Interview

# Dialogs on Architecture

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## Abstract

*Dialogs on Architecture* is a series of dialogs between researchers and practitioners. who are embracing the intellectual model of high technology and are involved in its advancement and application in architecture. The present dialog focuses on the role of parametric design and cyber-physical systems in architecture. It has been inspired by a lecture given by Henriette Bier at the Italian Institute of Architecture in Catania (2019) and addresses the question of the current paradigm shift in architecture and its impact on the role of the architect and the user. The dialog is led by Grazia Maria Nicolosi (GMN) with Henriette Bier (HB) and Maria Vogiatzaki (MV).

## Keywords

Cyber-physical Systems, algorithms and computational processes, Human-Computer and Human-Robot Interaction

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**Grazia Maria Nicolosi:** The 'particlizing' of matter (Kuma, 2007) and its simplification to elementary components is a complex act and a singular condition that comes from the arrangement of a series of distinct and separated elements into units. This coincides with making the invisible visible. Do you think this corresponds to a change of paradigms in architecture?

**Henriette Bier:** Architecture has always worked with arrangements of distinct elements into structures as for instance stones that are stacked into walls, etc. Only the scale at which these elements are addressed has changed. Hence, architecting materials and material systems in particular for additive manufacturing may represent a paradigm shift, however, architecting cyber-physical systems seems to be encompassing what the paradigm shift in architecture is about.

**Maria Vogiatzaki:** Materiality can, nowadays, be thought of at a micro-scale such as dust that can 'powder' and granulate geometries producing random otherness thereafter. Algorithms are like managing and manipulating matter in its dust existence. Dust geometries are a cognitive construct; they are abstractions, therefore could potentially bring about a new kind of architecture. The big data idea and its relationship with materiality allows to consider thousands of particles at the same time and moment, what ordinary limited and small data sets could not achieve. Particles not only change under observation, but also under the way they interact with other entities.

**Grazia Maria Nicolosi:** In 2014, in Barcelona, you took part in a conference titled 'What's Matter'. Could you explain what you mean by materiality and materialism in the age of computation?

**Henriette Bier:** At the time, the discussion on materiality and materialism has been put forward by Maria Vogiatzaki, whom I asked to join this interview. My own take on materiality is that in architecture the range is vast, from the perceived materiality of images, 3D models and other virtual representations to the materiality of physical prototypes, building components and buildings, where the full range of their virtual and physical aspects needs to be considered. Buildings are not anymore physical but cyber-physical systems (fig. 1).

**Maria Vogiatzaki:** To date issues of Ethics, Aesthetics and Politics have either been flattened, naturalised or ignored in favour of matter's self-organised capacities or worse they are still mobilised, understood and applied within a given anthropocentric framework of judgments and evaluations. After a long period of fierce experimentation with matter, the discussion, which was what was unfolded at the Barcelona conference, has been recently focusing onto what matters; to the radical realisation that materiality's dynamism suggests a post-human framework within which architecture as a creative act could possibly prototype spatiotemporal constructs that suggest alternative conceptions of ethics, aesthetics and politics.

**Grazia Maria Nicolosi:** In the design of architectural form by means of programming with algorithms what role does nature and natural processes play?


FIGURE 1 Sensor-actuators networks integrated into the reconfigurable physical-environments © Robotic Building, TU Delft

**Henriette Bier:** In my work with researchers and students at TU Delft, we implement multi-agent simulations for programmatic distribution as well as embed distributed sensor-actuators into the built environment. These operate as multi-agent systems and consist of autonomous entities which act towards achieving goals together by observing through sensors and acting through actuators. Their behaviour may be similar to a swarm of fish or flock of birds (Reynolds, 1987) that exhibits a bottom-up coordinated behaviour in absence of top-down control.

**Maria Vogiatzaki:** Materiality has been reconsidered extensively with the appearance of computational models that allow material to be encoded and with hardware that allows even for real time and simultaneous manipulation and malleability of matter. The shift that this perception has altered radically, is that in computational times the creation of any form is understood as yet another natural and systemic process which, through the computation power of the search and retrieve, can be modelled and tested. Any artefact and, consequently, any architectural creation are now conceived as material entities, generated as parts of a broader natural, social and cultural eco-system.

**Grazia Maria Nicolosi:** In your opinion, what is the future of Human-Computer interaction?

**Henriette Bier:** Human-Computer Interaction and Human-Robot Collaboration are most relevant developments that affect architecture and society at large. I expect that the physically built environment and building processes are increasingly imbued with ICTs and robotics. Architecture and building construction are at the very beginning of identifying the interaction between human and non-human agents participating in all phases from design to production and operation of physically built environments.

**Maria Vogiatzaki:** Experimentation on the project of architecture is about speculations and about the ways in which qualities can be embedded in this experimentation but also about the ways in which new qualities of crafting can be discovered by humans working with machines. It is about the exploitation of the granularity (dustism) that large data sets can provide. The future and the huge potential are for human and non-human symbiotic and synergetic creativity that would yield new and unthought of scenario, such as new material systems that can potentially self-organise and create flows of heterogeneous spatiotemporalities and variations, etc.

**Grazia Maria Nicolosi:** If technology develops faster than the human ability to understand it , how will this impact architectural design?

**Henriette Bier:** The development of technology has a huge impact on architecture. My plea with schools of architecture is to not let technology surpass the understanding of its impact and introduce students as early as possible to most advanced technologies to keep up the pace. It is obvious that architectural design, production, and operation rely increasingly on new technologies and our responsibility is to identify ways to employ this technology in a manner that potentially increases our cultural and material contribution to society, and the approach addresses societal challenges such as overpopulation, material depletion, climate change, etc.

**Maria Vogiatzaki:** Contemporary contemplation is focusing on reconnecting sensing and making and therefore thinking with a material base that is primarily imperceptible and outside the strict limits of human's sensorium domain. In such a post-human realisation, architectural design emerges as a result of the co-creativity/co-creation process between human and non-human agents.

**Grazia Maria Nicolosi:** On several occasions, you (HB) have argued that man remains the protagonist in the process of creating form and that technology and algorithms are tools. What do you mean?

**Henriette Bier:** Non-human agents such as algorithms and robots are from my point of view tools and/or instruments designed by human agents to implement certain tasks. The human and non-human agents (computational or robotic) are working together and the production of value is not allocated to the one or the other but emerges in the interaction between the two.

**Maria Vogiatzaki:** Algorithms are tools indeed, but very powerful tools that can offer inconceivable ideas, that humans would be unable to create without them. The point is not to harness technology in a competitive human-centred context. The algorithmic governance via computational platforms can augment the human's infinite virtual perfectibility. Hence, the mission of architecture is to contribute to this perfectibility both of the creating subject, the architect, and the appropriating subject, the user.

**Grazia Maria Nicolosi:** During a research investigation, we undertake systematic work to advance knowledge and amongst others we experiment and speculate. What are in your opinion significant phases that should be addressed during drawing up or reviewing research in architecture?

**Henriette Bier:** The architectural research that I am implementing with my researchers and students, is applied research aiming at solving practical problems. It generally employs empirical methodologies and conceptual frameworks that work with hypotheses. The hypothesis that seems to me most relevant for today's research is based on the assumption that building processes and buildings are increasingly imbued with ICTs and robotics and the question for the future is not if but how these technologies impact architecture.

**Maria Vogiatzaki:** In particular, research on AI could acquire an added value in the exploration of unprecedented fabrication techniques and unimaginable scales of construction. By pulverising, we aim to revise our concepts, in other words to re-cut the world and to allow for the constitution of new events, new materials, new construction methods, new scales. Machines provide us with a new sensibility.

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