BUILDING DYNAMICS: EXPLORING ARCHITECTURE OF CHANGE

International Symposium, Friday and Saturday, April 26 & 27, 2013

www.buildingdynamics.org

We have seen over the past decade an increasing interest in the capacity of built spaces to respond dynamically to changes in external and internal environments and to different patterns of use. The principal idea is that two-way relationships could be established between the buildings and the environment and users. Changes in the environment (or users) would affect the configuration of built spaces and vice versa. The result is an architecture that self-adjusts – an architecture that is adaptive, interactive, reflexive, responsive.

By adding sensors, actuators and controllers to various systems, buildings are in a way becoming large scale robots. This symposium will go beyond this current fascination with mechatronics and will explore what change means in architecture and how it is manifested: buildings weather, programs change, envelopes adapt, interiors are reconfigured, systems replaced. It will explore the kinds of changes that buildings should undergo and the scale and speed at which they occur. It will examine which changes are necessary, useful, desirable, possible...

SMART ARCHITECTURE, DUMB BUILDINGS

Michelle Addington, New Haven, USA

Sense, actuate, respond, interact, adapt. All are verbs of motion; as such, all are forms of energy. We thereby equate them with dynamic behavior. What we rarely understand is that the most salient characteristic of energy is not dynamism but transiency. Transiency denies fixity. Therein lies the dilemma of the smart building—our desire for dynamism has been manifest in our activation of every artifact we can find in a building from facades to surfaces to systems to components, but in so doing, we have created an architecture whose dynamic qualities are assigned to tangible objects. Transient behaviors are highly unlikely to emerge coincident with any given object, much less to do so repeatedly. Could our architecture become smarter if we allowed the building to become dumber? By decoupling actions from artifacts we may have greater opportunities to create more responsive environments.

CREATIVE CYNICISM AND THE CHEERFUL RESPONSE

Peter Cook, London, UK

Every generation has cried out that “life is hard”, “times are difficult”, “we are all probably doomed”. Circuiting the developed world this can be challenged by observation; my observation is via the trivia of the city: the ‘sub architecture’. Seeing the habits of townspeople, students, subway commuters, shopkeepers/waitresses/plumbers/academics it seems that they can (a) exacerbate the situation by using ‘the situation’ as a psychological crutch, (b) ride it with black humour, or (c) respond cheerfully and creatively, i.e by “making the best of it”. Architects have the same (a), (b) or (c) tendencies. I place myself heroically or maybe stupidly in the “c” group. CREATIVE cynicism means that you take the situation, “warts and all” and do a cheerful architecture. Illustrated with projects, buildings and a few cartoons.

BUILT ECOLOGIES

Anna Dyson, New York, USA

Emerging design opportunities offer a radical material departure, as we become capable of designing dynamically switchable quantum effects at the nanoscale to attain unprecedented control over surface phenomena, which could interact and adapt to energy and information flows in a completely different manner than those of material behaviors at the micro and macro scales that we have previously been accustomed to. We are induced to push for far greater

adaptability by managing the operation of dynamic quantum effects at the nanoscale, such that we could develop a material behavior that responsively switches its properties, e.g. – transparent to opaque, absorbing to insulating, blue to red, etc. As such, our most recent prototypes depart fundamentally from the 'fixed' material paradigms in a critical way – in a way that is emblematic of the radically new material opportunities that we as a society are grasping for the first time. Critically, these opportunities are rooted in a fusion of solid state and life processes, as opposed to the top-down material formation procedures within the operative manipulations inherent to past architectural and manufacturing practices.

MAKE ALIVE

Rodolphe el-Khoury and Carol Moukheiber, Toronto, Canada

Our research is premised on the notion that every building, city and landscape component can be – and will be – equipped with communicative and computational capacities. The migration of computing from dedicated appliances to physical environments directly empowers architecture as a transformative agent. The fact that objects can now sense, think, act and communicate with the help of embedded technology is opening up the potential for an architecture that is more closely aligned with the networked dynamics of living systems – a sentient architecture. Our projects establish an interdisciplinary platform involving artists, designers, scientists and engineers spanning different institutions and continents in a technological approach to spatial problems that is attuned to the dynamics of living systems. The collective aim is to develop from the collaborative experiments a digitally enhanced architecture that is well-equipped to handle persistent and emerging challenges in building a healthy and sustainable environment.

BIO-ROBOTIC ARCHITECTURE

Michael Fox, Los Angeles, USA

Bio-robotic architecture lies at the intersection of biology and robotics; it hinges on a unique area of naturally inspired and robotically augmented design. The talk explains the unfolding combinatorial worlds of biomimetics and robotics guides us through a variety of scales including a future of holistic ecological system design that is increasingly relevant to the environmental impact of architecture and design. As the term adaptive has increasingly fostered a shift from the paradigm of the mechanical to the biological it has left a gap in the area of control. Robotics helps to fill this gap in the strictly biomimetic approach to architectural design. Bio-robotic architecture defines an architecture that goes beyond the mere capacity to interact; it defines a world that repositions the role of the designer as a catalyst of design that can adapt and evolve with the world around it.

ARCHITECTURE OF PARTICIPATION

Usman Haque, London, UK

Cooperation is difficult. Even when everybody agrees on an end goal, and even when everybody agrees on what is needed to achieve that end goal, it does not mean that everyone (or even anyone) will be able to take the first step, which is a most important step. The talk will discuss these and other paradoxical structures of collaboration, and ways that the paradoxes can be harnessed in constructing participative architectural systems, with specific reference to Usman's interactive urban spectacles, collaboration platforms and other concrete examples.

DYNAMIC, ADAPTIVE BUILDING ENVELOPES

Edwin (Ted) B. Hathaway, Santa Monica, USA

Buildings currently account for 75% of the carbon emissions on the planet, so if we are serious about reducing greenhouse-effects we need to explore better ways to design and construct

buildings to achieve improved energy performance. With buildings consuming circa 50% of the United States' total energy, we should re-examine past practice; building envelopes can no longer be passive, they must become dynamic and adaptive. The development of adaptive buildings requires early design collaboration to examine trade-offs versus energy costs for heating and cooling. Achieving optimized building envelopes requires design to be integrated across disciplines. Selection of curtain wall, glass substrates, solar shading devices, fixed/operable windows, and window sizes requires critical analysis relative to the building's global site positioning and solar orientation, as well as weather, wind, and context within its built environment. We can develop building envelopes designed to accept or reject free energy from the external ecosystem, and as a result, reduce the cost of power required to achieve a comfortable, internal environment. Case studies such as "The Bow", Encana's headquarters in Calgary; Aura, Toronto's tallest 78-story condo tower, now under construction; and DFR 57, a residential rental project in New York City, will be featured to demonstrate how with collaboration and technology, the AEC industry can bring intelligence to performance-based design and achieve more energy efficient buildings.

TRANSFORMABLE: BUILDING STRUCTURES THAT CHANGE THEMSELVES

Chuck Hoberman, New York, USA

Physical transformation is all around us in nature, constant and ubiquitous. Yet architectural design remains focused on structures that are essentially static. How can we understand transformation itself as a design parameter that can be shaped, crafted and optimized? Inventor Chuck Hoberman will speak about his pioneering work in Transformable Design with projects that range from public art to kinetic facades to dynamic sets for live entertainment. He will discuss the process of realizing large-scale transformable structures, starting from inventive concept through engineering and fabrication. Hoberman will give an overview of his methods to create objects that controllably change their size, shape and surface. These methods are based on his unique, patented structural systems that have inherent modes of transformable behavior (e.g. expansion, surface modulation, shape-morphing). He will also speak about his work with the Adaptive Building Initiative (ABI), a co-venture formed in 2008 with the global engineering firm, Buro Happold. ABI develops adaptive technologies for the built environment and has built a series of architectural installations including dynamic facades and operable roofs in the US, Japan and the Mideast.

FLEXIBLE ARCHITECTURE: CONTINUOUS AND DEVELOPING

Robert Kronenburg, Liverpool, UK

People are flexible creatures. We interact continuously with our physical environment regardless of whether it is living or inert, animate or inanimate. And yet, though architecture is the setting for much of human life, it is largely perceived as a part of the inert and inanimate fabric of our world. There is, however, a form of architecture that has existed throughout human history that is receptive to human desires and responsive to human needs. Architecture that adapts rather than stagnates; transforms rather than restricts; is motive rather than static; enables rather than inhibits. This flexible architecture has continuously developed alongside humanity's evolving creative skills and its changing physical relationship with technology and the material world. This presentation explores flexibility as a continuous and developing component in architectural design. It examines how the human need for architectural change has resulted in design strategies that are both innovative and timeless. It surveys the global typological characteristics of successful flexible buildings and compares these with types that have failed and consequently wasted valuable resources. Its ultimate focus is on the new flexible developments that are essential if architecture is to remain relevant to cultural and societal trends.

MAKING SPACE FOR TIME

David Leatherbarrow, Philadelphia, USA

The synchronization of the work with the world is the topic this lecture will address. The several schedules every work must engage are obvious: hours, days, seasons, and ages. Synchronization is accomplished by a set of spatial and material instruments that can also function as emblems. Something as simple as a door lock, for example, can be seen to begin and end a building's day; the same can be said for the rather more complicated instruments (geometries) that locate morning and evening settings on a site. In a number of European countries, rural buildings are whitewashed every spring. More largely, and with a view to the full range of architectural elements, apertures, finishes, furnishings, and entire configurations can be seen (and used) to align the work's "movements" with those of the natural and built environments. Considering a range of contemporary and historical examples, I will try to show that architectural anticipations, recollections, and pacings allow buildings to perform as clocks, calendars, and chronicles that add to our knowledge of where we are an understanding of when we are.

NEXT GENERATION BUILDINGS

Kas Oosterhuis, Amsterdam, Netherlands

We *radicalize the concept*. The radical concept contains precise data and is described in a few lines of script. We usually *establish a point cloud* first. The point cloud of reference points forms our personal universe. Then we *draft simple rules*. Simple rules are the drivers of the reference points to communicate with their immediate neighbors. We *internalize swarm logic*. The flock of nodal points behave bottom-up to become the members of the swarm of building components. Our signature design strategy is based on our unique concept of *Powerlines*. Powerlines inform and spatially organize top-down a selection of nodes to shape the feature lines of the swarm. Scripting procedures and powerlines together conceive the *complex adaptive system*. We build our buildings as *input output devices*. We *shape the building body*. The input output processing takes the shape of a building body with a consistent body plan. In this dynamic design process we *exchange data bilaterally*. The members of the swarm of design experts exchange their lean data bilaterally, but only those data that are crucial for mutual understanding. There is *no leader in the swarm*, all experts are co-designers being responsible for decisions identified as their own field of expertise.

IT'S ALL ABOUT PARTICLES

Enric Ruiz-Geli, Barcelona, Spain

Architecture is articulated transversally by particle theory, from the visualization of landscape to the design and construction of the architectural project. Reality can be interpreted at the level of the particles which provide us with information, designing strategies for the interpretation both of the tectonic or material (territory, buildings, people) and of the climatic or incorporeal (light, temperature, relative humidity, rain, wind, salt, CO_2, photosynthesis). Using 3D laser scanning technologies and sensors in the location the landscape is recorded as particles and managed by 3D software. The reproduction of this particles landscape maintains a direct link with the territory which in turn enables the project to be understood not as an internal emergency. But natural environment for working with particles surpasses proprietary software. Therefore generic environments are managed by the use of free programming environments through intelligent behavior. Work with particles allows not only formal development but also direct transposition from the 3D file to the construction. In this way, Particles Architecture becomes part of a discourse that makes no distinction between objects and products, buildings and landscape, sea and mountain, but which understands reality as performing particles.That will be the change in architecture, the architecture of change.

DEVISING DESIGN: AGILITY, APTNESS, EQUILIBRIUM, IM|PERFECTION

Brian Sinclair, Calgary, Canada

The pursuit of the extraordinary in Architecture is daunting, demanding and elusive. The needs of society increasingly shift and blur, with an allied expectation that landscapes, buildings, spaces and places will accordingly transform, mutate and accommodate. Development is vibrant, intense and forceful, often operating at unforeseen scales, through unfathomable complexities and with unpredictable consequences. Countering the call for heightened production and additional products are realities around resources, efficiencies and responsibilities. On one hand technology, in its broad definition and rich manifestations, proffers tools and techniques to advance the cause; yet on the other precautions warrant a tempering of unbridled subscription. Plato's Pharmacon proves apropos. Into the mix comes an emergent hope that cultural plurality can be addressed, contextual nuance can be measured, individual difference can be celebrated, buildings can be dynamic and cities can be smart. As we reconsider design in this ever-changing milieu it is constructive to contemplate new ways of seeing, thinking and acting, including the questioning of convention, the managing of expectation and the cultivating of invention. To this end such notions as agility, open building, fitness, balance, the quest for perfection and an acceptance of imperfection loom as potentially valuable possibilities.

MASS CUSTOMIZED PERFORMANCE

Tristan d'Estrée Sterk, Chicago, USA

Architects must change the way they practice in order to play a meaningful role in shaping tomorrow's buildings. They must forget about producing the next boutique building, be it big or small. They must systematize their practice to align every process and outcome with new construction and design technologies driven by optimized performance – of which structural shape change plays a key role. Tristan d'Estrée Sterk, founder of the Office for Robotic Architectural Media & Bureau for Responsive Architecture, will discuss a vision for practice that enables a new approach – one of mass customized performance through the use of structural shape change and key envelope technologies. He will also question the current emphasis that architectural technologists place the mass customization of ordinary components, and instead show how building performance can be mass customized. Examples of current work from ORAMBRA will be shown.

PROGRAMMABLE BUILT ENVIRONMENTS

Skylar Tibbits, Boston, USA

There is a disciplinary convergence upon us, one that spans from the nano-scale to the human-scale. We are now able to program everything from bits to DNA, proteins, cells, proto-cells, new materials, even products, architecture and infrastructure. Programmability and computing are now ubiquitous across scales and disciplines. We need to translate these phenomena into solutions for large-scale and global applications rather than focus on increasingly smaller-scale technologies. This nano-tech trend needs to look towards the built-environment, from manufacturing, construction and infrastructure, to develop more adaptive and highly resilient cities in the future. The key to applying this programmability and computational intelligence is human-scale self-assembly and programmable materials. We have demonstrated that self-assembly is scale-independent and have produced prototypes ranging from 1D, 2D, 3D and even 4D systems aimed at inventing a future of programmable built environments.