# Preface

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**Publication date**
2023

**Document Version**
Final published version

**Published in**
Computer-Aided Architectural Design

**Citation (APA)**
Turrin, M., Andriotis, C., & Rafiee, A. (2023). Preface. In M. Turrin, C. Andriotis, & A. Rafiee (Eds.), *Computer-Aided Architectural Design: INTERCONNECTIONS: Co-computing Beyond Boundaries* (Vol. 1819 CCIS, pp. v-vii). (Communications in Computer and Information Science). Springer.

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Editors

# Computer-Aided Architectural Design

## INTERCONNECTIONS: Co-computing Beyond Boundaries

20th International Conference, CAAD Futures 2023
Delft, The Netherlands, July 5–7, 2023
Selected Papers

Springer

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ISSN 1865-0929 ISSN 1865-0937 (electronic)
Communications in Computer and Information Science
ISBN 978-3-031-37188-2 ISBN 978-3-031-37189-9 (eBook)
https://doi.org/10.1007/978-3-031-37189-9



This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

# Preface

CAAD Futures is a biennial international conference on Computer-Aided Architectural Design under the umbrella of the CAAD Futures Foundation, and it is active world-wide in advancing and documenting related research. On 5–7 July 2023, the 20th CAAD Futures conference was hosted at Delft University of Technology. The CAAD Futures Foundation was established in 1985, holding the first conference on 18–19 September of that year at the very same University. The return of the conference to Delft for its 20th edition offered a chance to reflect on the past, present and future role of Computation in Architecture and the Built Environment.

With reference to the theme of "INTERCONNECTIONS: Co-computing beyond boundaries", CAAD Futures 2023 reflected on the role of computation to interconnect in and for Architectural Design.

As advances in computational fields empower artificial intelligence to decipher data and unlock new pathways for scientific knowledge, traditional interdisciplinary boundaries are diminished. The new language of data and computation offers a shared ground for interconnection across knowledge domains. Datasets and computational workflows facilitate continuity across scales, from the territorial and urban scales to the scales of building components, materials and beyond. Current advances in computational sciences foster new ways of sensing, collecting, organizing and reusing data, as well as new frontiers of machine learning enabling the transition to information and knowledge. Along with opportunities, new questions also arise. Current advances create new working paradigms, delineating questions yet to be addressed as points of joint attention. On this ground, CAAD Futures 2023 fostered research crossing knowledge domains, scales and single-inquiry trajectories.

CAAD Futures 2023 received 251 abstracts, followed by 144 related full papers, out of which 43 were selected for this Springer volume, based on a two-tier double-blind review process. All received papers were reviewed by international reviewers. The international Scientific Committee included 144 reviewers with established expertise, covering a broad spectrum of relevant topics. To facilitate optimal expertise matching, the reviewers were allowed to bid for papers, which resulted in 116 reviewers actively participating to the review process. All selected papers were positively reviewed by at least three reviewers. The selected papers meaningfully span across nine clusters, which correspond to the sections of this publication: (i) Algorithmic Architectural Design, featuring algorithmic thinking; (ii) AI-Powered Architectural Ideation, exploring emerging frontiers with Artificial Intelligence; (ii) Performance-Based Design, featuring parametric design, performance optimisation and design space exploration; (iv) Urban Models and Analysis, including 3D reconstructions and computational analysis methods; (v) Urban Design, highlighting data-driven participatory processes, computational intelligence and (parametric) simulations among others; (vi) Digital Design, Materials and Fabrication, featuring digital workflows for new materials, fabrication and construction processes; (vii) Spatial Information, Data and Semantics, including web semantics

and knowledge graphs for building information and data integration; (viii) Building Data Analysis, Visualisation, Interaction, presenting methods to process and visualise buildings data using novel AI, VR and AR techniques; and (ix) Building Massing and Layouts, featuring computational methods to design and assess building volumes and functional layouts. The Conference program included two days (5 and 7 July) centred around presenting these papers and debating their relevant topics in nine papers sessions and related panel discussions. It featured the keynote lecture by John Gero on studies on the brains of designers, including the effects of the use of digital visual representation media on brain responses; the keynote lecture by Ruth Dalton on interdisciplinary research at the intersection of cognitive science, architecture and digital technologies; and the keynote lecture by Cristiano Ceccato on architecture and human connectivity, reflecting on project management and computation as enablers for constructability and project delivery.

To celebrate the anniversary related to the 20th edition of the conference and foster interactions on the past, present and future role of Computation in Architecture and the Built Environment, on 5 July the conference program included a special evening event publicly open to everyone, featuring a speech by CAAD Future Delegates, invited talks with interactive debates, and a keynote lecture by Alessandro Bozzon on human-centred Artificial Intelligence.

Encouraged by the CAAD Futures Board, in parallel to the selection of papers collected in this Springer volume, CAAD Futures 2023 also newly introduced a Co-creation track to collectively discuss research urgencies and their roadmaps, resulting in position papers and supplementary material to be collected in a Co-creation Sourcebook. The Co-creation journey started in June 2022 with the call for Topics. Several Topics were selected, each one proposed by a Team of experts composed of scientists and/or professionals across multi-disciplinary backgrounds. The Teams joined the CAAD Futures 2023 Co-creation platform to collaborate online based on shared discussions, datasets, elaboration of digital models and documents, and other online materials. Besides individual Team activities, a number of online events across Teams took place prior to the conference. The Conference program included one day centred around the Co-creation presentations and working sessions, open to all conference participants. The Co-creation Sourcebook was envisioned based on Open Science principles, aiming at disseminating Open Access the position papers and supplementary content of each Team under a Creative Commons Attribution Share Alike 4.0 license, edited after the conference.

The editors of this Springer volume and curators of the selection process for the papers collected in this volume are only a fraction of the team that organized the conference. The editors would like to thank the other organizers and acknowledge their invaluable contributions: Serdar Asut and Mariana Popescu provided vital directions and decisive actions in their role as Program Chair and Co-creation Chair respectively; Marija Mateljan, Fatemeh Mostafavi and Eftychia Kalogianni offered crucial support and uplifting ideas during the entire organization process. We thank the CAAD Futures 2023 advisory board, Sevil Sariyildiz, Georg Vrachliotis, Peter van Oosterom and Frank van der Hoeven, for their helpful inputs and continuous insights. We convey our special thanks to the students who volunteered to support this journey driven by an enthusiasm that energized the process. We also thank the CAAD Futures Board, Tom Kvan,

Gabriela Celani and Mine Özkar, for their invaluable and always prompt support during the preparation process. Without their initial propositions, the Co-creation track would have not been ideated and their fruitful creativity when sharing thoughts has been crucial during its entire development. We express our gratitude to all members of the Scientific Committee for their insightful reviews and availability throughout the review process, which guaranteed the highest academic standards of the outcome. Finally, we gratefully acknowledge the support received from the TU Delft Faculty of Architecture and the Built Environment, and especially from the Department of Architectural Engineering and Technology.

June 2023

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