MATERIALS
Integrating New Materials into Landscape Design Systems

EDUCATION SESSION
MON-C10
November 18th, 1:30 PM - 3:00 PM
Boston Convention and Exhibition Center, 258

COORDINATOR
Janet Rosenberg
Founding Principal, Janet Rosenberg & Studio

MODERATOR
Liat Margolis
Assistant Professor, John H. Daniels Faculty of Architecture, Landscape, and Design, University of Toronto

PANELISTS
Kathy Velikov
Assistant Professor, Taubman College of Architecture of the University of Michigan and Partner at RVTR

Anna Dyson
Director, Center for Architecture Science and Ecology (CASE), Rensselaer Polytechnic Institute (RPI) and Skidmore, Owings & Merrill, LLP. and Professor at the School of Architecture, RPI

Billie Faircloth
Research Director, KieranTimberlake
SESSION DESCRIPTION

New academic and professional models are needed to cultivate a more experimental and exploratory design process that leads to the optimization of environmental performance in the built environment.

This education session explores the emergence of transdisciplinary, collaborative and multi-institutional research platforms within both academic and professional settings as a means to accelerate innovation. It also aims to reveal a new trajectory and agency for design students, faculty and practitioners in the realm of research and development of advanced materials and technologies through full scale prototyping and applied research.

The moderator—Liat Margolis at the University of Toronto Daniels Faculty and Green Roof Innovation Testing (GRIT) Laboratory, and three panelists—Kathy Velikov at the Taubman College of Architecture of the University of Michigan and her private practice RVTR, Anna Dyson at the Center for Architecture Science and Ecology (CASE) of Rensselaer Polytechnic Institute, and Billie Faircloth at KieranTimberlake—represent a forward-thinking, progressive, select yet increasingly conscious movement to promote the invention, investigation, and performance testing of new materials and design systems within research laboratories and degree programs established in design schools, as well as within professional practice.

The goal of this session is to understand the motivation and evolution of these research and design initiatives and the implications for landscape architecture education and practice.

INDIVIDUAL PRESENTATIONS

- Goals of the research
- Implications for industry, commercialization, construction standards, and/or policy
- New models for design education
- Research-integrated professional practice
- Collaborative and multi-disciplinary research structures
- Funding structures to support research within academic and professional practice
- How designer-researchers differ from the scientist or engineer, and what they brings to a transdisciplinary collaboration

DISCUSSION TOPICS

- The emergence of material research laboratories in design schools in the recent past, and how economic, ecological, and/or social challenges have influenced their focus and interests.
- The definition and role of the designer-researcher.
- The testing of material performance and the value of this understanding for future practitioners.
- An interest in expanding the design practice to include the design and invention of building materials with the collaboration of scientists/engineers as well as industrial manufacturers.
- The emphasis on properties and performance of materials informed by design criteria.
BIOGRAPHY

Liat Margolis is Assistant Professor of Landscape Architecture at the University of Toronto, John H. Daniels Faculty of Architecture, Landscape and Design. She is also the Principal Investigator of the Green Roof Innovation Testing (GRIT) Laboratory which is focused on testing, validating and evaluating the environmental performance of green roof, green wall and solar photovoltaic technologies. For her work on GRIT Lab, Liat received grants from the City of Toronto Environment Office, Ontario Centres of Excellence (OCE), RCI Foundation, MITACS, Natural Sciences and Engineering Research Council of Canada (NSREC), the Connaught Fund and the Landscape Architecture Canada Foundation (LACF). GRIT Lab is the recipient of the 2013 American Society of Landscape Architects (ASLA) award for Excellence in Research.

Prior to joining the Daniels Faculty, Liat worked as a landscape architect for Hargreaves Associates. She was also a founder and Director of Materials Research at Harvard Graduate School of Design (GSD), where she had advised on the pedagogical role of material research within design. Previously, as Director of Material Research for 6 years at Material ConneXion Inc., Liat was instrumental in the development of a cross-disciplinary material database and archiving system, as well as with consulting to a broad range of design firms and corporations in the fields of Architecture and Product Design. She holds a Masters of Landscape Architecture from Harvard Graduate School of Design (GSD), and a Bachelor of Fine Art in Industrial Design from the Rhode Island School of Design (RISD).

RESEARCH PRACTICE

The Green Roof Innovation Testing Laboratory (GRIT Lab) is located on the rooftop of the John H. Daniels Faculty of Architecture, Landscape, and Design at 230 College Street, Toronto. Established in 2010, GRIT Lab is a state-of-the-art facility — and the only one of its kind testing the environmental performance associated with green roofs, green walls and solar photovoltaic technologies in Canada.

GRIT Lab includes 33 green roof test beds, 3 green walls, a weather station, and 270 sensors connected to over 5,000 linear feet of wiring. Data on soil moisture, flow rates, temperature, rainfall, humidity, solar, and wind is collected every 5 minutes. The integration of real-time data monitoring to study the metrics associated with ‘green’ and ‘clean’ technologies provides a comprehensive and dynamic understanding of the water-energy-biology nexus in context of regional and climate specific priorities.

Phase I (2010-2016) has been designed to test and evaluate green roof construction standards specifically in context of the City of Toronto’s Green Roof Bylaw Construction Standard and with respect to four primary environmental criteria: 1) Stormwater Retention, 2) Evaporative Cooling, 3) Biodiversity, 4) Life Cycle Cost.
A 4,000 sq.ft section of the Daniels Faculty roof has been dedicated to conducting the experimental aspect of this research. Thirty-three beds have been designed to compare the following four parameters: 1) growing media type, 2) growing media depth, 3) vegetation community, and 4) irrigation regimes. Each bed is instrumented with thermal and moisture sensors, a rain gauge and infrared radiometer; the data will be analyzed against base-climate data, acquired via a weather station onsite. Phase I also includes a study of green facades and their influence on the thermal regulation of a building envelope.

Phase II (2013-2016) will focus on evaluating the synergistic relationship between green roofs and PV arrays. The hypothesis is that green roofs reduce local air temperature through evapotranspiration and solar reflectance and that this improves PV performance and lifetime. The integration of PV with green roofs is important because it will contribute to reducing environmental impacts by simultaneously designing for renewable energy, evaporative cooling, and stormwater retention on building rooftops. Phase II will include a 1500 sq.ft area of the Daniels Faculty roof. In Phase II, 2 different PV module heights – 2, 4ft will be tested above 2 roofing surfaces – white and green for optimal PV performance, exposure to wind, practicality of installation and maintenance, and effect of shading of plants.

GRIT Lab provides a platform for multi-disciplinary research and education by linking the fields of Landscape Architecture, Biology, Hydrology and Building Science. Its wide range of partnerships with industry, academic institutions and government agencies have far reaching implications for education and knowledge transfer, innovation and commercialization, as well as policy and guidelines. As such, students are offered a unique hands-on opportunity to work directly with the latest material and digital technologies, as well as with both industry experts and academics from a wide range of disciplines. The cross-pollination among various disciplines is intended to generate new ideas, while the link to industry facilitates their implementation.
Kathy Velikov is Assistant Professor of Architecture at the Taubman College of Architecture and Urban Planning at the University of Michigan where she teaches design studios, courses in the ecology of technology and is the co-coordinator of the Master of Science concentration in Material Systems. Previously, she was the 2006/07 Oberdick Fellow at Taubman College, and held teaching appointments at the University of Toronto and the University of Waterloo. Kathy is a licensed architect in the State of Michigan and the Province of Ontario, a partner in the research-based practice RVTR and a co-founder of the Metropolitan Futures Group (MFG). She holds an MA in the history of art and architecture from the University of Toronto, and a Professional BArch and BES from the University of Waterloo. Prior to founding RVTR, Kathy spent over ten years in practice, primarily in Toronto, Canada, as a project architect and senior designer working on urban masterplans, institutional buildings, private residences, and design competitions.


RESEARCH PRACTICE

RVTR was founded by Kathy Velikov and partners Geoffrey Thün and Colin Ripley in 2007 as a research-based practice. RVTR serves as a platform for exploration and experimentation in the agency of built environments that are shaped by advanced materials and technologies, and that operate as agents in complex ecological, economic, and social systems. The work exists at two scales: at the micro-material scale of responsive building envelopes, and at the macro-urban scale of regional analysis, infrastructures, energy, politics and design intervention. These scales of operation are connected through an ecological approach to design: an approach and sensibility towards operating within the broader schema-patterns, connections and co-evolutions between things, and in particular, between buildings, inhabitants and environments. With studios in Ann Arbor and Toronto, the primary body of RVTR’s work is funded through grants from various institutions and agencies including the Social Sciences and Humanities Research Council of Canada (SSHRC), The US Department of Transportation (DOT), Ford Motor Company, the U.S. Department of Energy (DOE) / National Renewable Energy Laboratory (NREL), the Ontario Power Authority (OPA), the National Research Council of Canada (NRC) and the Canada Council for the Arts.
The research in responsive envelopes explores interior and exterior building skins as thick, sensing, kinetic membranes that, like biotic skins, must perform multiple and sometimes conflicting functions in order to manage and transfer light, thermal gradients, air quality and acoustics. This work aims to reclaim the environmentally performative domains of architecture to within the purview of the discipline, and as territories of material, formal, technological and experiential exploration and innovation. The work is developed collaboratively with a range of interdisciplinary partners through full-scale prototyping and research that includes the development of performative material systems, dynamic surface geometries and variable actuation and control systems.

The Master of Science in Material Systems is a recently inaugurated post professional research program co-coordinated by Velikov in collaboration with other faculty at the University of Michigan’s Taubman College. The 2.5 semester long program focuses on research-based exploration and innovative development of instrumentalized material assemblies for architectural applications developed through the feedbacks between matter, environment, and methods of manufacture. Current work in collaboration with students and faculty is focused on explores lightweight building skins based in textiles and composites.

The Stratus Project, air-based interior responsive envelope system prototype, 2011 (Velikov, Thün)

Resonant Chamber, deployable acoustic envelope system prototype 2012 (Thün, Velikov McGee)
**BIOGRAPHY**

*Anna Dyson*

Anna Dyson teaches design, technology, and theory at the School of Architecture at Rensselaer. She is the founding Director of CASE (2007-present) which hosts the Graduate Program in Architectural Sciences / Built Ecologies. CASE is committed to bridging diverse worlds by proposing a new collaborative model for building research that unites interdisciplinary academic research with building and development practices. The consortium attempts to achieve this collaborative model without the schism that has typically divorced building science pursuits from the aesthetic, social and conceptual aspirations of architectural design inquiry. Anna has been recognized with multiple awards for her designs and innovations, and her work has been exhibited internationally at venues including the Museum of Modern Art (MoMA), The World Future Energy Summit (WFES), The Center for Architecture and the Postmasters Gallery. Dyson holds multiple international patents for building systems inventions and is currently directing interdisciplinary research funded by the National Science Foundation (NSF), the U.S. Department of Energy (DOE), the New York State Energy Research and Development Authority (NYSERDA), and the New York State Foundation for Science, Technology and Innovation (NYSTAR) to develop new building systems that integrate advances in science and technology from diverse research fields.

**RESEARCH PRACTICE**

A new academic-industrial alliance is required to accelerate a more aggressively experimental process that leads to development of new systems that produce a paradigm shift in the way that our future cities metabolize energy, water, and resources. The Center for Architecture Science and Ecology (CASE) is addressing the need for accelerated innovation of Built Ecologies through the development of next-generation building systems. A multi-institutional and professional research collaboration co-hosted by Rensselaer Polytechnic Institute and Skidmore, Owings & Merrill LLP, CASE is pushing the boundaries of environmental performance in urban building systems on a global scale, through actual building projects as research test beds.

CASE conducts interdisciplinary research focused on next generation building technologies for a sustainable built environment. We address the need for accelerated innovation of radically new architectural systems capable of harnessing local ecological energy, and integrating better with both human and natural systems.
CASE is a multi-institutional and professional office research collaboration co-hosted by Rensselaer Polytechnic Institute and Skidmore, Owings & Merrill (SOM). Through this partnership, the boundaries of environmental performance in urban building systems on a global scale are being tested using actual building projects as test beds.

Co-located on the Rensselaer campus in Troy, NY and at SOM’s offices in lower Manhattan, CASE unites advanced architectural and engineering practices with scientific research through a unique and intensive collaboration between multiple institutions, manufacturers, and professional offices within the building industry.

Rensselaer’s School of Architecture frames its advanced degree program in Built Ecologies—focused on fostering the next generation of researchers, who are able to provide performance-driven building technologies in support of clean, self-sustaining built environments—around CASE. The program aims to implement changes to building practices with international impact in three priority areas: energy consumption; sustainable resource management; and quality of access to essential resources: Fresh Air, Clean Water, Natural Daylight, and Plant and Animal Life. Research projects include: Building Integrated Concentrating Solar Facade, Active Modular Phytoremediation Systems, Solar Enclosure for Water Reclamation and Thermal Control, Tropical Coastline Remediation, EcoZoning for Coastal Development, Urban Heat Island Effect, Urban Morphology and Building Energy among others.
Billie Faircloth, AIA, LEED AP
Research Director

Billie Faircloth is Research Director at the internationally recognized architecture firm KieranTimberlake. She leads a trans-disciplinary research group of professionals leveraging research, design, and problem-solving processes from fields as diverse as environmental management, chemical physics, materials science and architecture. She fosters collaboration between disciplines, trades, academies and industries in order to define a relevant problem-solving boundary for the built environment. Her articles have been published by the Royal Danish Academy of Fine Arts, ACADIA, and the Journal of Architectural Education and are forthcoming from Princeton Architectural Press. She lectures internationally to academic and industry audiences, including talks most recently for the Australian Institute of Architects, University of Nottingham, the University of Washington, Columbia University, and the University of Texas at Austin. In addition to her practice, she is a lecturer at the University of Pennsylvania. Billie received a Bachelor of Architecture from North Carolina State University and a Master of Architecture with Distinction from Harvard University.

RESEARCH PRACTICE

KieranTimberlake is a prominent internationally recognized architecture firm and a leader in practice-based architectural research and innovative buildings. The 80-person firm engages in design and planning projects at a range of scales, from single family homes to laboratories and office buildings. Their research projects have been exhibited at The Museum of Modern Art and the Smithsonian Cooper-Hewitt National Design Museum. A trans-disciplinary research group works alongside architectural teams to define and support project-based research initiatives, leveraging skill sets in environmental management, urban ecology, green infrastructure, land use management, architectural design, manufacturing and fabrication, chemical physics, electrical engineering, materials science, and product commercialization. The Research Group is responsible for independent research projects, which include custom, open-sourced wireless sensor networks; application-specific environmental analysis and prediction tools; building performance assessment methods; building materials; building envelope technologies; and whole buildings for extreme climates. There are currently ten research group members working collaboratively in an open studio environment in Philadelphia, Pennsylvania.
REFERENCES

Relevant references/publications with research by Liat Margolis

grit.daniels.utoronto.ca
www.materialconnexion.com


Relevant references/publications with research by Kathy Velikov / RVTR

www.rvtr.com
vimeo.com/rvtr


Rethinking Infrastructural Ecologies in the Great Lakes Megaregion, North America,” Sustainable Energy Landscapes, edited by Sven Stremke and Andy van Dobbelsteen. CRC Press/ Taylor & Francis


Relevant references/publications with research by Anna Dyson and CASE

www.case.rpi.edu


Relevant references/publications with research by Kieran Timberlake

kierantimberlake.com


