tuesday & Thursday 1:00am–3:30pm.



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Course Description

This course is an introduction to generative design for landscape architects. In this course you will learn how to algorithmically model landscapes, numerically simulate physcial processes like the flow of water and sediment, and digitally fabricate landforms. You will conduct surveys with drones and terrestrial lidar, parametrically model variations on landfroms and planting using visual programming, and photorealistically render your algorithmic planting patterns. Through this course you will learn creative approaches to digital design and apply emerging technologies to landscape architecture.

Keywords

- Algorithmic architecture
- Generative design
- Parametric modeling
- Visual programming
- Digital fabrication
- 3D rendering
- Lidar analytics
- Drone photogrammetry
- Geospatial programming

Topics

Lidar & drone analytics

1 Design week
2 Alphabet & algorithm
3 Drone surveying
4 Drone photogrammetry
5 Lidar analytics

Algorithmic design

6 Geospatial modeling
7 Geospatial programming
8 Generative design
9 Parametric modeling
10 Spring Break

Generative design

11 Spring break
12 Waveforms
13 Point clouds
14 3D rendering
15 Geospatial analytics

Course Schedule

Drones

01.14.2020	**Studio** | Introduction	
01.21.2020	**Lecture** | Coastal drones	**Tour:** Ctr. for River Studies
01.23.2020	**Reading** | Alphabet & algorithm	**Essay:** Generative design
01.28.2020	**Tutorial** | Intro to drones	
01.30.2020	**Fieldwork** | Drone survey	
02.04.2020	**Tutorial** | Drone photogrammetry I	
02.06.2020	**Tutorial** | Drone photogrammetry II	**Project:** Drone survey
02.11.2020	**Fieldwork** | Lidar survey	
02.13.2020	**Tutorial** | Point cloud processing	**Project:** Lidar survey

Algorithmic

02.18.2020	**Tutorial** | Terrain modeling
02.20.2020	**Tutorial** | Hydrologic simulation
02.27.2020	**Tutorial** | Geospatial programming I
03.03.2020	**Tutorial** | Geospatial programming II
03.05.2020	**Tutorial** | Generative design
03.10.2020	**Tutorial** | Parametric planting
03.12.2020	**Tutorial** | Parametric landforms

Generative

03.31.2020	**Tutorial** | Waveforms I
04.02.2020	**Tutorial** | Waveforms II
04.07.2020	**Tutorial** | Parametric point clouds I
04.09.2020	**Tutorial** | Parametric point clouds II
04.14.2020	**Tutorial** | 3D rendering I
04.16.2020	**Tutorial** | 3D rendering II
04.21.2020	**Tutorial** | Geospatial analytics I
04.23.2020	**Tutorial** | Geospatial analytics II
04.30.2020	**Review** | Final review

Project: Parametric landscapes

Projects

Essay Read Mario Carpo's *The Alphabet and Algorithm* and Nick Dunn's *Digital Fabrication in Architecture* and then in reponse 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?

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

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

Drone survey Conduct a topographic survey of the landform at Hilltop Arboretum with an unmanned aerial system (UAS) and automated ground control points. Use photogrammetry to generate a point cloud, digital surface model, and orthophoto.

Lidar survey Conduct a terrestrial lidar survey of the LSU College of Art & Design quad.

Parametric landscapes Use visual programming to parametrically model nine variations of landforms and planting. Photorealistically 3D render your variants with 3D trees, shrubs, and grasses.

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

Online

Lectures will be recorded and posted on Youtube and Vimeo. Please watch before class. During class we will have discussions hosted on our Discord server. Please check our Basecamp project for news and announcements.

Basecamp | `https://basecamp.com/`
Discord | `https://discord.gg/NBSdJRS`
Youtube | `https://www.youtube.com/channel/UCmGEF6Bf1SO92oLQoGCPDTw`
Vimeo | `https://vimeo.com/baharmon`

Software

Agisoft Metashape | https://www.agisoft.com/
CloudCompare | https://www.danielgm.net/cc/
Sketchfab | https://sketchfab.com/
GRASS GIS | https://grass.osgeo.org/
ArcGIS | https://www.esri.com/
Rhinoceros | https://www.rhino3d.com/
Grasshopper | http://grasshopper3d.com/
RhinoTerrain | http://www.rhinoterrain.com/
RhinoCAM | https://mecsoft.com/rhinocam-software/
Thea Render for Rhino | https://www.thearender.com/

Plugins

r.skyview | https://grass.osgeo.org/grass78/manuals/addons/r.skyview.html
atträctor | https://www.food4rhino.com/app/attractor
Pufferfish | https://www.food4rhino.com/app/pufferfish
Nudibranch | https://www.food4rhino.com/app/nudibranch
Docofossor | https://www.food4rhino.com/app/docofossor
Bison | https://www.bison.la/

Resources

Intro to GRASS GIS | https://ncsu-geoforall-lab.github.io/grass-intro-workshop/
Hydrology in GRASS GIS | https://grasswiki.osgeo.org/wiki/Hydrological_Sciences
Grasshopper Primer | http://grasshopperprimer.com

Grading

Essay	5%	Parametric landscapes	50%
Drone survey	20%	Course portfolio	5%
Lidar survey	20%		

Readings

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

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

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

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

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

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

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

Deussen, Oliver, and Bernd Lintermann. 2010. *Digital Design of Nature: Computer Generated Plants and Organics*. Springer. https://doi.org/10.1007/b138606.

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

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

Terzidis, Kostas. 2006. *Algorithmic architecture*. Elsevier Architectural Press.

Schodek, D., M. Bechthold, J.K. Griggs, K. Kao, and M. Steinberg. 2004. *Digital Design and Manufacturing: CAD/CAM Applications in Architecture and Design*. Wiley.

Network drives

Windows: `\\desn-knox.lsu.edu\Landscape-Classes\LA7032-S2020`

Macs: `smb://desn-knox.lsu.edu/Landscape-Classes/LA7032-S2020`

Terminology

Digital design

- Mass customization
- Generative design
- Parametric modeling
- Performative design
- Algorithm

Spatial data

- Raster & Vector
- Array
- Point cloud
- Mesh
- Triangulated irregular network (TIN)
- Plain text
- Comma separated values (CSV)
- Integer & floating point numbers
- Quadtree & octree
- Non-uniform rational basis spline (NURBS)

Geospatial

- Geographic information system (GIS)
- Digital terrain model (DTM)
- Digital elevation model (DEM)
- Digital surface model (DSM)
- Lidar
- Unmanned aerial system (UAS)
- Structure from motion (SfM)
- Delaunay triangulation
- Interpolation
- Regularized spline with tension (RST)
- Map algebra

3D rendering

- Ray tracing
- Diffuse shading
- Texture map
- Particle system
- Head mounted display (HMD)
- Cave automatic virtual environment (CAVE)

Digital fabrication

- 3D printing
- Computer numeric control (CNC)
- Collet & Bit
- High density urethane (HDU)
- Medium density fiberboard (MDF)

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.