

NATHAN MELENBRINK

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TEACHING & RESEARCH

[Fabrication Lab](#), Faculty of Arts and Sciences,
Harvard University

Lecturer in Physics; Spring 2021 – present
Fabrication Lab Supervisor; Fall 2020 – present
Lead Instructor; Summer 2019 – Fall 2020

- **PS70: Introduction to Digital Fabrication (Fall, Spring)** Developed a new course for beginners of all disciplines. Skills taught include electronics, microcontroller programming, CNC milling, 3D printing, and sensor and actuator design. ([Link](#))
- **PHYS 5-12: Introduction to Digital Fabrication:** Condensed format version of the course for Harvard Summer School.
- Awarded Harvard University Certificate of Teaching Excellence 2021, 2022, 2023

Climate & Sustainability Systems Thread
New Engineering Education Transformation
Massachusetts Institute of Technology

Founding Lead Instructor; Fall 2021 – present

- **3.0061/22.03: Introduction to Design Thinking and Rapid Prototyping (Fall)** Provides hands-on experiences in creativity, problem scoping, prototyping, system design and integration, problem solving and debugging, and portfolio design and communication.
- **22.S094: Decarbonizing Ulaanbaatar at the Million-Person Scale (Spring)** A capstone where students prototype and deploy solutions for the coal pollution problem in Mongolia.
- **3.006/22.003: Climate & Sustainability Systems Seminar (Fall, Spring)** Consists of guest lectures and research discussions, hands-on activities and material experiments, and research lab visits on campus.

School of Engineering and Applied Sciences,
Harvard University

Postdoctoral Fellow in Materials Science and Mechanical Engineering; Summer 2020 – Fall 2022

Developing autonomous robots for the construction and maintenance of space habitats for a NASA research grant.

Wyss Institute for Biologically Inspired Engineering,
Harvard University

Electromechanical Engineer; Fall 2019 – Summer 2020
Fellow in Computer Science; Fall 2016 – Fall 2019

Research focused on distributed robotics for construction, infrastructure and environmental restoration. Work scope ranged from development of custom simulation software to physical prototyping of robotic actuators and construction materials.

EDUCATION

Doctor of Engineering

Institute for Computational Design and Construction, University of Stuttgart, 2021

Dissertation: Designing for Unsupervised Construction: An Investigation of the Affordances of On-Site Autonomy, Advisor Achim Menges

Master in Design Studies-
Technology Concentration

Harvard Graduate School of Design, 2016

Thesis: Swarm Robotics for Collective Construction, Advisor Panagiotis Michalatos

Coursework in robotics, computer science, mechanical engineering, electronics and digital fabrication

Bachelor of Architecture

Virginia Tech, 2010

Bachelor of Architecture, In Honors, Summa Cum Laude, GPA 3.83 [out of 4.0]

Awarded 2010 Alpha Rho Chi Medallion for Outstanding Student Leadership

TECHNICAL SKILLS

- CAD/CAM for large-format machining (CNC milling, laser cutting, 3D printing, water jet, 6-DoF robot arms)
- Programming languages: JavaScript, C/C++, C#, Processing, Arduino, Rhinoscript, Grasshopper, Python and VB Script
- 3D modeling and rendering: Fusion 360, Rhino, 3DS Max, Unity3D, Maxwell Render
- Electronics design and PCB fabrication
- Mechanical engineering and simulation (FEA, motion studies, physics simulations for robotics applications)
- Design software: InkScape, Photoshop, Illustrator, InDesign and Premiere
- 10+ years teaching experience with Processing, Javascript, Arduino, Rhino, Grasshopper, Rhinoscript, Unity3D, Illustrator, Photoshop and digital fabrication tools
- Native fluency in English and professionally conversational (spoken and written) in Mandarin Chinese

Northeastern University
College of Art, Media and Design

Adjunct Professor; Fall 2017 – Spring 2018

- **ARTG 2260: Programming Basics (Fall, Spring)** Developed an original curriculum for creative coding in a design-studio format with an emphasis on novel web applications. ([Link](#))

University of Hong Kong Shanghai Study Centre

Assistant Professor; Fall 2012 – Spring 2014

- Independently developed unique curricula and course materials for the undergraduate requisite lecture courses Visual Communications II (Material Culture) and III (Animate Systems), providing project-based instruction for Rhino, Grasshopper, Illustrator, Photoshop, and Ecotect for environmental analysis.

Faculty of Architecture, University of Hong Kong

Researcher; Fall 2010 – Spring 2011

Developed urban design software to project region-specific urban growth patterns for cities in China.

Virginia Tech College of Arch. and Urban Studies

Adjunct Faculty; Summer 2010 – Fall 2010

- **Qualifying Lab** worked as a general design tutor for first year studio, offering specific instruction for Rhino 4.0 and Grasshopper as well as laser cutting and CNC use.
- **Design in the Digital Age** developed and co-taught a 3-credit course directed at preparing students with software skills necessary for internships.

INDUSTRY EXPERIENCE

East China Architectural Design Institute

Senior Architect; October 2013 – August 2014

Completed the redesign of a super-highrise in Dalian, China. Although already under construction, the facade, interior, podium and tower crown were completely redesigned from the schematic phase. Additional tasks included design critiques of other current projects as well as lectures and tutorials. Almost all communication was in Mandarin Chinese.

Playze China Co. Ltd

Architect; September 2012 – October 2013

Contributed a leading role to the office's largest project, the Ningbo Urban Planning Museum, specifically the design for the custom ceramic facade, as well as general form and landscape design. Additionally led small teams for two urban design projects, a hotel, an office interior and a housing project using shipping containers.

UNStudio

Junior Architect; Fall July 2011 – July 2012

Parametric design and facade specialist for the Shanghai office. Served as the lead facade designer for a large office complex from schematic design through design development phase.

INVITED TALKS

- 2022 NASA RETH Institute Annual Review; Purdue University, June 25th.
- 2022 "Building on Other Worlds" ICRA workshop on Collective Robotic Construction. Philadelphia, PA; May 24th.
- 2021 NASA RETH Institute Annual Review; Purdue University, June 23rd.
- 2020 "[Toward Unsupervised Construction](#)" CDR – Remote Design Technology Lecture Series. Blacksburg, VA; April 14th.
- 2020 "Increasing Automation in Design and Fabrication", UVA School of Architecture Lectures on Design and Making; Charlottesville, VA; September 22nd.
- 2018 "Toward a Machine Ecology" Lecture at the Institute for Computational Design and Construction, University of Stuttgart, November 19th.
- 2018 "Swarm Robotics for Construction Automation" Lecture at the Robotics In Construction Summit, Autodesk BUILD Space, Boston, MA. June 21st.
- 2015 "Project Delivery in China" Lecture at the Harvard University Innovation Lab as guest lecturer for Professor Mark R. Johnson's course PRO-07420 - Innovation in Project Delivery, Cambridge, MA; November 24th.
- 2015 [Design Technology](#) Lecture at the Virginia Tech College of Architecture and Urban Studies, sponsored by the Digital Mentorship Collaborative (DMCO) bi-annual lecture series. Blacksburg, VA; April 17th.
- 2015 "Computation + Design" Lecture at the Rhode Island School of Design, Department of Architecture, Providence, RI; January 10th.
- 2013 "Applied Computation and the Digital Toolbox" Lecture at the Shanghai Food for Thought series, sponsored by the AIA and the Architect@Work Conference, December 4th.
- 2013 "Parametric Thinking in Practice and Education" Lecture at University of Nottingham, Ningbo, China, Department of Architecture and Built Environment, on November 9th.
- 2013 "New Digital Architecture" Lecture at Area Dialogue 15, Shanghai PRC, April 4th.
- 2010 "Computation vs. Computerization" Lecture at Virginia Tech, July 18th.

SERVICE & ADVISING

- 2022 – present: Advisory board for Qnetic, grid-scale storage startup
- 2021 – present: 3D Core Advisory Group, Harvard SEAS
- 2020 – present: Advisor for the [Possible Project](#) (Boston non-profit)
- 2020: Fabricated and donated over 100 face shields during Covid-19 pandemic

PUBLICATIONS

Journal Articles

- Melenbrink, Nathan, Katja Rinderspacher, Achim Menges, and Justin Werfel (2020). "Autonomous anchoring for robotic construction". In: *Automation in Construction* 120, p. 103391.
- Melenbrink, Nathan, Justin Werfel, and Achim Menges (2020). "On-site autonomous construction robots: Towards unsupervised building". In: *Automation in Construction* 119, p. 103312.
- Melenbrink, Nathan and Justin Werfel (2018). "Local force cues for strength and stability in a distributed robotic construction system". In: *Swarm Intelligence* 12.2, pp. 129–153.

Conference Proceedings

- Melenbrink, Nathan, Clark Teeple, and Justin Werfel (2022). "A Robot Factors Approach to Designing Modular Hardware". In: *IROS*.
- Melenbrink, Nathan, Ariel Wang, and Justin Werfel (2021). "An Autonomous Vault-Building Robot System for Creating Spanning Structures". In: *ICRA*.
- Melenbrink, Nathan and Justin Werfel (2019a). "Autonomous Sheet Pile Driving Robots for Soil Stabilization". In: *ICRA*.
- Melenbrink, Nathan, Paul Kassabian, Achim Menges, and Justin Werfel (2017). "Towards Force-aware Robot Collectives for On-Site Construction". In: *ACADIA*.
- Melenbrink, Nathan, Panagiotis Michalatos, Paul Kassabian, and Justin Werfel (2017). "Using Local Force Measurements to Guide Construction by Distributed Climbing Robots". In: *IROS*.
- King, Nathan, Nathan Melenbrink, Nick Cote, and Gustav Fagerström (2016). "BUILD-ing the MASS Lo-Fab Pavilion". In: *ROB|ARCH*.
- Melenbrink, Nathan and Nathan King (2015). "Full-dome Interfacing: A Real-time Immersive Environment as a Tool for Design". In: *CAADRIA*.

Invited Book Chapters

- Melenbrink, Nathan and Justin Werfel (2019b). *Robotic Building: Architecture in the Age of Automation*. DETAIL. chap. A swarm robot ecosystem for autonomous construction, 2017, pp. 88–89.

PATENTS

- 2021 Melenbrink, Nathan and Justin Werfel. "WO2020132472 - Self-contained Soil Stabilization System" ([link](#)).
- 2022 Melenbrink, Nathan. "Deployable Flood Barrier with Air and Water Compartments".

GRANTS & AWARDS

- Wyss Institute BioInspired Soft Robotics Platform, "Romu: Autonomous Robots for Environmental Restoration", \$10,000. June 2019 – June 2020.
- IEEE Robotics and Automation Society Special Interest Group on Humanitarian Technology (RAS-SIGHT), "Autonomous Robots for Coastal Restoration", \$4,000. January 2020 – January 2021.
- Harvard College Hoopes Prize for outstanding undergraduate research, advisee Ariel Wang. \$5,000 for the student, \$2,000 for the advisor. May 2023.

WORKSHOPS

- 2015 – 2020 **MIT Media Lab / Center for Bits and Atoms**: Served as a Teaching Assistant for the MIT course How to Make (Almost) Anything. Topics include digital fabrication, microcode, and electronics prototyping.
- 2015 – 2017 **NuVu Studio Innovation School**: Taught over a dozen two-week studios to students aged 11-18. Topics included Sci-Fi Vehicles, Sci-Fi Toys, Future Shoes, Robot Swarms, Robo-Pets and Battlebotics. Taught international studios related to swarm robotics in [Glasgow](#) and [Mumbai](#).
- 2012 – 2016 **Architectural Association Visiting School (Shanghai)**: Responsibilities included development of a project brief to include a "tooling up" phase followed by a group project. Work was presented to a large audience and published in various formats.
- 2016 – 2018 **Institute for Computational Design, University of Stuttgart**: Introductory Coding and Robotics Workshop and Research Presentation
- 2014 **SmartGeometry**: Served as organizer and Cluster Champion for a research cluster called "Full-dome Projections: Interfacing Ephemeral Urbanism."
- 2009 **Virginia Tech CAUS**: Primary organizer, curator and contributor to the school's first computational design exhibition "Str8 Scrippin"

JURIES

- 2019 – 2022 (GSD) SCI 6478 Informal Robotics / New Paradigms for Design & Construction, Prof. Chuck Hoberman
- 2019 – 2020 (GSD) SCI 6476 Transformable Design Methods, Prof. Chuck Hoberman
- 2018 – 2021 (GSD) SCI 6317 Material Systems: Digital Design and Fabrication, Dr. Nathan King
- 2013 Juror for the [Next7 International Design Competition](#) (sponsored by ArcH2O).