Simulation

Context Architecture: Fundamental Concepts Between Art, Science, and Technology

Digitalization has altered architectural discourse. Today, discussions in architectural theory and design are shaped by many new ideas, including some that previously had no meaning in that context, or else very different ones. Increasingly, the conceptualizations and strategies of architectural discourse are molded by influences emerging along the interface joining scientific and cultural images of modern information technology. Posing itself against this background is the question: on the basis of which practical and in particular which theoretical concepts can architecture come to terms with these new technologies, thereby entering into a simultaneously productive and critical dialogue with them? Presented for debate in *Context Architecture* is a selection of such ideas, all of them central to current discourses. *Context Architecture* is a collaboration of the Zurich University of the Arts (ZHdK) and Ludger Hovestadt, chair for Computer Aided Architectural Design at the ETH Zurich.

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Simulation

Presentation Technique
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Edited by Andrea Gleiniger and Georg Vrachliotis

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EDITORIAL

"Our interest in the invisible world stems from a desire to find a form for it in the visible one, which means to prise open, to decompose, to atomize the deceptively familiar, the visible exterior appearance, before we can deal with it again. [...] We are interested in the hidden geometry of nature, in an intellectual principle, and not primarily in the external appearance of nature."[1] This is how Jacques Herzog and Pierre de Meuron describe their architectural enterprise. In the age of computer simulation, this characterization appears in a very special light. Increasingly, conceptualizations and strategies for architectural design are conditioned by influences that lie somewhere along the interface between scientific and cultural images of contemporary information technology. This raises the question: by means of which practices, and in particular which theoretical tools, can architecture productively interact with these new technologies while simultaneously engaging in a critical dialogue with them?

Just how close the above characterization by Jacques Herzog and Pierre de Meuron comes to what Vilém Flusser has dubbed "calculatory thought"[2] becomes clear only against the background of the computer as a "universal machine." For the interplay between analysis and synthesis made possible by the computer points toward a level where, finally, overarching questions can be weighed in the context of reflections on architectural production. In light of the increasing dissemination of models of thought drawn from information technology, it has become necessary to re-engage in a critical discussion of the relationship between architecture and art, science, and technology. But it is not a question simply of heeding repeated demands to re-situate architecture. Rather, it is an issue of the basic concepts that make it possible to identify, reflect upon, and contextualize

1 Jacques Herzog und Pierre de Meuron, "Die verborgene Geometrie der Natur," in *Sturm der Ruhe. What is Architecture?* ed. by the Architekturzentrum Wien, Salzburg 2001, p. 265, (lecture delivered by Jacques Herzog, Basel 1984, in: *Herzog & de Meuron, 1978–1988 – Das Gesamtwerk,* ed. Gerhard Mack vol. 1, Basel, Boston, Berlin 1984, pp. 207–211): "Unser Interesse an der unsichtbaren Welt liegt darin, für sie in der sichtbaren Welt eine Form zu finden, das heißt das trügerisch vertraute, sichtbare, äußere Erscheinungsbild aufzubrechen, zu zerlegen, zu atomisieren, bevor wir erneut damit umgehen können. [...] Unser Interesse ist die verborgene Geometrie der Natur, ein geistiges Prinzip und nicht primär eine äußere Erscheinungsform der Natur."

2 Vilém Flusser, "Digitaler Schein," in: *Digitaler Schein: Ästhetik der elektronischen Medien,* ed. Florian Rötzer, Frankfurt 1991, pp. 152ff.

the transformative processes to which architectural design thinking has been subjected under the influence of the paradigm change triggered by information technologies.

In light of the method of investigation alluded to by Herzog and de Meuron, we might also ask: "Could there be anything more natural than to start with the visible form and then gradually to penetrate into the realm of the invisible? The architect must be able to manipulate the invisible so as to render reality visible, but also capable of seeing reality in order to change it."[3] The instrument for achieving this is computer simulation, with which it has become possible not only to visualize and represent the invisible, the as-yet inexistent or inconceivable, but also to gain access to an epistemological investigation. And is this not precisely the inverted path toward knowledge harbored by computer simulation? To begin in the realm of the non-visible, advancing painstakingly towards the structures of the visible? For an increasingly computational scientific landscape, this development towards synthetic procedures opens up a broad spectrum of new paths towards knowledge production. This is also the case for architecture. We are far from fathoming in detail just what this methodological turning point offers architectural design and planning processes. In this context, the concept of simulation must be accorded a very special significance. All the more so since it can be positioned in terms of architectural history as well as in a context of the growing importance of digital design and production methods.

In architecture as well, the concept of simulation plays an essential role in discussions of mediatization: as illusion and imitation, as dissimulation and *mimesis*. In dialogue with information technology and computer science, moreover, it has acquired a new quality for architectural discourse as well: today, we understand simulation primarily as computer simulation. While simulation once pertained to modes of presentation, it now connects architecture to the natural sciences and to a methodological and strategic instrument, a tool of knowledge. Ontologically, computer simulation must be distinguished from the spectrum of traditional concepts of simulation found in architecture. It is no longer merely a technology of visual simulation, but rather a technological instrument for acquiring knowledge

3 Franz Oswald: Foreword to Pierre von Meiss: *Elements of Architecture: From Form to Place,* Lausanne 1991, p. xiii; "Préface" in: Pierre von Meiss: *De la forme au lieu: Une Introduction à l'étude de l'architecture,* Lausanne 1986, p. 7: "Y a-t-il voie plus évidente que de partir du visible, la forme, pour pénétrer peu à peu dans l'invisible, le caché? L'architecte doit être capable de manier des choses invisibles pour rendre visible la réalité, capable aussi de voir la réalité afin de la transformer."

in the spirit of the modern natural sciences. This means a leap from a timeless to a time-contingent technology. It is this temporal aspect that distinguishes computer simulation from inherited concepts of simulation in architecture.

Computer simulation in architecture has a relatively brief history. As a rule, computer simulation is classified with computing and applied mathematics, while the technical development of its visualization methods is nonetheless inseparable from certain architectural aspects. Even early on, architects were involved in the development of computer-based methods of representation. More than 20 years ago, Horst Rittel, a former lecturer in design science at the Hochschule für Gestaltung in Ulm, referred to computer simulation as one of the most important areas where architects interacted with the computer.

With the rapid development of hardware and software, finally, numerical simulation advanced to become a new working practice in science and research, in architecture and design. Having now established itself as a ubiquitous cultural technology, it increasingly alters our interactions with the world. "Simulation," then, is a fundamental concept in whose definitions repeated demands for transdisciplinarity make themselves felt. This is true not only for the arts, but perhaps even more so for a dialogue between architecture, technology, and the sciences. With this background, it becomes clear that a discussion of such basic concepts goes beyond the traditional discursive boundaries of architectural discourse, and is characterized increasingly by an intensive dialogue with the theory and philosophy of technology and with the history of science.

In order to do justice to these aims, we have chosen authors from diverse disciplines, all of whom we consider to have had a fundamental impact on the shaping and interpretation of these conceptualizations in architecture, or to be expected to do so in the future. Please note that it has not been possible to take account of every discipline that has been preoccupied with simulative strategies, whether conceptually, technologically, or in terms of epistemology. Instead of a contribution from the perennially popular field of neuroscience, for example, we chose to focus on one of the earliest and simultaneously most advanced fields of application of numerical simulation, meteorology. The modeling and simulation of climatological scenarios, of new molecules and materials, as well as of new building types and complex geometries, all testify to the profound change triggered by the use of computer-based simulations. A better understanding of this change from an architectural perspective also requires a deepened critical confrontation with historical as well as contemporary definitions of the concept of simulation.

Taking as his point of departure the concept of mimesis as formulated during the Renaissance and Baroque periods, with recourse to Classical Antiquity, *Thomas Hänsli's* article traces art-theoretical interpretations of the idea of simulation and its artistic applications, beginning in the 15th century. Against this background, he inquires into the jurisdiction of the concept of simulation for current artistic presentations of architecture, for example, in the area of architectural photography.

The article by *Andrea Gleiniger* demonstrates that the adaptation of the idea of simulation in the history of 20th-century architecture spread beyond the fields of representation and visualization. Using examples drawn from 20th-century spatial conceptions in the field of experimental media, she makes it clear that the concept of simulation was reflected and transformed in modern architecture in ways closely related to the history of ideas and of the media. In an outline of architectural history leading from El Lissitzky's "Wolkenbügel" all the way to contemporary digital work, the history of an increasingly mediatized architecture is also read as a history of simulation. Decisive here is the way in which the concept of simulation, hitherto primarily tied to modes of representation and presentation, now links architecture increasingly to knowledge acquisition and to the natural sciences at the level of strategies for modeling dynamic processes.

It is with regard to reflections on architecture from the perspective of media history that media-theoretical realizations of the concept of simulation acquire their special significance. This is all the more true because in media studies as well, as *Nils Röller* elaborates, the terms "simulation as dissimulation" and "simulation as modeling" are used to distinguish two traditional conceptualizations. Artificial intelligence developed from a branch of early computer science to become an independent and powerful scientific program, one that broke down eventually when it failed to live up to its own expectations. The desire, articulated in this context, to render complex models used in scientific investigations accessible through computer simulation is nonetheless decisive for discussions of the concept of simulation. Emerging in place of seemingly deceptive visualizations are questions of prognostication. Against this background, *Georg Vrachliotis* investigates the resulting impact on technical thinking in architecture. The associated question – which architectural design instruments can be generated from the historico-discursive space of computer simulation? – leads to a search for adequate theoretical access to an architectural production that is increasingly stamped by the structural sciences. Critical architectural reflections on the

methods of numerical computer simulation (which are substantially structural, and are characterized by a "mathematics of temporal procedures"[4]) demands more than an improved understanding of the underlying technical principles. Even more important is an improved feel for their sociocultural implications and limitations. The heightened penetration of numerical computer simulation in the diverse branches of scientific research endows it with the status of a cultural technology.[5] From the perspective of the philosophy of technology, *Gabriele Gramelsberger* not only examines the general constitution of these mathematical worlds, but also investigates their epistemo-theoretical space of possibility on the basis of specific climatological simulations. Anyone wishing to become more closely involved with simulation should avoid remaining on the "surface of the monitor," for only a look into the depths of the data makes it possible for these semiotic worlds to be investigated adequately. Even earlier, it had become evident that such an investigation would necessarily refer to an additional, overarching level of discussion: to the changing relationship of interdependency between knowledge production and the mathematical logic of computer simulation. As *Erich Hörl* points out in his article, one prerequisite for any understanding of this transformation of knowledge is an enquiry into the epistemological and ontological situation created by the "computational turn" in the sciences. More than the meaning of the sciences, he argues, is displaced by computer-supported practices of modeling and simulation, from the descriptive to the projective. More important, the status of the technological shifts as "technical objects with minority status" and tools of instrumental reason form a "majoritarian structure," a "new milieu of knowledge and becoming." Detectable within the contours of these lines of development on various levels of knowledge production, in diverse dimensions of the aesthetic and of the technical, and in the most various disciplines, is a change in the concept of simulation – one that, considering the steady growth potential for applications of computer simulation, has perhaps yet to be exhausted. The essays collected in this volume attempt to expose a multifaceted panorama, and to set the basic idea of simulation and its underlying cultural-historical dynamics in an architectural context.

4 Carl Friedrich von Weizsäcker: *Die Einheit der Natur. Studien,* Munich 1971, p. 23; English edition available: *The Unity of Nature,* New York 1980.

5 See Walther Zimmerli: *Technologie als Kultur. Braunschweiger Texte,* Hildesheim 1997.

In conjunction with an accompanying volume on the topic of "Complexity," this essay collection on "Simulation" initiates the publication Series *Context Architecture.* This series undertakes the task of opening up for discussion fundamental architectonic concepts in a realm situated between art, science, and technology. This project developed from an intensive collaboration between its two editors, and its profile came into sharper focus via constructive dialogue with its various authors. We take this opportunity to express our gratitude to all of our writers for their profound contributions to this volume. All texts were written expressly for the present publication.

Our very special thanks also to Prof. Dr. Hans-Peter Schwarz, Founding Rector of the Zurich University of the Arts, and to Prof. Dr. Ludger Hovestadt, chair of Computer Aided Architectural Design at the ETH Zurich. Their generous financial support and encouragement regarding content made it possible for our book project to assume its present form. The associated cooperation between these two institutions also reflects the aim of bringing architecture, technology, art, and science into dialogue, and has manifested the ubiquitous call for transdisciplinarity in a singular fashion. Ultimately responsible for realizing this publication project was Birkhäuser Verlag. Our very special thanks go to Robert Steiger and Véronique Hilfiker Durand for their patient, competent, and consistently committed editorial efforts.

Andrea Gleiniger, Georg Vrachliotis