Special Issue: Architectural Ecologies: Code, Culture and Technology

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Abstract:

This special issue of 'Systema', presents eight contributions to the track "Architectural Ecologies: Code, Culture and Technology at the Convergence' at the European Meetings on Cybernetics and Systems research (EMCSR) 2014 in Vienna. It describes one starting point of conversations about habitat, design, decision-making and digital operations from a variety of perspectives developed by architects and researchers working in the digital and computational paradigm. The issue aims at tackling the obvious disappearance of discipline specific boundaries in favor of novel systemic understanding of architecture, her becoming into being and cultural transformation.

Keywords: ecologies, architecture, culture, design, cultural transformation

Impacts and Reflections on the Development of Architectural Ecologies

"Architectural Ecologies operates on the level of adopting sound material, fabrication and coding knowledge and pairing it with emerging theory and philosophy to arrive at an architectural culture that "embraces a multi-ordered cybernetic model1 of and for the new world owing a multitude of facets, classes of information (data) and ways of learning." LCW

Architectural Ecologies: Code, Culture and Technology and the Convergence derived from a debate and conversation that most likely started in the beginning of the 21st century. Reason being was the *Digital Turn*, experienced by architecture and other disciplines between 1992 and 2012. The *Digital Turn* implied on one hand that digital tools were used in order to ease the production of the architectural drawing and the process-management of an architectural project and the emergent of novel design strategies on the other. Algorithms, genotypes and phenotypes, the application of swarm behavior and the advent of digital fabrication furnished the flourishing of a new culture of architects and architecture in a new culture of humans living in a new culture of environment. Automation and the virtual invaded almost every household, and most of the atom-based machines and wires transferring information morphed into small devices featuring a rather amoebae-like existence, machinic and virtual. Novel, converging technology and human culture, describing a further industrial revolution. At this moment in time the next step is approaching; namely from bits to biology.

The present issue of *Systema: connecting matter, life, culture and technology* introduces the current state of change, in which the architect engages with approaching and challenging systems merging analog and digital. The design of discrete and autonomous objects steps back and triggers a re-entry of architecture into itself. Architecture observes itself in order to re-establish its construction, contents, language, code and meaning.

All articles embed the notion of experimental architectural intelligence featuring bottom up approaches that serves as platform for problem solving rather than goal-driven solution finding.

Articles range from biotechnology and a radical shift towards living structures with cognitive properties and chemical computing via interactive fabrics, parameter and multi-agent based urban design, computational morphogenesis through activating systems of data structures to the notion of politics in an age of decreasing individual authorship and the question for an architectural answer to the ecological crisis and big data.

The Choreography

This special issue is choreographed along the topics of digital philosophy, data, digital biogenetic and evolutionary architecture - virtual and material softness.

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1 A model is defined as the representation of reality or a part of reality. 'Reality' is here defined according Heinz von Foerster in 'Constructing Reality'. Reality is a phenomenon constructed by the observer through the memories and codes embedded in the observer. One can refer to 'reality' as personal bandwidth and to a model as the representation of personal bandwidth.

In addition to selected papers presented at the conference we added two invited papers, one by Pablo Lorenz-Eiroa (Cooper Union), the other by Rachel Armstrong (Newcastle University).

Authors' references stretch from Ludwig von Bertalanffy and Norbert Wiener via Allan Turing, Nicholas Negroponte, Gordon Pask, Otto Bütschli, Walter Benjamin, Le Corbusier, Donna Haraway, Christopher Alexander, Stan Allen to Bruno Latour, Martin Heidegger and Gilles Deleuze. The bibliography mirrors a crisis and a tipping point of determining and determined architectural form to a process driven exploration of architectural ecologies. I would like to address the question of this development as path to a general system theory for architecture, its novelty and correctness to the future. The reader is invited to embrace the subject critically and passionately at the same time.

Digital Philosophy

Pablo Lorenz-Eiroa, Cooper Union, argues that computation is the new structure of and for architecture. Eiroa begins his article with a review of extension and expansion of architecture, technologically, tool-wise and in terms of ecological awareness. Key point here is that the term ecologies does not refer to the natural ecological space in the first place, but to the new architectural ecologies nourished by code and computation. Infinitesimal differentiation, the author argues, leads to a transformed representation of architecture, whereby interface, code and the architecture itself are embedded. This post-digital-structuralist approach is tested in case studies presenting architectural theory and architectural design strategies simultaneously along a genealogy ranging from a structuralist hardly integrating topology via the blob to the hidden complexity structures in which the production of architecture and the perception of structure and space are interwoven with.

Urban Ontological Systems draws from the philosophical notion of ontology (especially Gilles Deleuze) in an alchemic relationship with the mathematical approach of the urban grid. Jeff S. Nesbit discusses and critics the dichotomy between a technological approach of 'orthogonality' and a natural self-organizing approach; two still opposing design strategies for urban developments. *Nesbit* embeds his argument within the philosophical framework of 'ontology', a characteristic of the "space of possibilities" (DeLanda) and Ludwig von Bertalanffy's initiation that communication generates outcomes that feedback into the communicating structures. The theory is tested through case studies and finally arrives at levels of multivalency for typological adaptability, as a result of intensive differentiations as an ontological system.

Actuating Auto(poiesis) by Emmanuil Zaroukas, University of East London, and Tim Ireland, DeMontfort University / Leicester School of Architecture provides the reader with a critical observation and claim that current digital generative methodological tools creating simulations and scenarios of artificial life cannot seen as radical novelty. The authors support their argument through the philosophical / mathematical views of Gilles Deleuze's 'deterritorialzation' and Cariani's 'combinatoric emergence'. They further the philosophical character of the article by referencing Kurt Gödel in relation to incompleteness and Ludwig Wittgenstein's 'tractatus Logico-Philosophicus'. Zaroukas and Ireland describe three phases of cybernetics from linear homeostatic via self-organizing to emergence and innovation representing the phenomenon of deterritorialization, the incomputable and unthinkable.

Critical Data

The Computation of Digital Phenotypes by *Ali Farzaneh* (Architectural Association) presents a brief history of the Digital in Architecture, the use of code and the quest for a never-ending Turing Machine. The rise of the genetic algorithm paired with digital data structures form the breeding ground for an evolutionary architecture first investigated between 1960 and 1980 at MIT and the Architectural Association. Farzaneh's article summarizes one path on the journey from object to system.

Henriette Bier (TU Delft) and *Sina Mostafavi* (TU Delft) present a selection of projects developed and built at Hyberbody, TU Delft. Their article *Data-Driven Architectural Design to Production and Operation* discusses two different approaches for using data in digital architecture: a) for reasons of simulating settlements, mainly through swarm algorithms and restricted parameters, and b) for reasons of form-finding and an intelligent use of material behavior, partly in conjunction with physical computing using sensors and micro-processors to arrive at data-informed kinetic structures.

Lila PanahiKazemi, Temporary Autonomous Architecture, and *Andrea Rossi*, ETH Zurich created a strong critic towards computational architecture along similar lines. The observation is that drawing from a desire for designing natural design processes creates a trap of limited understanding of their benefits, rules and complexities. *Deciding Architecture: a Framework for the Definition of a Temporary Autonomous Architecture* understand the design process as an interaction between the architect, the tool (the computer) and the environment, which is divided into a virtual platform providing information, knowledge and design and a material platform in which the architect mingles in a social, political and economic environment. PanahiKazemi and Rossi further encourage the re-discovery of craft in the production of architectural space and urban design, aka human habitat by understanding scripting and coding as an art similar to drafting and skillfully executed mathematical calculations and geometric operations. They argue that a truly Temporary Autonomous Architecture can only exist, once the mentioned components familiarize themselves and cybernetically convers and regulate

Biogenetic and evolutionary architecture: Virtual and material softness

The Red Queen Hypothesis by Allessio Erioli and Paolo Alborghetti investigates the potential of biological behavior such as stigmergic grammar and chemotaxis for programming parasitic architecture. The exploration of a specific design strategy to generate spatial organization, tectonics and topological soft- bodies is an excursion into extensive coding and hence the relationship from topology and morphogenesis to pattern formation and isomorphism. Their project is a testing ground for the extension of ready available tools and their replacement with scripts from scratch.

Rachel Armstrong, Newcastle University, steps further than the previous articles and examines a material explorative architecture beyond the coded script and armies of self-organizing swarms and agents. *An experimental approach towards characterizing Architectural Ecologies* asks questions and dips into exciting fields of alchemy, space configuration, tool-making and perception; not only from the architect's or user's perspective, but from the material perspective and hence the architectural one. Architecture here becomes a distinct organism where not only human or technical disciplines and forms meet, but hard and soft matter merge,

but also operations are transported, adopted and transformed. Operations become the new material for a protocell architecture that makes use of biotechnology, analog computation and physical computing. *Armstrong* herself describes her article as a manifesto for architectural ecologies suggesting and demanding to understand the production of architecture as an agile process to escape from a non-resilient one way street of obsolete rules and regulations.

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About the Guest Editor

Liss C. Werner is a licensed architect based in Berlin, founder of Tactile Architecture – Office für Systemarchitektur. Werner is Adj. Assoc. Professor at Taylor's University, Studio Master at DIA Dessau and George N. Pauly Fellow 2012/13 at Carnegie Mellon University and lecturer for Prozess- and Project Management. In 2010 she founded the Graduate Design Studio *Codes in the Clouds* at DIA, which was exhibited at Tongji University, and the Venice Biennale 2012. As an architect Werner practiced in the UK, Russia and Germany. As a scholar she lectured and taught internationally at Texas Tech, MIT, CalArts, University of Nottingham, Kunstuniversität Linz, TU Berlin among others. Her research generally focuses on cybernetics + architecture, the discourse of computational architecture as a relational and systemically focused discipline. Her specific research is dedicated to the future of human habitat and the design of socio-ecological systems, global, urban and local.

Werner chaired several international conferences on Computation, Architecture and Ecology, is the editor of *[En]Coding Architecture* and *Grammar Code and Computation* (2015). She is a member of the Scientific Committee 2015 for eCAADe, Milan, the American Society of Cybernetics and the Society of Code-Biology. She was educated at the UCL Bartlett School of Architecture , University of Westminster, RMIT and Humboldt University Berlin where she pursued her Dr. phil in Cultural History and Theory on Gordon Pask and his relevance to computational architecture in the 21st century.