INTRODUCTION

SYNTHETIC DIGITAL ECOLOGIES

Why use the terms *synthetic* and *ecology* in the context of a conference dedicated to the field of digital architecture, computation and fabrication? How do we begin to unpack the synthetic union of diverse elements, processes, collaborators, and code underlying any single contemporary design or research project? What could our field gain by interrogating these diverse ecologies? What are *the relationships and interactions* between our design processes, including our various tools and techniques, and the multiple environments with which we routinely work, collaborate and make?

It is these questions and more that we hope to address at this year's *"Synthetic Digital Ecologies"* conference. A quick scan of the papers and projects that will be presented at ACADIA reveals an extraordinary ecology of experimental research that emerged by working between messy labs, studios, workshops, hacker spaces and the like. In many ways today's so-called *"digital architects"* do not feel compelled to distinguish between what is digitally designed and what is not. They are leading the way through a promiscuous and synthetic mixing of skill sets, of pens and paper, hardware and software, electronics and g-code. In a single research project these designers might collaborate with a computer scientist, a robotics expert and a glass blower, and in many cases they might even attempt to do all of these things themselves. It was with this in mind that we put forth an international call inviting, *"... architects, fabricators, engineers, media artists, technologists, software developers, hackers and others in related fields of inquiry ..."* to submit papers and projects for this year's conference.

This year the proceedings have been organized into twelve synthetic categories based around the potential for diverse research topics to inform new and unexpected conversations. Instead of organizing peer-reviewed papers and projects through their formal characteristics, we were interested in forming new synthetic categories by curating unexpected juxtapositions. This ecology of ideas and research was meant to provoke and inspire new ways of thinking, making, building and collaborating. The proceedings sections and conference sessions are organized into the following categories:

1. PERFORMATIVE PARAMETRICS

With the ubiquity of parametric design, greater emphasis is now placed on analytical feedback between real world data and digital design parameters. Research presented here links analysis—quantifying structural, energy, and even financial data—with design intuition.

2. MATERIAL INTENSITIES

This category presents research that explores active modeling approaches which develop extensive geometry from intensive energies, and seeks to understand materiality not simply in terms of metrics and tables, but through key relationships that affect architectural performance.

3. RESPONSIVE MATERIAL SYSTEMS

Often beginning with experiments conducted at full scale, works presented in this category focus on constructing a digital to physical feedback loop, and suggest a synthetic relationship between formal morphology and material behavior.

4. ROBOTIC CONSTRUCTIONS

The introduction of industrial robots in architectural production represents not only the next step in computer aided manufacturing, but potentially enables a systematic intertwining of the design to production loop linking material behavior and the tectonics of assembly.

Jason Kelly Johnson
Conference Chair and Technical Co-Chair

Mark Cabrinha
Technical Co-Chair

Kyle Steinfeld
Technical Co-Chair

5. STRUCTURAL FORMATIONS

Research presented in this category employs computational workflows to create feedback between empirical experimentation, and digital / analog form-finding. Projects detailed here combine a rational yet expressive logic in the formation of structural solutions.

6. ENERGETIC ASSEMBLIES

Building assemblies do not simply develop from their intrinsic tectonics, but as energetic expressions of the environment in which they are assembled. This research demands a reconsideration of the natural—artificial separation, from an architecture that is insulated from the environment to one that is actively intertwined with it.

7. MATERIAL FEEDBACK

Moving beyond the familiar divide between formal expression and the intrinsic behavior of materials, this section examines the application of information technology applied to fabrication and construction, and asks if recent advances have fundamentally destabilized the separation of formal exuberance and material expression.

8. DYNAMIC RESPONSES

Static models of the world are generally incapable of addressing the temporal dynamics essential to a synthetic approach to design. The research presented here endeavors to bend these static methods into processes capable of addressing a range of dynamic phenomena.

9. PERFORMATIVE GEOMETRIES

Work presented here explores the ecology of architectural production by transferring techniques and discoveries from disciplines both adjacent to architectural design and those further afield. A focus on the performance of specific geometries binds these disparate fields, and unifies the full-scale applied research.

10. EMERGING INTERFACES

Research presented here questions the standard human-computer interface, suggesting a potential bridging of the digital-physical divide into a more synthetic and sensory experience. It combines the tacit knowledge contained in our everyday gestures with the analytical power of computation.

11. SYNTHETIC OPTIMIZATIONS

Experimental design methods and tools represent not only the expanding role that quantitative methods have begun to play in experimental practice, but also suggest the emergence of a new aesthetic of the optimal.

12. COLLABORATIVE ECOLOGIES

This category explores the boundaries of collaborative design frameworks in order to address problems encountered when designing at scales beyond those within reach of traditional architectural design processes.

In addition to the peer-reviewed and keynote papers presented in this volume, the ACADIA 2012 conference will also host two unique exhibitions. The first exhibit, consisting of peer-reviewed content and curated projects from emerging California-based designers, has been organized and fabricated by Nataly Gattegno and Brian Price. The exhibition, entitled *"Wild Cards"*, will feature projects suspended in a fluid and ephemeral framework located in the CCA Nave. The work of this exhibit is being published in a separate volume. A second smaller exhibit, organized by TEX-FAB / DFA (Brad Bell, Kevin McClellan, Andrew Vrana) will showcase four finalist submissions and full-scale prototypes from the *Applied: Research Through Fabrication* competition. Taken together, these two exhibitions will greatly enrich the intellectual content of the conference and will reinforce the value ACADIA places on digital and material experimentation, iterative prototyping and full-scale fabrication.

To further engage these ideas we actively sought keynote speakers whose research pushes the boundaries of digital design through innovative and critical uses of technology, production and cross-disciplinary thinking. This extraordinary group of designers, makers and thinkers craft synthetic relationships and blur distinctions between the digital and the physical, between the natural and artificial, and between performance simulation and real-world testing. Greg Lynn, the first key note speaker of the conference, is no stranger to the ACADIA community. His influential early writing brought together topology, material science, animation and parameter-based thinking into a clear and unified argument. Today, his thriving design studio merges theory and practice by engaging a multitude of ideas, collaborators, robotic machines and materials. Our second key note, Manuel DeLanda, is one of the most important theorists and writers of our time. His most influential books include: *War in the Age of Intelligent Machines(1991), A Thousand Years of Non-linear History(1997),* and most recently, *Philosophy and Simulation: The Emergence of Synthetic Reason (2011)*. DeLanda's work often interconnects the theories of Gilles Deleuze with topics such as the history of architecture, science, warfare and technology on one hand, and contemporary ideas related to artificial life, robotics, and self-organizing systems on the other. Our third and fourth keynotes, Neri Oxman and Achim Menges, focus on exploring biological models and material based investigations. Oxman, now teaching at MIT, is gaining a reputation for her inspiring and innovative use of multi-material 3d printing technologies. Menges, now teaching at the University of Stuttgart, uses installations to explore morphogenetic design strategies and material inherent behaviors. Saul Griffith, our last keynote, brings together diverse interests to make inflatable robots, air-borne wind turbines, and online tools such as the instructables.com website. Griffith recently received a MacArthur Genius Grant to support his future endeavors. His San Francisco based otherlab has become an interdisciplinary hub in the gritty Mission District of the city.

This year, the conference is set against the backdrop of an extraordinary physical setting. San Francisco is the metropolitan center of the Bay Area. Surrounded by water and connected by spectacular bridges, the city is well known for its dramatic hills, diverse neighborhoods, world-class museums and its liberal minded, tech-savvy citizens. It is also bracketed by the research powerhouses of UC Berkeley, Stanford and Silicon Valley. San Francisco is a place where a conference named "Synthetic Digital Ecologies" seems quite at home. This year the conference is being hosted at two urban institutions devoted to the intersections of art, design and science research: The California College of the Arts (CCA) and UCSF Mission Bay. CCA, housed in an open and light-filled 120m long former bus depot, is a scrappy and energetic art, architecture and design school with a growing track record for excellence in digital computation, interaction and fabrication. A few blocks away, UCSF is a recently constructed world class bio-tech hub focusing on the fields of synthetic biology, genetics and emerging fields in the bio-sciences. It seems fitting that ACADIA 2012 would be held in the midst of these two extraordinary, unique and diverse institutions.

Since its inception the Association for Computer Aided Design in Architecture (ACADIA) annual conference has been at the forefront of exploring the synthetic use of digital tools to enhance design creativity and critical thinking in both practice and the academy. Contrary to what the name suggests, the conference has not shied away from fully engaging the building sciences, fabrication, production and emerging technologies. Indeed it would be hard to imagine the conference today without the integration of these important topics. The conference consistently brings together synthetic thinkers and makers, people fusing creative and technical pursuits through the agency of design, computation and fabrication. This synthetic ecology of tools, techniques and processes has had a profound effect on the discipline of architecture. We regularly see evidence of the ACADIA ethos and its members fingerprints on some of the most important essays, books, software, machines, prototypes, projects and buildings of our time. We also see the influence of ACADIA on the academy, where a high percentage of our attendees either attend or lead the finest architecture and design schools, labs, workshops and research studios around the world. Each year these attendees exchange new knowledge, discuss, debate and hatch new ideas, and plan future collaborations. In this way the annual conference serves as an intense and rich moment of intersection for practitioners, academics, students, developers, vendors and more. Similarly, this year's conference will be a time for attendees to make new acquaintances, strengthen bonds, learn, listen, browse and explore.