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ASSOCIATION FOR COMPUTER AIDED DESIGN IN ARCHITECTURE

BUILDING A BETTER TOMORROW

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RUSSELL LOVERIDGE
DOUGLAS PANCOAST

PROCEEDINGS OF THE 29TH ANNUAL CONFERENCE OF THE ASSOCIATION FOR COMPUTER AIDED DESIGN IN ARCHITECTURE (ACADIA)

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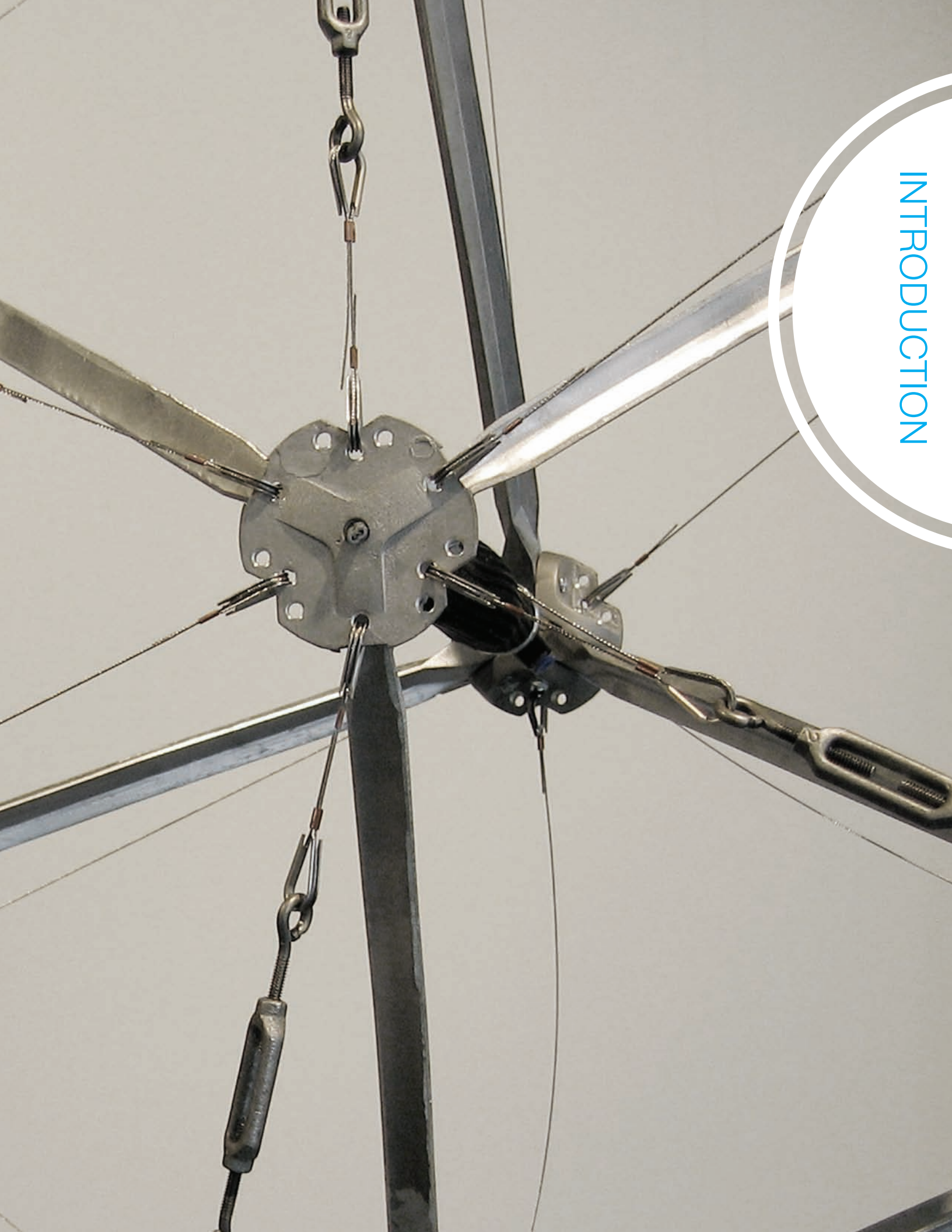

INTRODUCTION

Introduction:
Thoughts for Gen X—Speculating about the Rise of Continuous Measurement in Architecture

Tristan d'Estrée Sterk
Technical Chair of ACADIA Conference 2009

We are here, in Chicago, not to talk about what we know, but what we do not know. We are here to share ideas and to speculate about what the world might look like if it were challenged, rethought, and rebuilt. We are here to uncover, piece by piece, a sense of our own ambitions for an architecture influenced by today but motivated by tomorrow.

We are all speculators and dreamers. We find places for dreaming in our work, our models, our essays, our lectures, our research, and our teaching. Through these activities we speculate on the architecture of tomorrow. Sometimes these speculations hold great promise, while at other times they do not – certainly much of what we do can be improved, refined, qualified, quantified, and genuinely benefit from being computed. This could be horrifying; it could set the scene for an engineered architecture if we do not adapt.

But architecture is changing and responding to very fresh and different ways of thinking. As a movement, young architects are questioning their inheritance and establishing new values, new methods, and new forms of practice. We might best think of these young architects as the Generation X of architecture – a generation who shapes discourse through technological, social, and environmental lenses. From its smallest technical process to its highest level of thought, this conference represents the spirit of this movement.

THE UPBRINGING OF GEN X: NURTURE NOT NATURE

Generations of architects do not grow from thin air. They take time to establish themselves, and as they mature, each generation experiences many different forms of practice. This is true for every generation of architects, but it might be even truer for Gen X.[1]

Over the past twenty years, change has ripped through the profession of architecture at an incredible rate, giving rise to a plethora of micro-movements that form a continuous line of thought from the late eighties through to today. Architecture's Gen X is unique in that it has witnessed each of these changes and, in many ways, adopted them as a collective

heritage. A case of nurture rather than nature gives this generation of architects a perspective like no other. But what is this perspective and how might we make sense of it?

The history of Generation X really begins in the late eighties when the seemingly all-encompassing grasp of postmodern architecture began to exhaust its fuel and turn to examinations of material, form, and structure. As a form of post-modern practice, deconstructivism emerged to investigate rhetorical forays into truth, unity and humanist construction in architecture.[2] Transforming the discipline, the deconstructivists arrived at what can only be described as the polar opposite to architectural convention. Evading conventional notions of building, their work established architecture as a chaotic, perhaps nihilistic, and fragmented practice. Without urgency for order or restriction, the works that resulted sought to be no more than 'building'. To achieve this was a challenge. Peter Eisenman's early thinking led the discipline to believe that architecture should aim to upset conventional design methodologies and aesthetic outcomes by dislocating buildings from everyday expectations. Like Eisenman, Lebbeus Woods spent time producing several works of that dislocated architecture from its 'known' environment.[3] As an intellectual position, this was revolutionary and critical to the development of new discourse.[4] But the necessity of this architecture was short-lived.

As deconstructivism fell new forms of practice came forward to fill its void. Not immune to postmodern discourse, these new architectures absorbed selective chunks of deconstructivism.[5] Part of this process involved debate from the related arts of video and new media, which drew architectural thinking into concerns of the body and its adaptive capabilities. Cyber-bodies, virtual space, and the televisual became important features of this new architecture.[6]

Virtual and digital architectures, unencumbered by gravity, material connections, and time, opened the door to early Gen X investigations. Cheap and limitless exploration in networked social spaces that had no history or expected norm provided the ideal forum.[7] The works that resulted often emphasized what architects could not effectively or easily achieve in the real world. Merging still further with notions of body, STELARC's ideas became known to architects, giving rise to the architectural hybridization of the human body. Architects could now directly realize that the spaces they were designing no longer needed to be detached from the body. Space could detect and adapt to people.[8] The brightest genius of this movement is found in the work of Marcos Novak. At its peek, his work inspired a class of remarkable, temporary digital forms to emerge.

Marcos Novak's most famous work was carried out in the mid- to late nineties in the area of practice known as liquid architecture. He described it in 1995 in the following way: "If we described liquid architecture as a symphony in space, this description should still fall short of the promise. A symphony, though it varies within its duration, is still a fixed object and can be repeated. At its fullest expression, a liquid architecture is more than that. It is a symphony of space, but a symphony that never repeats and continues to develop. If architecture is an extension of our bodies, shelter and actor for the fragile self, a liquid architecture is that self in the act of becoming its own changing shelter. Like us, it has an identity; but this identity is only revealed fully during the course of its lifetime."[9] These virtual architectures adopt much of the cybernetic; they configure and adjust to our actions, our gestures, and our presence. As a field of practice, Marcos' work introduced the discourse to extremely sophisticated notions of event, interaction, and customization – making each central to the production of architecture. Though this work was marked by the distinct aesthetic overtones of deconstructivism its intellectual core was very different. His work let Gen X develop, liberate, and question everything that they had known about architecture.

Figure 1 Lebbeus Woods, SCAB Construction 1993

However, architects were not the only people exploring this turf. While Gen X watched Novak blaze trails into the use of interaction in architecture, computer scientists worked independently to lay claim to similar ground. Using very different tools, computer scientists placed microcontrollers, sensors, and actuators into the fabric of the built world with the desire to produce new types of controllable systems. The pinnacle of this work was Bill Gates' famous mansion.[10] This intelligent building made headline news in 1997 when it was reported that the house used microcontrollers and simple network technologies to produce spaces that could track users and adjust its character to suit. Interactive systems were spreading and computing was becoming physical via cheap, reliable sensors.

Though concurrent for the most part, the ultimate successor to Novak's liquid architecture was Greg Lynn and the animate form movement. Lynn's work[11] fell in lockstep with Novak, adopting much of the larger ambition for architecture that liquid architectures had sought. "Animation is a term that differs from, but is often confused with, motion. While motion implies movement and action, animation implies the evolution of a form and its shaping forces; it suggests animalism, animism, growth, actuation, vitality and virtuality."[12] Lynn built upon this common foundation, extending the work to tackle the production of architecture in a much more direct way. In doing so, he adopted new methodologies and tools while refining

and repositioning the aesthetic from one of fracture to one of smoothness. By making this exchange, he resolved many but not all of the practical problems architects face during construction. Intellectually, his work gave digital architecture the language of dynamics, fields, and forces.

Novak, and Lynn each used time in a different capacity to determine the role it could play in architecture, challenging the theoretical and methodological frameworks of the discipline. Both found a place for using events and forces as structures to organize space and generate form – even if these forces and events were never rationally quantified. As each of their fields matured, both contributed to the advancement of digital architecture and its ability to incorporate more realizable and refined notions of scripting, choreography, and emergence.

The baton pass of concepts from deconstructivism's adoption of no measure, to virtual architecture's explorations of form as a dynamic measure of body and event, to the animate exploration of time in relation to surface, forms a key sequence. While observing these developments and their gradual deepening within architectural thinking, a young generation of architects learned the tools of their new trade. For this generation, computation and design were the same thing.

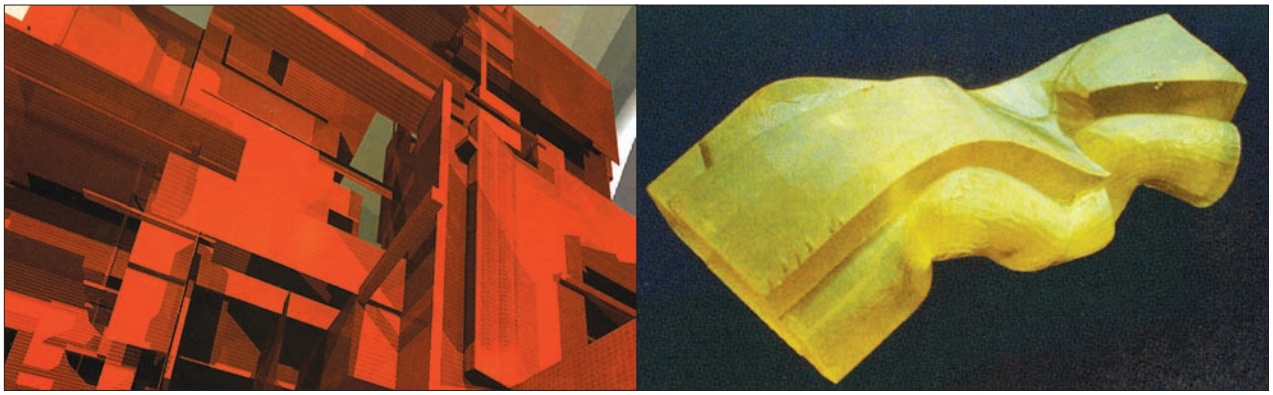

Figure 2 Marcos Novak, trans TerraFerma/ TidsvagNoll v2.0, 1995

Figure 3 Greg Lynn, Stereolithography model, House Prototype in Long Island, 1999

For a moment, we must pause and be cautiously critical. This still young movement has not yet matured its discourse to the level of outright theory. Undoubtedly, these words will be received sensitively, but it should be realized that much of what we have been reading over the past several years, even within the work of Lynn, is method, not theory. Today, method often rests in the guise of theory, which is problematic because methods themselves do not produce movements – a point that might account for some of the recent schism between thinking and making, and the perceived "thoughtlessness" of technology in architecture. This emerging movement is not thoughtless, but neither is it as thoughtful as it could be. It is a young movement and its practitioners are still finding their legs.

So we ask, what is to come. Is something deeper and more significant happening to our profession, or are we just looking at a change in methods and tools? Is this new architecture more than method, and what might its approach imply about the aspirations and dreams of Gen X?

MEASUREMENT IS NOT X'S MEASURE

If one concept can bind all of architecture it must be measurement. Measurement holds just the right degree of symbolic value and technical wit for nexuses between theories and methods to form. Throughout history, measurement has been the primary method used by architects to conceive, describe, develop, and control their work. It is crucial.

Or is it? If one concept defines the emergence of Generation X's architecture, it is a change in the nature and role of measurement. Through a sequence of movements, architecture has reared away from the measure of modernism, through the wilderness of fragmentation, and toward a rationale of event and time. Measurement, its use, role, and visibility, has changed dramatically at both intellectual and technical levels. So how does Gen X see measurement?

Conventionally, architects have used measurement for the production of architectural form, but as a tool used for this purpose, it no longer exists in the work of Gen X. Rather, form is produced intuitively and with great fluidity.[13] It is cast, pulled, stretched, and twisted by parametric processes as though it were toffee at a country fair. The architecture that these processes craft will still fill a site, they will still contain interiors, condition them and provide shelter, and at points through these processes, calculations will be done to find the usable area of a building – but that is about it. For Gen X, measurement is found on the reverse side of the equation, within the analysis of form rather than in form itself. For the most cunning of Gen X, the bleeding edge of this process rests in developing automated loops that tie analysis directly to form.[14] Here, analytical processes, not the architect, provide form with its measure. Though this sounds new, it is not; it is a direct relative of Lynn and Novak's work from nearly ten years ago.

If we step back to look at the discipline of architecture as a whole, it is clear that architecture has made a series of major moves. It has moved away from frozen form and toward dynamic form. It has shifted away from discrete measurement, to

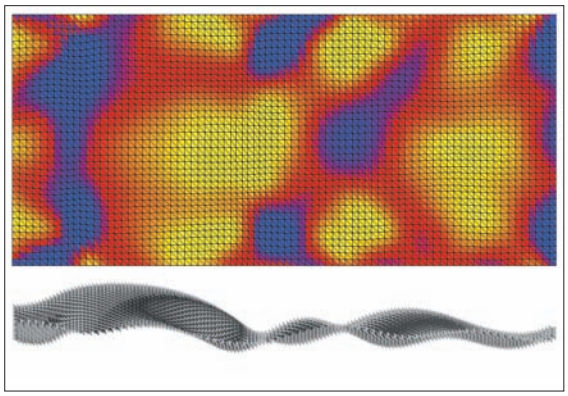

Figure 4 SOM Black Box Studio, Analysis informing form in a roof canopy, 2009

more fluid, parameterized notions of form. It has moved away from single processes to iterative systems and automation. It has also come to accept analysis as the primary means by which measurements are made and successes or failures are found.[15] Furthermore, this new generation is quickly adopting analysis as a means to drive everything from structural decisions to those that affect lighting, acoustics, and thermal comfort. In this newfound capacity, the production of automated form is likely to become the hallmark of Gen X's work. So this is what has been happening: Generation X has been slowly increasing its use of computation, in lieu of measurement, to take advantage of convenient analytical techniques that are used produce an informed architecture.

THE FUTURE OF MEASUREMENT IS CONTINUOUS MEASUREMENT

We are not really at this conference to deliberate what is known but, rather, to turn our attention to the unknown. If the power of computers to calculate quickly and accurately has dramatically changed the role of measurement in architecture, altering the nature of our work, then we might ask how to best envision the future.

There might be no more radical idea for our discipline than that of employing continuous measurement to produce works of architecture that can change autonomously. These works will bind measurement (in the form of analysis) directly into the fabric of our buildings. Such buildings will challenge not just the design methods we use, but also the very concept of what a building can be. In effect, this move translates building systems into robotic architectural media.[16]

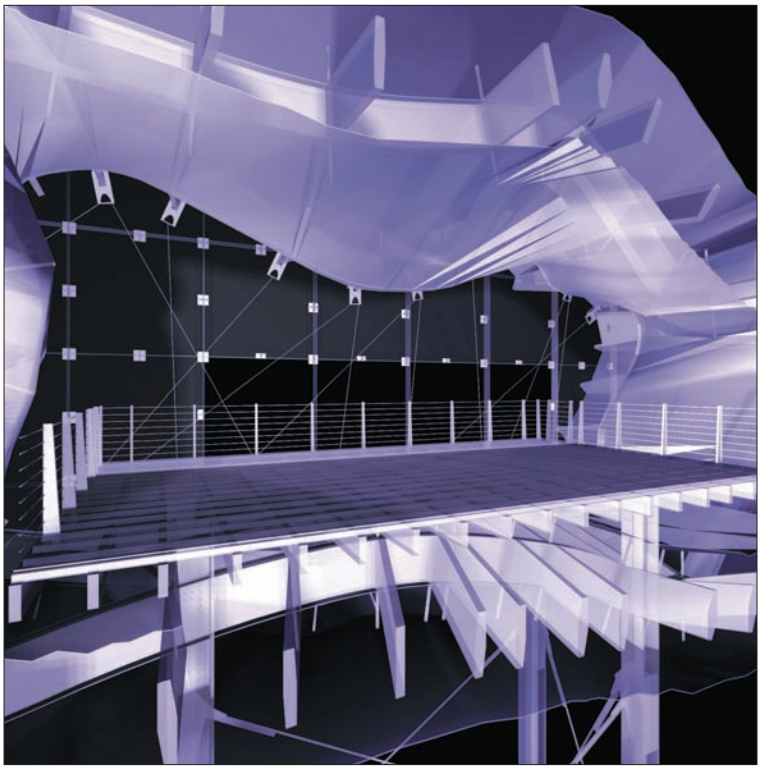

Figure 5 Tristan d'Estrée Sterk, ideaCloud: Experimental dance theatre for Grange Beach, 1998

About ten years ago, I began working in the field of robotics in architecture with the goal of producing a new class of buildings that echoed the work of Novak and Lynn. Building upon Novak's idea of event-based architectures and Lynn's idea of animate form, I concluded that the only logical step forward was for architecture to incorporate analysis directly into the fabric of a building, rather than into the models that we use to describe buildings.[17]

This work took shape via a series of early structural experiments that incorporated computational devices directly into built fabric. Each prototype was capable of continuously analyzing and measuring their geometry with the goal of correcting and changing their shape. Using embedded control devices, with sensors and actuators, each structure directly responded to the forces that acted upon them. A new class of structures emerged from this work to provide an early demonstration of the promise that continuous measurement holds for our discipline.[18] As an idea continuous measurement has the potential to bring major change.

CONCLUSION

Recently, there has been a somewhat hidden, tenuous relationship between parametric architecture, and modernism. We often recognize this as a conflict between mass production (industrialization) and mass customization (parameterization), but more subtly and importantly, the heart of this conflict can be found in the differences between the beliefs we hold for space and the technologies we use to produce it. It is a question of holding universal aspiration or being locally content.[19] Continuing from this we can understand digital tools, and by extension the architectures they produce, in one of two ways. In the modern sense as works that are built in and ascribe to universal space, or alternatively as works that support highly contextualized notions of real space.

The incorporation of continuous measurement and the affect it will have on modulating and adapting architectural form might provide a way for us to bridge this divide. It might enable us to build simple models that can be applied universally but adapted extremely quickly and accurately to suit real space. Parametric design should be capable of making these ideas

tangible but this will only happen when the parameters we use are allowed to creep into the very fabric of our buildings. I am delighted to report that much of the work shown at this conference represents several first steps made by this younger generation of architects – first steps towards achieving a vision for the architecture of tomorrow.

ENDNOTES

1 DOUGLAS COUPLAND FIRST DESCRIBED THE NATURE OF GENERATION X IN 1989 IN A SHORT, ILLUSTRATED ARTICLE IN A TORONTO BASED BUSINESS MAGAZINE CALLED VISTA. QUOTING THE ARTICLE: "THEY WERE RAISED ON POP-TARTS, SWIMMING POOLS AND BOUNDLESS PROMISE. THEY WANT EVERYTHING—AND DESERVE ROOM TO GO FOR IT…BECAUSE THEIR EDUCATORS HAVE TRAINED THEM LARGELY AS DESIGNERS AND ANALYZERS, THEY AVOID JOBS THAT MAKE THEM MERE IMPLEMENTERS OF POLICY…"

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11 LYNN, G. (1998), "GEOMETRY IN TIME," IN ANYHOW (CAMBRIDGE, MA: THE MIT PRESS), PP. 165–173.

12 LYNN, G. (1999), ANIMATE FORM (NEW YORK, NY: PRINCETON ARCHITECTURAL PRESS), P. 9.

13 BURRY, M. (1999), "PARAMORPH: ANTI-ACCIDENT METHODOLOGIES," IN ARCHITECTURAL DESIGN MAGAZINE, HYPERSURFACE ARCHITECTURE II (LONDON UK: JOHN WILEY & SONS), PP. 78–83.

14 A SIGNIFICANT EXAMPLE OF THIS APPROACH TO DESIGN IS FOUND IN THE WORK OF SKIDMORE OWINGS & MERRILL'S BLACK BOX STUDIO (CHICAGO). THIS GROUP HAS DEVELOPED A SERIES OF PROJECTS (REAL AND RESEARCH BASED) THAT DEMONSTRATE A CONSISTENT PERFORMANCE-BASED METHODOLOGY.

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16 STERK, T. (2009) HTTP://WWW.ORAMBRA.COM

17 STERK, T. (2000), "THE SYNTHETIC DIALECT AND CYBERNETIC ARCHITECTURAL FORM," IN PROCEEDINGS OF THE 2000 ACSA TECHNOLOGY CONFERENCE (MIT, CAMBRIDGE, MA, 4–7 JULY 2000), PP.117–122.

18 THIS WORK RESULTED IN THE DEVELOPMENT OF ACTUATED TENSEGRITY. AS A STRUCTURE, THESE SYSTEMS EMPLOY CONTINUOUS MEASUREMENT (VIA SENSORS) TO ACTIVELY ADAPT AND CHANGE THEIR SHAPE BY ADJUSTING THE QUANTITY AND LOCATION OF STIFFNESS OF ONE OR MORE STRUCTURAL MEMBERS. THROUGH THE SELECTIVE PLACEMENT OF SENSORS AND ACTUATORS, THESE STRUCTURES CAN MONITOR THEIR SHAPE AND RIGIDITY.

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