

# Design Computation Symposium

December 3, 2014 | 8:00 a.m.–12:00 p.m.

Mandalay Bay F, Level 2 | Mandalay Bay Hotel, Las Vegas, Nevada



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Session 1: 08:00 am – 09:30 am		
08:00 am – 08:05 am	Introductions	Matt Jezyk
08:05 am – 08:15 am	Opening Remarks: Craftsmanship and Digital Fabrication / Pier 9	Carl Bass
08:15 am – 08:45 am	Hy-Fi	David Benjamin
08:45 am – 09:30 am	Keynote 1: Reshaping Urban Airspace	Janet Echelman
09:30 am – 10:00 am	Break	
Session 2: 09:45 am – 12:00 pm		
10:00 am – 10:30 am	Designing a New Materialism	Andy Payne
10:30 am – 11:00 am	Unlocking Robotic Design	Sigrid Brell-Cokcan
11:00 am – 11:45 am	Keynote 2: Craft, digital fabrication, and digital assembly	Mark Burry
11:45 am – 12:00 pm	Closing Remarks, Q&A	

The 2014 Design Computation Symposium will focus on **“Craftsmanship and Digital Fabrication”**, highlighting the balance, and sometimes tension, between traditional design and construction processes and the ever-increasing opportunities surrounding digital fabrication. Over the past 10 years we have seen automated manufacturing techniques driven directly by design professionals become more widespread in the AEC community. We are at a point where barriers to entry are decreasing daily and digital fabrication is not the domain of just the select few. Will this opportunity help the AEC design profession or hurt it? Is the time ripe for designers to start mastering this new domain and harnessing its potential?

Like many new technologies before it, there has been resistance and concern over the erosion of the status quo. Many participants are concerned that digital fabrication removes the vital understanding of materiality and erodes the craft of making. Is this a valid criticism? Is there an inevitable erosion of craftsmanship from using new tools? Or can the profession simply ‘get with it’ and add these new tools to their toolset? Is the designer more in control now with an expanded set of tools or are they constrained by technologies and fabrication processes outside their comfort zone? Can we expand our definition of craftsmanship to encompass digital fabrication? Can these tools foster more innovation and collaboration in our fragmented industry?

To help answer these questions and educate us on what is possible, we are pleased to bring a group of professional sculptors, architects and makers to the symposium. They will speak about their design processes and how digital tools have shaped their professional careers.

## Session 1 | 8:00 a.m.–9:30 a.m.

**Matt Jezyk:** Intro and Emcee

**Carl Bass:** Opening Remarks – *Craft and Digital Fabrication / Pier 9*

### Hy-Fi

David Benjamin, The Living

For the Young Architects Program 2014 of the Museum of Modern Art and MoMA PS1, The Living designed and constructed a 40-foot-tall tower made of 10,000 compostable bricks. The complex geometry of the tower, the unusual new material, and the inability to cut bricks to size in the field presented a series of challenges. In order to address these challenges, the design team used generative modeling, unusual structural simulation, and intensive physical testing to bring the project to life.



■ *Costa Minimal Energy Surface in Marble, Matt Jezyk, Digital Stone Project, Tuscany 2014*



■ *Hy-Fi, The Living, David Benjamin, New York PS1, 2014*

### Reshaping Urban Airspace

Janet Echelman, Studio Echelman

Janet Echelman will discuss the evolution of her artwork in public spaces around the world and the infusion of art and technology in her practice. She shares the stories behind the designs, including *Skies Painted with Unnumbered Sparks*, a 745-ft sculpture that premiered at the 2014 TED Conference. As the largest pre-stressed rope structure in the world, Echelman utilized custom software to model the sculpture and test its feasibility. Learn how digital tools have informed and influenced how Echelman transforms cities across the globe.

■ *Skies Painted with Unnumbered Sparks, Janet Echelman, Vancouver 2014*

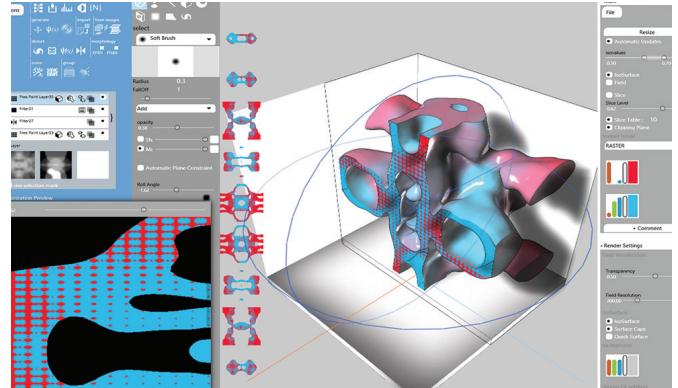


## Session 2 | 10:00 a.m.–12:00 p.m.

### Designing a New Materialism

Andy Payne, CASE and Harvard GSD

At present, computer aided design (CAD) software has proven ill equipped to manage the spatial variations in material properties. Most digital design applications employ a surface modeling paradigm where a “solid” object is that which is enclosed by a set of boundaries (known as boundary representations or ‘B-rep’ for short). In surface models, material representations are often treated as homogeneous and discrete. Yet, natural materials are capable of complex structures where the variability of material within a volume is defined at a multiplicity of scales and according to various functional criteria. With the advent of new 3D printing techniques, a new possibility emerges - allowing the creation of new multi-material composite objects which can be fabricated in a single build volume with a high degree of dimensional accuracy and repeatability. However, a big limitation facing complex high resolution digital fabrication comes from the software’s inability to represent or handle material variability. This presentation will explore a new framework for working with multi-scale digital material distributions and showcase a new tool, called Monolith, which aims to address the current limitations in traditional CAD applications and enable new creative opportunities for researchers and designers.

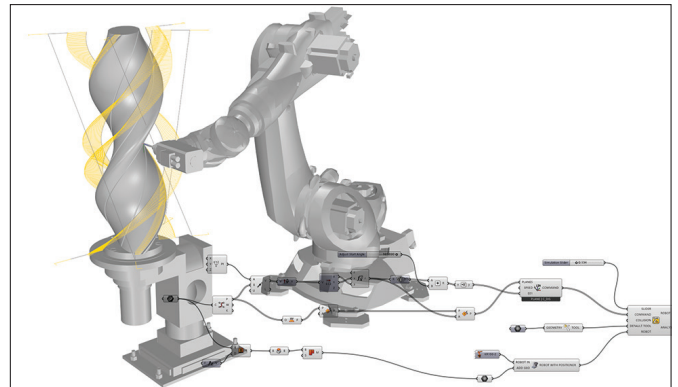


■ *Monolith, material variability in 3d printing, Andy Payne, 2013*

### Unlocking Robotic Design

Sigrid Brell-Cokcan, Robots In Architecture

Industrial robots – or robotic arms – are highly complex kinematic machines with six or more axes that, similar to a human arm, can be equipped with different tools. This multifunctionality along with their many degrees of freedom enables robotic arms to perform tasks that go far beyond the scope of regular CNC machines or CAD-CAM processes. Especially the creative industry is interested in such machines, as it enables the fabrication of new geometries as well as the implementation of new fabrication processes. However, most software for programming robotic arms is aimed at facilitating mass production, while the creative industry requires new and flexible solutions that enable customized fabrication in smaller numbers. Thus, new approaches are required to model innovative robotic processes for architectural prototypes. KUKA|prc (parametric robot control) is designed as an accessible interface that links the parametric modelling environment of Grasshopper and Dynamo with KUKA robots.



■ *KUKA|prc for Grasshopper and Dynamo, Robots In Architecture, 2014*

### Digital Fabrication, and Digital Assembly: Thrusting Heads into the Clouds While Keeping Feet on the Ground

Mark Burry, RMIT

On the one hand the mysterious time lag between the take-up of new technology in the AEC sector when compared to the auto and aero industries is perhaps not quite so mysterious: the obvious differences include the typically ‘one-off’ nature of architectural adventures compared with industrialised mass production, and the fractured nature of the contracting organisations that have not been able to enjoy the advantages of the manufacturing sector with its consistent supply lines for identical components. Taken less into account when seeking to explain the tardiness for building construction to ‘get with it’ is the nature and role of craft. Two questions emerge: firstly, to what extent can slow traditional methods be successfully substituted by robotic efficiency? And secondly, is ‘efficacy’ in outcome for the end-user the same when considering the machine-made masterpiece as it is with the handcrafted?



■ *Continued Construction on Sagrada Familia, Mark Burry, 2014*

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**David Benjamin** is Founding Principal of The Living and Assistant Professor at Columbia University Graduate School of Architecture, Planning and Preservation. The Living brings new technologies to life in the built environment, integrating design innovation, sustainability, and the public realm. Clients include the City of New York, 3M, Airbus, and Miami Science Museum. Recent projects include the Princeton Architecture

Laboratory (a new building for research on next-generation design and construction technologies), Pier 35 EcoPark (a 200-foot floating pier in the East River that changes color according to water quality), and Hy-Fi (a branching tower for the Museum of Modern Art and MoMA PS1 made of a new type of biodegradable brick). The Living was recently acquired by Autodesk.



American artist **Janet Echelman** builds soft, billowing sculpture at the scale of buildings that respond to the forces of nature - wind, water, and light. She combines ancient craft with custom Autodesk technology to create ultra-lightweight sculptures that move gently with the wind in ever-changing patterns. Her recent sculpture *Skies Painted with Unnumbered Sparks*, a 745-ft sculpture that premiered at the

2014 TED Conference, the largest pre-stressed rope structure in the world. She recently received the 2014 Smithsonian Ingenuity Award in Visual Arts, honoring "the greatest innovators in America today."



**Professor Mark Burry** is a practising architect who has published internationally on two main themes: the life, work and theories of the architect Antoni Gaudí, and putting theory into practice with regard to 'challenging' architecture. He has been Senior Architect to the Sagrada Família Basilica Foundation since 1979 pioneering distant collaboration with his colleagues based on-site in Barcelona. He is

currently the Founding Director of the RMIT University's *Design Research Institute* (DRI), established in 2008 to collaborate across the entire university design community ranging from hard-core sciences and technology to applied arts. In 2001 he founded RMIT University's state-of-the-art *Spatial Information Architecture Laboratory* (SIAL) in Melbourne Australia, established as a holistic transdisciplinary spatial design research environment.



■ RMIT FabPod, Mark Burry and team, 2012



**Andrew Payne** is an architect and Senior Building Information Specialist at Case-Inc. He recently completed his Doctoral degree at Harvard's Graduate School of Design where his dissertation examined new personalized intelligent comfort control strategies for office spaces. Andrew's other research interests focus on embedded computation, parametric design, robotics, microcontrollers, and 3d

printing. He is the co-author (with Jason K. Johnson) and lead developer of Firefly – a software plugin which bridges the gap between the digital CAD environment of Rhino/Grasshopper (and soon to be Dynamo) with physical input/output devices like the Arduino, web cams, mobile phones, game controllers and more. He has lectured and taught workshops throughout the United States, Canada, and Europe and has held teaching positions at Columbia University and the Pratt Institute. He also sits on the Board of Directors for the Association for Computer Aided Design in Architecture (ACADIA).



**Sigrid Brell-Cokcan** is a professional architect with her own successful architecture firm II Architects<sup>int</sup> in Istanbul and Vienna and is currently holding the first international professorship for "creative robotics" at the industrial design department of the University for Art and Industrial Design, Linz/ Austria.

Co-founded by Sigrid Brell-Cokcan and Johannes Braumann in 2010 the Association for Robots in Architecture has been pioneering the easy use of industrial robots for the creative industry. They are participating in international research and industry projects and have recently become KUKA System partners and a validated EU research institution under the FP7 program.