06 >> Connecting Digital Thinking

Chairs: Mahesh Senagala, Cristiano Ceccato

Digital Theory

Mahesh Senagala

The computer has gone from being an isolated box to become part of a gigantic digital network of networks that shapes our collective future. The way and pace at which we connect, communicate, memorize, imagine and control the flows of valuable information have changed forever. There are at least six digital phenomena that directly affect the architectural world: miniaturization (of all that can be shrunk), ubiquity (being everywhere, global), realtime (communing globally in realtime, which is 1/10th of a second), noospherization (networking every-thing), virtuality (all that is solid melts into knowledge), and anamnesia (inability to forget). Temporal contiguity and temporal connectivity have taken precedence over spatial and geographical contiguity. The strands that animate our life today emanate from spatially distant but temporally contiguous/ connected places. These phenomena have squeezed, stretched, restructured, reconfigured, and redistributed most major human institutions. Consequently, the built world's role, importance and nature have changed. Architecture as traditionally understood has become more marginalized than before. Many practices, however, have been repositioning themselves to take advantage of the new opportunities beyond the bounds of traditional architectural practice. Design, practice, fabrication and construction are increasingly becoming networked affairs. The new measures of architecture are connectivity and speed. The architecture of a new world needs to recognize these transformations and think differently.

Mahesh Senagala is an Assistant Professor of Architecture at the University of Texas, San Antonio and runs an international practice. His areas of expertise include systems theory, cybernetics, sustainability and design computing. He has written and lectured extensively about digital culture, thinking and architecture.

From Emergence of Form to the Forming of Logic

Cristiano Ceccato

Driven by digital design tools and production methods, the interplay of theory and practice in architecture is converging on the notion of *process*. Process definition and process tools are now an essential part of design, design development, fabrication and construction. The word *process* itself can be interpreted in different ways, as being deterministic or non-deterministic.

Computer programming can be understood as a design process and a structuring mechanism. Rather than making finite designs (products), architects are beginning to understand their roles as *toolmakers*, developing algorithmic processes that incorporate constraints and intents into software / procedures / programming. New methodologies such as parametric-associative design hierarchies are a clear example of semantic design structuring (a form of grammatical ordering); the creation of hierarchical parametric models can be understood as a form of visual programming. In a deterministic sense, it can be argued that if a process is correct and critical, then by definition so will be the product.

Non-deterministic usage of computation differs in its goal to search for solutions rather than generate them through finite generation algorithms. Examples include evolutionary design, neural networks for pattern and form recognition, and decentralized cellular design systems. All these can be explained as types of design-structural data-mining that yield solutions that were not determinable before the application of a particular form-searching (as opposed to form-generating) process.

The question, then, must be: what are the implications of this for practice? Practice here must be understood beyond the experimental fashioning of rapid-prototyped test forms, though these may aide in gaining an understanding of the geometric constructability of materials. Rather, we must understand practice in the sense of actual construction of complete projects, with all the limitations, constructability requirements, legal complexities and particularly the serendipitous events that mark the uncertainty that is the production of buildings.

Norman Foster's office employs a sophisticated set of techniques that utilize structured hierarchies of geometric mechanisms to achieve complex form constructs through clearly discernible sequences of computational procedures. Complexity, in this case, arises from the systematic overlay and feedback of geometric information, while constructability is addressed and maintained by incorporating form restrictions and geometric limitations of components. Frank Gehry's methodology, by contrast, is the inverse, conceptually oriented towards what John Frazer has termed a *post-digital* process. Here, the architect does not deterministically control technology for finding form, but rather is liberated from technology by technology itself: the cogent application of computational post-rationalization of form allows us to explore a design process without having to first explicitly encode rules of formal structuring or computational morphogenetic processes.

Architects operating within the realms of theory-driven conceptual projects find they are required to rapidly produce workable schematic designs that embody their ideas. Nowadays, there is an expectation of everyone to 'put their model where their mind is,' in the sense that purely abstract discourses no longer find enough traction to substantiate a theoretical claim– they have to be tangibly demonstrated in practice.

The question that follows this, then, must be: how would a *post-computational* design process be structured, meaning how can forms be explored computationally without having to resort to preset rules or geometric hierarchies? How can a logical substructure of form be found without having to first describe it through literal geometric relationships or the [grammatical] programming of information? And, how can such a design process still be rigorous and rational enough to ensure constructability, capitalizing on the efficiencies of modern fabrication techniques, mass-customized industrial methods and a post-fordist economy?

Transcending the restrictions imposed on architects by current technological paradigms and the structuralism of form-finding algorithms is a logical progression in the development of design computation. Current tools are focused either on the generation of complex-form geometry, or its optimization for material behavior and componentized constructability, or both. The challenge will lie in moving beyond the implicit structuring imposed by the grammar of programming, the relationships of objects and object hierarchies which are used to describe discernible form topologies. Beyond the emergence of structured form, we can explore the emergence of structural topologies and form typologies from unstructured information – the *forming* of structured logic.

Cristiano Ceccato is an architect and computer scientist, specializing in the development of computationally driven architectural design tools and associated fabrication methods. He has conducted extensive research and development at Gehry Partners, where he is responsible for the development and application of parametric design tools and integrated modeling principles, and associated digital construction methods. He is also a director in a new subsidiary company, Gehry Technolgies, where he is responsible for technology transfer and pilot projects, developing design tools based on Gehry's 3D computational building construction methodologies. Ceccato has practiced architecture in Europe, Asia and the US. He has lectured widely on the subject of computational rule-based design systems and parametric form finding in digital building processes. He has held academic faculty positions in London, Milan and Hong Kong. he received his diploma in architecture from the Architectural Association (1996), an MS in Computer Science from the ImperialCollege of Science and Technology in London (1997).