

LIVING ARCHITECTURE SYSTEMS GROUP

*Activity Descriptions*  
2016 - 2019

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# Testbed Installations

## Le Frouit

Testbed  
October 2019  
Brittany, France

Interactive canopy environment installed in 19th century castle located on coast of Brittany, France. Grotto composed of densely massed light chains with protocell chemistry accessed from second-floor balcony space, extended by river-like canopy and cloud extensions extending over main hall.

## Meander

Testbed  
Fall 2019  
Cambridge, Canada

Immersive large-scale permanent testbed environment constructed within historic warehouse building at centre of residential highrise development in Cambridge, Ontario. Collaboration with 4DSOUND. Accompanied by interpretive exhibit, STEAM workshop program, and interactive kits.

## Futurium

Testbed  
Sept 2019 - March 2021  
Berlin, Germany

Interactive spherical installation within long-term interdisciplinary exhibition space Futurium in Berlin, integrating new field-based 'Excitor' software, including collaboration with 4DSOUND. A central double-shell expanded stainless steel and transparent polymer meshwork shell contains massed vibrating fronds, custom double LED lighting vessels, custom omnidirectional and directional high-fidelity distributed sound drivers employing distributed Dante sound data communications. The system is stimulated by a polar array of grideye sensors.

## Aletheia

Testbed/Installation  
January 18 - 27, 2019  
Toronto, Canada

Sphere-shaped sculpture installed for Toronto Design Festival at Aesop Queen St. West, Toronto storefront, January 2019. Double-layered pyramidal cells creating space-truss spherical shell. Spine extensions featuring liquid-filled vessels amplifying light. Concept development: form-language that evokes 'abiogenesis,' emergence of life from mineral origins.

## The Beauty Project

Testbed  
October 2018 - 2022  
MAK: Museum  
of Applied Arts  
Vienna, Austria

Grotto-like accreted spherical meshworks containing densely massed protocell flasks, surrounded by cloud of lace-like skeletal membranes. This project featured significant progress in conception and fabrication methods of cross-linked double-shell scaffold systems. New attachment details were developed, permitting accretion of multiple shell forms. Cross-bracing and arching contributed by individual shells yields a stiffened foam-like reticulum, affording substantial structural performance. Presented in *The Beauty Project*, a traveling group show curated by Sagmeister & Walsh, MAK. Vienna 2018, Frankfurt 2019.

## Radiant Soil

Testbed  
July 16, 2018 - Oct 21, 2018  
Daejeon Museum of Art  
Daejeon, Korea

New immersive interactive environment constructed for Daejeon Biennale, Korea, adapting details originally exhibited at the 2013 EN VIE exhibition at Espace EDF Fondation. Systems include meshwork columns, actuated shape-memory alloy frond-clusters, scent-glands, and vinegar electrical cells. Curated by Carole Collet. Exhibited in concert with *The Rise* installation by CITA.

## Transforming Space/ Aegis and Noosphere

Testbed  
June 1 - Oct 8, 2018  
Royal Ontario Museum  
Toronto, Canada

Collaboration of Living Architecture Systems Group with Iris van Herpen including Aegis and Noosphere sculpture testbeds, collaborative Dome Dress, film presentations, interpretive displays, and multiple related couture works. Suspended Aegis canopy comprised of lightweight architectural scaffolds supporting interactive electronic systems including light and sound. Collaborative Aeriform dress is cradled by the canopy. Within an adjacent museum space was Noosphere, integrating large suspended spherical forms and floating islands with sound and grotto-like hanging chains with protocell fluids. Installations incorporate spatial sound developed with Salvador Breed and Poul Holleman of 4DSOUND in Amsterdam, integrated with LASG software and controls. The 4DSOUND software system presents dramatic acoustic imaging, coordinated with interactive responses including chains of actuators.

## Colloquy of Mobiles

Installation  
May 2018 - present  
College of Creative Studies  
Detroit, USA

Restored full-scale version of Gordon Pask's 1968 *Colloquy of Mobiles*, iconic interactive environment. Constructed by College of Creative Studies (CCS) now adapted to contemporary software, sensors and motors. Student work produced during *IxD Studio IV: Immersive Interactive Experiences* (scripting of the mobiles' interactions) and of the *IxD Studio II: IoT & Prototyping* (software writing, recording interactions). Development of 1:6 scale physical model, 3D digital models of components, and specification documents for the various motors, lights and electronics.

## Amatria

Testbed  
April 2018  
Luddy Hall  
Indiana University,  
Bloomington, USA

Permanently installed in Indiana University School for Informatics and Computing, public atrium and acting as a beacon within surrounding landscape. Suspended 30' x 50' canopy and densely massed spherical meshwork assemblies. Excitor system software integrated with 4DSOUND. Extension of *Amatria* with custom data visualization tablet application, *Tavola*, showing sensor and actuator positions, communication flows, & behaviors unfolding over time.

## Astrocyte

Testbed  
Sept 28 - Oct 8, 2017  
Unilever Detergent Factory  
Toronto, Canada

First-generation spherical meshwork construction with interactive light, kinetics and sound developed for *DX EDIT: Expo for Design, Innovation & Technology*. 15' x 45' canopy extension with lightweight meshworks holding protocol chemical flasks. Installed in abandoned massive space within Unilever Detergent Factory. Spatialized sound with 4DSOUND.

## Sentient Veil

Testbed  
March - Aug 2017  
Isabella Stewart  
Gardner Museum  
Boston, USA

Suspended miniature-scale embroidered canopy installed in historic Fenway Room of the Isabella Stewart Gardner Museum, presented within the group show entitled Listen Hear: The Art of Sound. Delicate openwork veil canopy and layers of custom glass hold custom spiral ported speakers and chains of digital colour-changing lighting. Included collaborative research platform with Indiana University Bloomington's School of Informatics and Computing to develop an augmented reality tablet computer application to visualize collected data from the sculpture.

## Brainhealth

Testbed  
On hold  
Center for BrainHealth  
University of Texas  
Dallas, USA

Three-story vertically mounted expanded tapestry comprised of lightweight architectural scaffolds supporting a series of interactive electronic systems; including light, kinetics and sound. Permanent installation in the atrium of the Center for BrainHealth, University of Texas at Dallas. Detailed design completed, on hold pending funding.

# Publications

## Resurgence of Organicism

Edited by  
Sarah Bonnemaïson  
Riverside Architectural Press  
Dalhousie University Press  
2019

Coinciding with the Living Architecture Systems Group Symposium, Sarah Bonnemaïson has curated an exhibition presented at the OCADU University. This exhibition originated as a Dalhousie University School of Architecture graduate seminar. In Fall 2018, graduate architecture students investigated the history and theory of Organicism through a close reading of Caroline van Eck's seminal book on the topic in order to understand its architectural manifestations over the course of centuries. This collective study resulted in an exhibition and catalogue entitled *Resurgence of Organicism*. The 2019 edition has been expanded with contributions from contemporary architects and artists who share a quest for biologically inspired design. The exhibition invites us to see how nature is an enduring source of inspiration for designers.

## Living Architecture Systems Group White Papers 2019

Edited by  
Philip Beesley,  
Sarah Bonnemaïson  
and Sascha Hastings  
Riverside Architectural Press  
2019

Through essays, interviews and images, *White Papers 2019* chronicles current research and projects of LASG members in fields including responsive environments, integrated sound systems, robotics, artificial intelligence, urban design, organicism, ecology and software design. Contributors: Michael Awad, Katy Börner, Sarah Bonnemaïson, Salvador Breed, Andreas Bueckle, Daragh Byrne, Dana Cupkova, Desiree Foerster, Adam Francey, Rob Gorbet, Petra Gruber, Poul Holleman, Mark-David Hosale, Todd Ingalls, Haru Ji, Mitchell Joachim, Luke Kimmerer, Manuel Kretzer, Dana Kulić, Douglas MacLeod, J. Eric Mathis, Brandon Mechtley, Nima Navab, Paul Oomen, Vera Parlac, Maya Przybylski, Connor Rawls, Amirbahador Rostami, Jenny Sabin, Sha Xin Wei, Sheida Shahi, Michael Stacey, Julian Stein, Codrin Talaba, Mette Ramsgaard Thomsen, Iris van Herpen, Graham Wakefield, Alex Webb.

## Living Architecture Systems Group White Papers 2016

Edited by  
Philip Beesley  
Riverside Architectural Press  
First Edition 2016  
Second Edition 2019

*Living Architecture Systems White Papers* is a dossier produced for the occasion of the Living Architecture Systems Group launch event and symposium hosted on November 4 - 5, 2016 at the Living Architecture Systems Sterling Road Studio in Toronto and the University of Waterloo School of Architecture at Cambridge. The *White Papers* presents research contributions from the LASG partners, forming an overview of the partnership and highlighting opportunities for future collaborations.

## Symposium Proceedings

Edited by  
Philip Beesley and  
Sascha Hastings  
2019  
Riverside Architectural Press

Emerging from a March 2019 gathering of architects, artists, engineers, and scientists, the Symposium Proceedings 2019 publication is a compendium of abstracts from presentation papers by more than 40 LASG members exploring next-generation architectural environments. Contributors: Michael Awad, Phil Ayres, Robert Bean, Henriette Bier, Sarah Bonnemaïson, Katy Börner, Salvador Breed, Andreas Bueckle, Carole Collet, Dana Cupkova, Martyn Dade-Robertson, Matias del Campo, Colin Ellard, Simone Ferracina, Neil Forrest, Michael Fox, Matt Gorbet, Petra Gruber, Maria Paz Gutierrez, Bernard Guy, Ellen Hlozan, Poul Holleman, Mark-David Hosale, Barbara Imhof, Todd Ingalls, Tomasz Jaśkiewicz, Haru Ji, Mitchell Joachim, Axel Kilian, Manuel Kretzer, Andrew Kudless, Dana Kulić, Juintow Lin, Douglas Macleod, Alan Macy, J. Eric Mathis, Brandon Mechtley, Tim Miller, Navid Navab, Sha Xin Wei, Catie Newell, Paul Oomen, Vera Parlac, Paul Pangaro, Connor Rawls, Val Rynnimeri, Matthew Spremulli, Michael Stacey, Julian Stein, Ross Stevens, Codrin Talaba, JD Talasek, Mette Ramsgaard Thomsen, Graham Wakefield, Alex Webb, Andrew Wit.

## Amatria Pictionary

Project Lead  
Andreas Bueckle  
2018

Authored by Indiana University collaborators, *Amatria Pictionary* provides a visual dictionary that documents the specialized components of the permanent *Amatria* sculpture testbed at School of Informatics, Luddy Hall, Indiana University at Bloomington.

## Sentient Chamber

Edited by  
Philip Beesley  
First Edition 2016  
Second Edition 2019  
Riverside Architectural Press

Monograph documenting controls, mechanisms, structure and chemical systems within the Sentient Chamber testbed pavilion constructed at the National Academy of Sciences in Washington, D.C. (2015). The book contains documentation of the project including design patterns and photography of the construction process, undertaken in collaboration with Washington-based students. Includes research essays from contributing project leads. Published by Riverside Architectural Press with Cultural Programs of the National Academy of Science, Washington.



# Exhibitions

## Epiphyte Chamber

Sept - Oct 2017  
Taubman College Gallery  
Ann Arbor, USA

Large-scale photographs installed in Taubman College Gallery within group show entitled *Ambiguous Territory* on the occasion of ACADIA 2016 conference.

## Venice Biennale at Cambridge Galleries

May 22 - July 2017  
Design at Riverside Gallery  
Cambridge, Canada

Collection interactive sculptural fragments, framed drawings, and video describing *Hylozoic Ground*, Canada's entry to the 2010 Venice Biennale for Architecture. The collaborative *Hylozoic Ground* project resulted in the founding of the *Hylozoic Ground* collaborative research group and formed a basis of the LASG. Exhibited at the Cambridge Gallery within University of Waterloo, School of Architecture together with parallel exhibits describing Venice Architecture Biennale exhibits 2008-2016.

## Hylozoic Grove

Travelling, 2017 - 2019  
Weil am Rhein, Germany,  
Vienna, Austria, and  
Ghent, Belgium

Meshwork columns containing helical chains of shape-memory alloy-actuated frond mechanisms surrounded by sculptural lace-like cloud membrane, presented within "Hello Robot" traveling group exhibition, curated by Vitra Design Museum.

## LASG Art, Design and Media Exhibition

Nov 2016 - March 2017  
ADM Gallery  
Nanyang Technological  
University, Singapore

Historical overview of the first years of Living Architecture Systems Group and related Hylozoic Series projects including interactive sculptural fragments, drawings, sketchbooks, video and publications.

## Design Exchange Evolution

Jan 9 - 12, 2017  
Design Exchange  
Toronto, Canada

Collection of design material including interactive sculptural fragments, framed drawings, and film, demonstrating roles of natural paradigms within design by LASG/Philip Beesley Architect Inc.

# Kits

## Dendrite Moth Kit and Workshop

Project Lead  
Katy Börner  
Summer 2018  
Luddy Hall  
Indiana University,  
Bloomington, USA

Pilot project composed of sculpture components selected from *Amatria* testbed sculpture. Components included shape-memory alloy mechanism, frond assembly, expanded-mesh stand, and control electronics accompanied by assembly documents and software. Parts were prefabricated for final assembly by workshop participants. The workshop produced multiple mechanisms capable of assembly into a complex group that can be connected to the *Amatria* testbed. Success of this project has resulted in multiple new workshops and extensive kit expansion.

## Desktop Electronics and Sculpture Kits

In Progress  
Cambridge, Canada

Design and manufacturing of kit-based components employing LASG sculpture component patterns and controls. Interlinking assembly and modular organization designed for collaborative testbed research and for STEAM curriculum. Three generations of kits are in development oriented to experts, students, and schoolchildren. Variations within kits include interlinking construction scaffolds, mechanisms, control electronics accompanied by software, and sound. Collaborative development involves Indiana University, TU Delft, York University, and Gaslight Developments.

# Projects

## **Institute for Regenerative Design & Innovation Symposium**

Lead: Eric Mathis  
Pending 2019  
Elon University  
North Carolina, USA

A collaboratively developed symposium between the Institute for Regenerative Design & Innovation (IRDI) and the Living Architecture Systems Group will explore the implications of regenerative materials integrated within community-based economies.

## **Omnidirectional Distributed Dante Speaker Design**

Lead: 4DSOUND  
and Leo Klerk  
2018 - 2019  
Bloomline, Netherlands

Development of high-fidelity compact speaker employing Dante distributed power-over-ethernet networking, designed for compatibility with LASG Testbed applications. Acoustic shell developed in collaboration with Formlabs, non-periodic fin stiffening system for minimum material consumption.

## **Printed Foam Mannequin**

Leads: Iris van Herpen  
and Philip Beesley  
2018 - 2019  
Toronto, Canada

Filamentary cellular meshwork construction system mapped to precise mannequin form for exhibition use within Atelier van Herpen couture presentations, to be used in touring exhibitions and for conception of next-generation couture. Developed for transparent photopolymer resin 3D printing.

## **LASG Studio Documentation**

Lead: Michael Awad  
2018 - 2019  
Toronto, Canada

Next-generation photographic project documenting saturated spaces within the LASG studio and the couture and spatial constructions of the Royal Ontario Museum's Transforming Space and Transforming Fashion exhibitions, employing large-data continuous scans.

## **Iridescent Biopolymer**

Leads: Moien Giashi  
and Philip Beesley  
2018 - 2019  
Toronto, Canada

Cellulose Nanocrystals developed into biopolymer sheets demonstrating resilience, transparency and iridescence. Feasibility study developed for potential applications within digital fabrication applied to architecture and couture projects.

### **Kazumi Kumagi Breathing Frond Empathy Study**

Lead: Dana Kulić  
Student Project  
April 2018  
Waterloo, Canada  
Toyko, Japan

Software development employing hardware assembly of multiple shape-memory alloy actuated frond mechanisms, with test results analyzing empathetic responses by observers. Residency at Adaptive Learning Laboratory, University of Waterloo. Paper by Tokyo University PhD Candidate on the work of the LASG for IEEE RO-MAN 2018, the 27th IEEE International Symposium on Robot and Human Interactive Communication..

### **Living Architecture Systems Software Simulator**

Leads: Dana Kulić, Matt Gorbet, Rob Gorbet and Antonio Camurri and Leo Klerk  
July 2017 - 2019  
Toronto, Canada  
Genoa, Italy

Software simulation of dynamic behavior and feedback of living architecture systems in a virtual environment. Digital design platform that can integrate architectural components and interactive electronics in a virtual space which is able to simulate interactive behavior between architecture, occupant, and surrounding environment. Developed in collaboration with Scalalab, University of Genoa. The digital design platform leverages pre-existing software packages with pipelines and custom tools/add-ons.

### **Sentient Systems**

Lead: Mark Cohen  
2017 - 2019  
Semel Institute  
UCLA, California, USA  
Toronto, Canada

Series of consultations examining potential for neural topologies to be translated into control systems and physical organizations within LASG interactive testbeds, supported by Keck Futures Initiative and the National Academy of Sciences. Dialogues included review of magnetic resonance scanning and electroencephalograph technologies including open-source brain-computer electronics. Dialogues resulted in conception of next-generation *Teensy* electronics organized in meshworks and applied to testbeds including Toronto and Indiana installations.

### **Tavola Data Visualization**

Leads: Katy Börner and Andreas Bueckle  
2017 - 2019  
*Amatria*  
Luddy Hall, Indiana, USA  
Isabella Stewart Gardner Museum, Boston, USA

Tablet-computer application *Tavola* that overlays digitally visualized realtime data with 3d model of interactive architecture installation. Data collected from the interactive sculpture is visualized within animations. Application developed by Andreas Bueckle, School of Informatics and Computing of Indiana University Bloomington working with LASG studio team in Toronto. The app was initially applied and tested on the *Sentient Veil* testbed, Isabella Gardner Museum, Boston.

**Atelier IvH Couture**

Lead: Iris van Herpen  
2016-2019  
Toronto, Canada  
Amsterdam, Netherlands

A series of 2D/3D fabric patterns and prototypes collaboratively developed between Philip Beesley Architect Inc. and Iris Van Herpen used in haute couture garments. Includes 10-year anniversary show for IVH in Paris, France.

**Toolbox Dialogue  
Initiative LASG  
Organization and  
Methods Study**

Lead: Edgar Csrdenas,  
Michael O'Rourke  
2016-2019  
Online  
Michigan State University,  
East Lansing, USA  
Toronto, Canada

Communication and collaboration study, examining inter- and transdisciplinary processes in collaborative LASG research organization.

# Workshops

## Thresholds Arch 393

Fall 2018  
Cambridge, Ontario

Term-long distributed sound/responsive scaffolds design studio for fifteen Arch 393 design students. Eight workshop sessions employing with prefabricated desktop kit and actuator mechanisms, manipulating prepared software. Included mechatronics and structural engineering tutorials.

## TU Delft Workshop

Leads: Philip Beesley,  
Aadjan van der Helm,  
Henrette Bier,  
and Teun Verkerk  
November 12-17 2018  
TU Delft, Netherlands

Three academic TUD units focusing on robotics in architecture, software and interactive systems, and architectural components in collaboration with the TU Delft Science Centre worked with a team of LASG industrial design, electronics and software researchers to develop a new pavilion construction. 30 students participated.

## LASG/4DSOUND Behaviour Workshop

Leads: Salvador Breed,  
Poul Holleman,  
and Matt Gorbet  
September 2018  
Toronto, Canada

Symposium and workshop integrating 4DSOUND, Netherlands, York University, Toronto, and University of Waterloo researchers pursuing integration of software systems for spatial distributed interactive sound, light, and motion-based environments. Firmware developed together with digital modeling and distributed location tracking of massive arrays. Workflow and data visualization specialized studies extended the workshop.

## Petra Gruber Workshop

Leads: Petra Gruber  
March 20, 2018  
University of Waterloo  
Cambridge, Canada

Petra Gruber *Living Architecture: Biomimetics and Growth* to graduate students and professors as an extension of the 2018 LASG Graduate Research Seminar course at the University of Waterloo, School of Architecture. Commentary on biomimetics and methodology in nature. Sketching and discussion

## 4DSOUND - LASG Workshop

Leads: Poul Holleman  
and Salvador Breed  
Toronto, Canada

### **Games Institute Worldbuilding Workshop**

Lead: Beth Coleman  
October 2017  
University of Waterloo  
Cambridge, Canada

Workshop with graduate Architecture students from the University of Waterloo, conducted by the Games Institute exploring simulated behavior and future scenarios. Included discussion of orchestrated behaviour conceived as urban space and contemporary literature. Technical craft tutorials included software manipulations for creation of dynamic virtual environments. Experimental applications of HTC Vive Tilt Brush embodied creation device.

### **EGS Dissipative Architecture and Colloquium 2017**

June 13 - 19, 2017  
European Graduate School  
Saas Fee, Switzerland

PhD Seminar 2017 including demonstration models and discussion

### **Akron Workshop**

Lead: Philip Beesley  
February 16 - 19, 2017  
University of Akron  
Ohio, USA

Workshop with students in the Myers Forum Class at the Mary Schiller Myers School of the Arts to create an immersive architectural installation entitled *Strataform* guided by Philip Beesley.

# Courses

## Meander STEAM Curriculum

Lead: Rob Gorbet  
Fall 2019  
Cambridge, Ontario

Science, Technology, Engineering, Art, and Mathematics programming developed for community workshops and public-school curriculum, in partnership with large-scale urban development corporation in Cambridge, Ontario.

## LASG Graduate Research Elective

Leads: Philip Beesley,  
January - April 2018  
University of Waterloo  
Cambridge, Canada

University of Waterloo School of Architecture Graduate Seminar. Production of literature reviews and critical theory discussions applied to key LASG researcher topics. Included partner interview transcripts.

## LASG/UNMA Theory Seminar

Leads: Alex Webb  
February 16, 2018  
University of New Mexico  
Albuquerque, USA

A theory seminar on the work/research of the LAS conducted by Philip Beesley with graduate and undergraduate architecture students at the University of New Mexico (UNMA). Examination of *Sentient Chamber* testbed installation as a living system, through the lens of intelligence, agency, empathy.

## Responsive Membranes

Leads: Philip Beesley  
September - Dec 2017  
University of Waterloo  
Cambridge, Canada

An advanced elective architecture course led by Philip Beesley exploring the design, fabrication, and energy exchange of Responsive Membranes. Student-prepared seminars focused on the following individuals were conducted each week: D'Arcy Wentworth Thompson, A.L. Oparin, Alan Turing, Gordon Pask, Valerio Braitenberg, Humberto Maturana and Francisco Varela, Ilya Prigogine and Jeremy England, Rachel Armstrong, Karen Barad, and Donna Haraway.

## Thesis Research and Design M1 Studio

September - Dec 2017  
University of Waterloo  
Cambridge, Canada

Graduate research and design studio led by Philip Beesley focusing on LASG topics, including complex systems.

## Reactor Cells Seminar

May 1 - August 28, 2017  
University of Waterloo  
Cambridge, Canada

Undergraduate elective architecture course at the University of Waterloo: School of Architecture led by Philip Beesley exploring the design, fabrication, and energy exchange of cellular construction units.



# Studentships

## **Alive Architecture: A Design Methodology Towards Biological Digital Evolution**

Mahdiar Giashi, Ph.D.  
In Progress  
University of Calgary  
Calgary, Canada

“Alive Architecture” defines a range of design concepts that own organic characteristics and natural behaviours that could be interpreted as signs of integrated intelligence and life. Some of the aforementioned natural characteristics borrowed from biology are responsiveness, adaptability, evolution, genetics, growth, natural harmony and balance. Similar to the life form on earth and different evolutionary ranks of creatures, alive architecture could also range from minimum smartness to highly intelligent design products. In this research “Alive Architecture” is considered to be fully free of electronic components, and instead put the emphasis on materiality and mechanical qualities of elements in an integrated manner, similar to natural life forms.

## **Parametric Pyramidicone**

Mengdie Zhang M. Arch  
In Progress  
University of Waterloo  
Cambridge, Canada

This project investigates how to use regular pyramidal and cone-like expanded mesh stretching from metal sheet as the basic modular unit to assemble a space frame structure. Parametric tool to aid design process and evaluate the structural tenability of lightweight space frame structures, employing Grasshopper and FEA software Fusion360.

## **Adaptive Balconies: Adaptive Reuse of Multi-family Residential Towers**

Sheida Shahi Ph.D.  
2018 - 2020  
University of Waterloo  
Cambridge, Canada

This project analyzes adaptive reuse prototypes for balconies as extensions to existing residential towers. The goals of this project are to investigate methods for analyzing existing buildings for their potential adaptability at the scale of the balcony through developing an index for adaptability. Tall concrete structures with cantilevered balconies have prevailed as the main type of multi-family housing construction in Canada since the 1950s. Within aging residential structures, balcony degradation is a prominent contributor to overall performance. This includes high levels of structural failures, low energy performance, and inefficient use. Some common strategies for improvements to balconies in residential towers include structural reconstruction, thermal insulation, enclosure of balconies, and reconstruction of guards. While these strategies can greatly improve existing conditions of residential towers, there is opportunity for adaptive reuse and future-proofing of tall buildings.

### **Parametric Structures**

Richard Mui M. Arch  
2017 - 2019  
University of Waterloo  
Cambridge, Canada

Analysis of LASG expanded meshwork scaffolds and development of adaptive parametric tools, employing geometrical primitives and hybrid test methods, establishing capability of prototype systems for full-scale deployment within exterior environments.

### **Interaction and Agency**

Adam Francey M.Sc/Psych  
2017 - 2019  
University of Waterloo  
Cambridge, Canada

Research of the perceived sense of 'agency' that a person will experience when engaged with an interactive agent. The research will explore how levels of perceived agency in an agent can be controlled by machine learning algorithms in the distributed interactive electronic systems of the Living Architecture Systems Group (LASG) sculptures.

### **Architectural Environment**

Parisa Hassanzadegan  
M.Arch  
2017 - 2019  
University of Waterloo  
Cambridge, Canada

Proposal of synthetic architectural environment derived from science fiction novel *A Door Into Ocean* by American science fiction writer and microbiologist, Joan Slonczewski. The environment would offer a new approach to life through architecture based on a buoyant living space of a small community of women who use genetic engineering to adapt their bodies to a marine environment. Critique of human life on earth, rejecting totalitarian and dictatorial behaviour of living creatures. Proposed is a dynamic, non-hierarchical system of living materials: ever-growing, ever-changing, and without border. Focus is towards a speculative future, rendering the built space as a living entity.

# Living Architecture Systems Group 2019

The Living Architecture Systems Group is an interdisciplinary partnership of academics, artists, designers and industry partners dedicated to researching and developing next-generation architectural environments. Environments produced by this group are now showing qualities that come strikingly close to life, transforming the built world. These experimental works can move, respond, explore, learn and adapt. The LASG disseminates its work through exhibitions, publications and events.

The LASG is generously supported by Social Sciences and Humanities Research Council of Canada (SSHRC), University of Waterloo, Canada Council for the Arts, Ontario Arts Council, Toronto Arts Council, National Academies Keck Futures Initiative, OCAD University, MITACS, Voltera, Formlabs, and the Consulate General of the Kingdom of The Netherlands.



