9 · 2 | DECEMBER **2024**

ITRUVIO

International Journal of
Architectural Technology and Sustainability

DANA: LEARNING FROM THE PAST TO RESPONSIBLY BUILD

Interview with **CARLO RATTI**

9 · 2 | DECEMBER **2024**

ITRUVIO

International Journal of
Architectural Technology and Sustainability

DANA: LEARNING FROM THE PAST TO RESPONSIBLY BUILD

Interview with **CARLO RATTI**

EDITORIAL TEAM

Editor in Chief
Luis Palmero Iglesias
Universitat Politècnica de València, Spain

Editor Associated
Graziella Bernardo
Università degli Studi della Basilicata, Italy
Stefania De Gregorio
Universitat Politècnica de València, Spain

Editorial Boarding Members
Pierluigi De Berardinis
Università degli Studi dell'Aquila, Italy

Fernando Cos-Gayón López
Universitat Politècnica de València, Spain

Joaquín Díaz
Technische Hochschule Mittelhessen, Germany

Maríangela De Vita
Consiglio Nazionale delle Ricerche, Italy

Maria Cristina Forlani
Università degli Studi "G. D'Annunzio" Chieti-Pescara, Italy

Francesco Frontini
Scuola universitaria professionale della Svizzera Italiana, Switzerland

Juan Antonio García-Esparza
Universitat Jaume I, Spain

Francesco Paolo R. Marino
Università della Basilicata, Italy

Ippolita Mecca
Università Telematica Pegaso, Italy

Fabio Minutoli
Università degli Studi di Messina, Italy

John Pendlebury
Newcastle University, United Kingdom

Gilles Perraudin
Architect, Lyon, France

Advisory Board Members
Avi Friedman
McGill University, Canada

Tsuneaki Fukui
Hosei University, Japan

Olimpia Niglio
Kyoto University, Japan

Published by
Univesitat Politècnica de València

CONTACT

Luis Palmero Iglesias
Phone: +34 963879451; Fax: +34 963879129
Email: lpalmero@csa.upv.es

Scientific Comitee
Paola Ardizzola
Gdansk University of Technology, Poland

Stefano Bertocci
Università degli Studi di Firenze, Italy

Timothy Brown
Clemson University, United States

Javier Cárcel Carrasco
Universitat Politècnica de València, Spain

Olivier Chamel
Florida A&M University, United States

Rosa María Domínguez Caballero
Universidad de Sevilla, Spain

Antonella Guida
Università degli Studi della Basilicata, Italy

John Hughes
University of West of Scotland, United Kingdom

Özlem Lamontre-Berk
École Nationale Supérieur d'Architecture de Lyon, France

Renato Morganti
Università degli Studi dell'Aquila, Italy

Sandro Parrinello
Università di Pavia, Italy

Tiziana Poli
Politecnico di Milano, Italy

Donatella Radogna
Università degli Studi "G. D'Annunzio" Chieti-Pescara, Italy

Adriana Rossi
Seconda Università degli Studi di Napoli, Italy

Ali Taha Omar
Italian-Egyptian Center for Restoration and Archaeology (CIERA), Egypt

Rafael Temes Córdovez
Universitat Politècnica de València, Spain

Humberto Varum
University of Porto, Portugal

Antonella Violano
Università degli Studi della Campania "Luigi Vanvitelli", Italy

Graphic designer
Enrique Mateo
Triskelion Diseño Editorial

Cover image: Tribute to the volunteers who have helped the victims of the Dana disaster by Paco Roca and Martín Forés. Mural, La Rambleta, Cultural Center, Valencia. Photographer: García Poveda

FOCUS AND SCOPE

VITRUVIO Journal is an international research journal publishing articles with links to architectural technology and sustainability. The aim is to present original technical advances as well as innovative methods and applications in order to contribute to the sustainable development through the architecture.

The journal is a resource for sharing innovative researches with an interdisciplinary comparison.

The selection of papers complies with the protocols for scientific publication.

The peer review is done through a system of referees, experts in the field of research.

PUBLICATION FREQUENCY

From Vol. 9 Iss. 2 (2024), VITRUVIO adopts the continuous publication system, with semiannual cut-off dates on June 30 and December 31 each year. Therefore, the journal continues to publish one volume per year, comprising two issues that will include all articles processed within that year.

SECTION POLICIES

Editorial: open indexed

This section describes the point of view of experts in the topics related to the journal. Written by the editorial team or an invited author.

Research articles: submissions, open indexed, double blind peer review The peer review will evaluate the coherence with the focus and scope of the journal, the technical quality, the technical impact and relevance and the presentation.

OPEN ACCESS POLICY

VITRUVIO Journal provides immediate open access to its content.

SUBSCRIPTION INFORMATION

Volume 9, 2 issues: 15€
Contact: pedidos@editorial.upv.es
Printed in spain by: By print percom, s.l.
EISSN: 2444-9091
On line version:
http://polipapers.upv.es/index.php/vitruvio

ETHIC AND BEST PRACTICES

VITRUVIO, in its commitment to ensure ethical and rigor of its content, follows the Declaration ethic and best practice of PoliPapers (service of the Universitat Politècnica de València to promote open editing of scientific electronic journals).

COPYRIGHT NOTICE

Online journal is published by UPV, being necessary to cite the source in any total or partial reproduction.

Unless otherwise stated, all content of this electronic edition is distributed under a license and distribution “Creative Commons Attribution-Non commercial 4.0” (CC-by-nc).

Publisher allows authors to upload their articles in institutional or subject repositories for their dissemination and preservation.

PRIVACY STATEMENT

The names and email addresses entered in this journal will be used exclusively for the stated purposes of this journal and will not be available for any other purpose or another person.

EDITORIAL QUALITY CRITERIA

Vitruvio journal declares its commitment to respect the integrity of published works. For this reason, plagiarism is strictly prohibited and texts that are identified as either plagiarism or fraudulent content will be removed or unpublished. The journal will act in this cases as quickly as possible. By accepting the terms and agreements expressed by our journal, authors must ensure that the text and the materials associated with it are original (or that they have the publishing permissions) and that there isn't infringed copyright. Authors also have to justify that in case of joint authorship, there was full consensus of all authors involved and that the manuscript has not been previously presented or published in other media.

Expressed opinions are those of the authors and do not necessarily reflect the editorial opinion. All people listed as authors are responsible for the contents of the investigation by having contributed substantially in their physical execution and/or intellectually. Authorship is recognized for the contributions made to the field of knowledge, therefore, the author is responsible for agreeing with the team that took part in the conduct, and for the decision about the order of the authors.

Acknowledgements should be cited, explaining the sources of research funding (if any) and aid, substantial advice or recommendations made by third parties.

COPYRIGHT NOTICE

Hard copy and online journal is published by UPV, being necessary to cite the source in any total or partial reproduction.

Unless otherwise stated, all content of this electronic edition is distributed under a license and distribution "Creative Commons Attribution-Noncommercial 3.0 Spain" (CC-by-nc).

VITRUVIO is not responsible for any copyright of the images reproduced in the texts. These are the responsibility of the authors in accordance with the arrangements set out in the call for submissions.

© texts: authors

© images: authors/institutions

Table of contents

Editorial Team iv

Contact iv

Focus and scope v

Editorial
Graziella Bernardo, Stefania De Gregorio, Luis Palmero 2

#23054 Interview with Carlo Ratti 4
Graziella Bernardo, Luis Palmero

#22468 Urban mining potential in demolition and design for innovative material reuse within a circular model 16
Deniz Üçer Erduran

#22880 Musealisation of architectural heritage for sustainable and inclusive tourism. The Yonghe Temple. Beijing 30
Alba Soler Estrela, Joaquín Ángel Martínez Moya, Siqi Li

#22939 Influence of detail level in acoustic modeling of heritage buildings. Case of the Lonja de los Mercaderes in Valencia 44
Jaime Llinares Millán, José Miguel Molines Cano

#22093 Modelling for uncertainty in HBIM processes 54
Alessia Mazzei, Letizia Martinelli, Tommaso Empler, Luciano Cessari, Elena Gigliarelli

#21873 Analysis of structure and function of natural air-conditioning elements in the traditional context of Bandar-Lengeh 72
Hamed Mohammadi Mazraeh, Mohammadbagher Kabirsaber

#22495 The Adaptation of Modern Housing Heritage: Authenticity and Integrity in the Case of Cité Modèle 90
Ayça Özmen

#22421 Leveraging deep learning segmentation techniques and connected component analysis to automate high-level cost estimates of facade retrofits using 2D images 104
María Escalada

CapitaSpring Tower, Singapore, CRA Associates Studio. Credits: Finbarr Fallon.

Carlo Ratti

Born in Turin in 1971, he is architect and engineer. He teaches Practice of Urban Technologies and Planning at the Massachusetts Institute of Technology (MIT, Boston, USA) and Strategic vision for the building engineering of the future at the Politecnico di Milano. He is director of the Senseable City Lab at MIT and founding partner of the architecture firm CRA-Carlo Ratti Associates (Turin, New York and London). He is curator of the XIX International Architecture Exhibition, Venice Biennale 2025.

To build meanings

Graziella Bernardo, Luis Palmero

INTERVIEW WITH CARLO RATTI

Graziella Bernardo, Luis Palmero: *First, thank you on behalf of all our readers for granting us an interview despite your busy schedule. Let us also try to upset the rules of the game by following your breakthrough way of teaching and designing. A first question, or rather a curiosity. You are an engineer and an architect. Which master's degree did you obtain first? Why did you decide to pursue the other one degree as well?*

Carlo Ratti: Engineering was my first choice, the base on which to build. It is like learning how to use bricks before designing the house. Then came architecture, which adds poetry and vision. I believe that technique without beauty is an end, and therefore useless. Art without a sound technical basis risks remaining insubstantial. The combination of the two makes it possible to construct not only buildings, but also meanings.

GB, LP: *You are curator of the XIX International Architecture Exhibition to be held in Venice in 2025 entitled* Intelligens. *As you say in the presentation of the exhibition, 'the final syllable, "gens", means "people": from here it emerges an imaginary alternative root, suggesting a more multiple and inclusive future of intelligence, one that escapes the excessive limits of today's focus on A.I.' Can you explain what kind of intelligence you envision for a better future? How can we escape the drift of the abdication of human intelligence to artificial intelligence?*

CR: *Intelligens* is not just a title, but a manifesto. The exhibition aims to explore a new form of intelligence, broader and more porous, plural and inclusive. We will try to chart broken new routes for the future, suggesting a range of solutions to the most pressing problems of the present, putting together a collection of experimental

Figure 1 | CapitaSpring Tower, Singapore, CRA Associates Studio. Credits: Finbarr Fallon.

design proposals, inspired by a definition of 'intelligence' as the ability to adapt to the environment from a limited stock of resources, knowledge or power. The dialogue between the intelligences is the core of the argument. We must think of a notion of intelligence that is distributed and rooted in people, in their creativity and adaptability. You make a good point: today we are too focused on the idea of Artificial Intelligence (and specifically ChatGPT): but this artificial intelligence will not be enough on its own. It will perhaps be able, a few years from now, to move from Text-To-Image to Text-To-Bim, helping us to realize complete projects by taking away the charge of the most boring and repetitive jobs. Let us remember, however, that Artificial Intelligence can only reproduce what already exists. It can never create what is not yet there. This is why intelligence must not replace but complement each other.

GB, LP: *Architecture bears great responsibility in the environmental, social and economic crisis of our times. The exhibition proposes a range of concrete solutions to reverse the current trend. In your opinion, is there a priority among these solutions?*

CR: When we think of cities, we can start with four numbers: 3, 55, 70 and 80. Globally, cities cover only 3% of the earth's surface, but are home to over 55% of the population, consume 70% of energy and are responsible for 80% of CO_2 emissions. By acting in the city, in its heartbeat, we can achieve great results provided we understand that there is no single solution. Let me give you an example: in Italy it makes no sense to build new buildings. I hope that, in the not-too-distant future, we will achieve zero land consumption in our country. Instead, we must make what is already there more energy efficient and resilient to new weather conditions. In Southeast Asia, on the other hand, other types of solutions are being planned: a more vertical architecture that aims at circularity by integrating architecture with the innovations brought for example by hydroponics, as in the Jian Mu Tower project in Shenzen that we designed with CRA-Carlo Ratti Associati. Above all, however, I believe that we must start with the decarbonization of our cities: still with CRA, we have designed Hot Heart, in Helsinki, which to date is the largest decarbonization project in Europe. Floating islands collect water to generate clean energy and, at the same time, create

Figure 2 | Jian Mu Tower Shenzhen, China. Credits: CRA-Carlo Ratti Associati.

Figure 3 | Hot Heart. Helsinki, Finland. CRA Associates. Credits: CRA.

Figure 4 | The Greenary. Parma, Italy. CRA Associates. Credits Delfino Sisto Legnani and Alessandro Saletta from DSL Studio.

Figure 5 | The Greenary. Parma, Italy. CRA Associates. Credits Delfino Sisto Legnani and Alessandro Saletta from DSL Studio.

urban ecosystems for the community. An example of how we can use renewable energy to create resilient infrastructure and public spaces.

GB, LP: *Where should we start in order to spread the culture of* 'experimental design' *that can adapt to the environment and synergize the opportunities, contingencies and fragilities of each place?*

CR: Experimental design starts with listening. In Pristina, we worked with the local community for the 14th edition of Manifesta, the European Nomad Biennial, to create new green spaces accessible to all. We did this starting from the needs of the city and its inhabitants, thus combining the needs of the *urbs*, the physical city made of bricks and streets, with those of the *civitas*, of the people who inhabit it every day.

GB, LP: *Architecture is an art form to serving the community. How can we involve people and listen to their plurality of voices in experimental design processes?*

CR: *Participation and awareness are fundamental. Let us always remember that there is no such thing as an intelligent city without intelligent citizenship. In Biennale 2025, we want to bring people to think about the challenges we face. It is an educational and inclusive process, where everyone becomes an actor of change. I do not believe in the role of the demiurge architect who casts his vision from above and modifies entire cities to his liking, as when Le Corbusier imagined in his Plan Voisin a new Paris that would sweep away the capital's Hausmannian imprint. Instead, I believe in an architecture that puts itself at the center of many other disciplines (such as biology or data science), bringing them back to urban space and helping to answer the big question. Faced with the acceleration of the climate crisis, should we resign ourselves or are we still able to offer substantial and not cosmetic, effective and quick to implement solutions?*

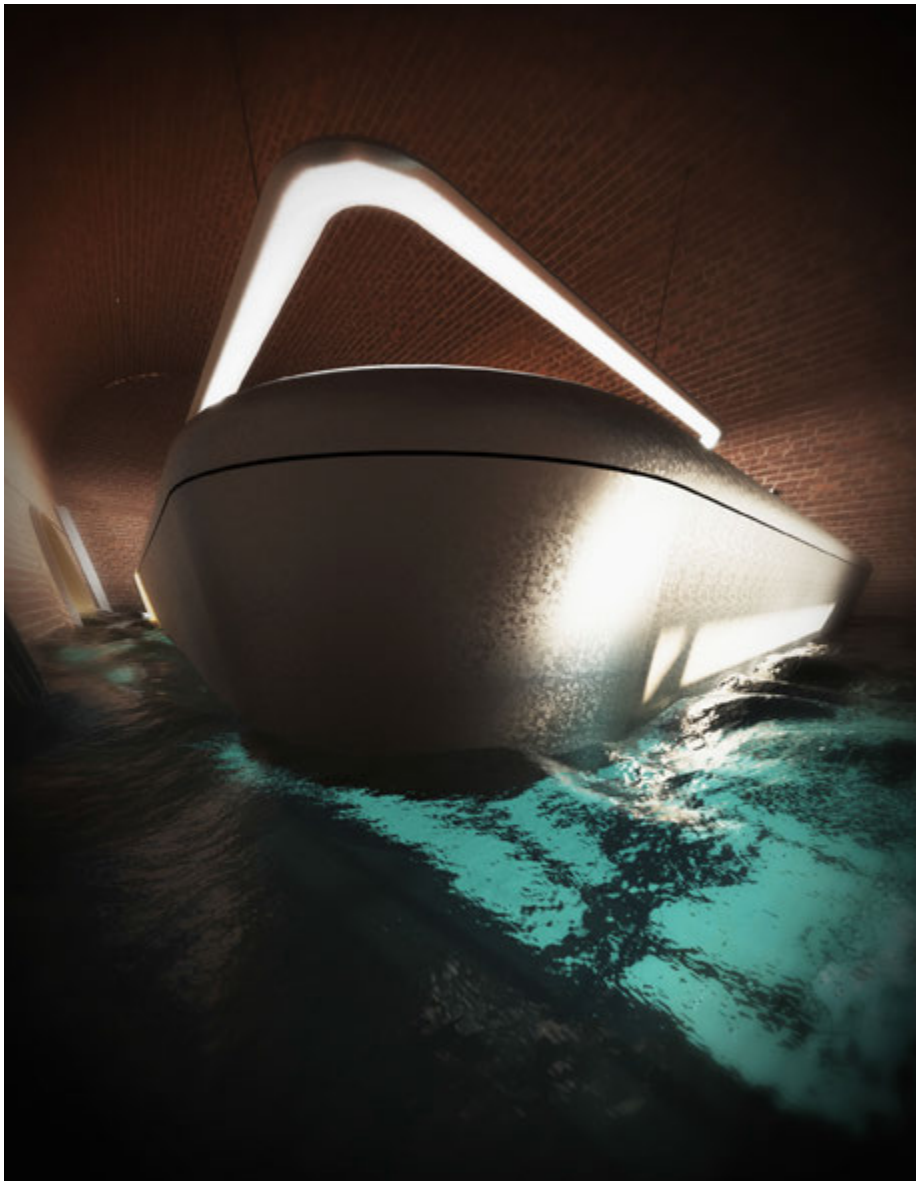
GB, LP: *What are the activities of the Senseable City Lab that you direct at Massachusetts Institute of Technology (MIT, Boston, USA)? Can you tell us about one of the many successful experiments?*

CR: I would not speak of successes or failures. The very nature of the experiment is to never end and to arrive at the conception of new solutions precisely from mistakes, from failures. It is a continuous process of trial and error. As for our laboratory: I'll start with the name. With 'Senseable' we want to distance ourselves from the 'Smart City' paradigm. The 'Senseable' city emphasizes a more human dimension of the city of tomorrow because the word has a double meaning: a 'sensible' city, but also a city that can feel. Today's cities talk to us and continuously provide us, through networks, with data to be processed and cross-referenced. The information obtained from these analyses can have infinite applications: from reducing energy consumption, to streamlining traffic, to improving waste collection and disposal. In short, all aspects and dimensions of cities can be transformed and improved through this increased knowledge derived from data collection and networks. The best results are achieved when citizens, who are the real actors, become aware of what is happening around them and, by obtaining information in real time, make decisions that can change their cities. Let me give you an example that is often used: traffic. Through real-time information obtained from the networks, we can optimize time and petrol looking for a parking space or change the route home to avoid unnecessary traffic jams. So, many problems can be solved by making better use of the infrastructure that already exists thanks to the application of new technologies. With less asphalt and more silicon! In 'smart cities', it is the citizen himself who, with his needs and demands, influences and changes the city.

GB, LP: *With Italo Rota, you designed the Italian pavilion at Expo Dubai 2020. How can Made in Italy contribute to the ecological transition?*

CR: Italo was a great innovator, one of those rare designers capable not only of providing new answers but also of asking new questions, which, in our profession, is the key to continuing to innovate. With Italo, we imagined a pavilion, the one at Expo Dubai, in which the elements of nature and even the waste of human activity would become an element of value in a perspective of circularity: from coffee grounds to orange peels, passing through the recycled plastic ropes that naturally conditioned the space by reusing two million bottles. The fabric of start-ups in Italy is rich and I think the best opportunities are yet to be discovered. But from companies working with waste materials to produce new objects (think of rice husks that can also become garment fabric) to those experimenting with large-scale 3D printing, we can really put the Italian genius, that of globalization that I call niche - that is, the ability to create unique and excellent products capable of competing in the global market

Figure 6 | Italian Pavilion at Expo Dubai 2020 (Credits: Michele Nastasi).



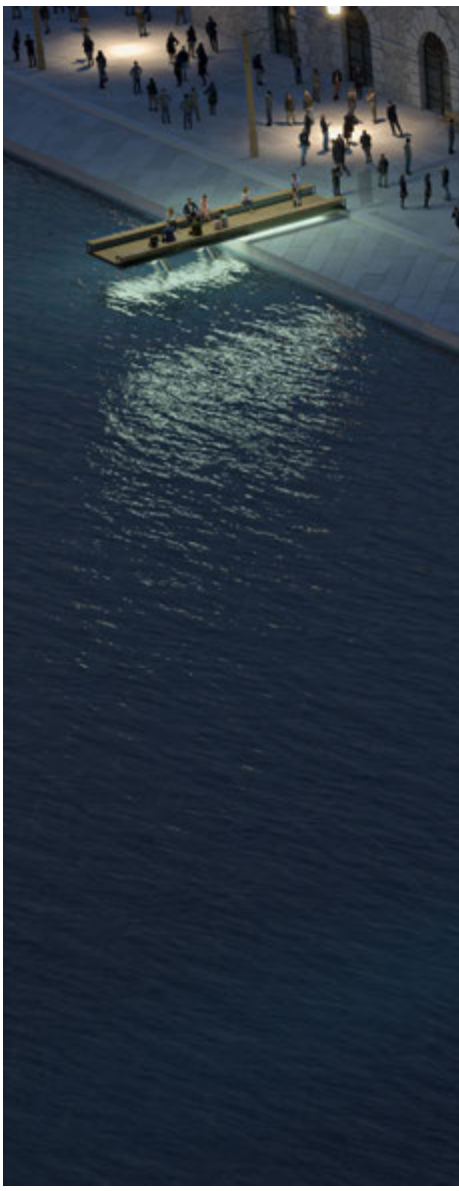


Figure 7 | Floating Above the Floods, River center, Murazzi del Po, Torino, Italy. Credits CRA Associates.

even in communities far from the usual centers such as Milan or Rome - in the conditions to thrive.

GB, LP: *One of his studio's latest projects is ILOW, a new building in the western suburbs of Paris linking the financial district La Défense to Tours Nuages in the municipality of Nanterre, one of the most iconic post-war social housing projects designed by Émile Aillaud between 1973 and 1981. The building with its open ground floor and curved glass façade evokes the shape of two open arms connecting two urban areas with a huge socio-economic gap. The parametrically designed façade uses solar radiation for lighting and maintaining indoor comfort conditions. Can you explain the meaning of the name and give us some design details of the modular system used for the façade?*

CR: The vision behind the ILOW project was to be a bridge between two profoundly different urban realities: the Défense financial district and Émile Aillaud's Tours Nuages in Nanterre, a symbol of post-war social housing. The name recalls both the idea of a 'green islet' (îlot de verdure) and the building's low energy impact (low energy). The curved façade, inspired by Aillaud's Tours Nuages, is designed to develop through prefabricated modules that follow the sun's trajectory, optimizing

Figure 8 | Floating Above the Floods, River center, Murazzi del Po, Torino, Italy. Credits CRA Associates.

natural light and reducing energy consumption. We decided to think of a transparent and open ground floor to promote what is central for us: the meeting between people and transforming the closed physical space into a common ground. Let us remember that only from the encounter between people can true innovation be born.

GB, LP: *Finally, we cannot but ask your opinion on the reconstruction of Valencia's peri-urban areas following DANA. Where do we start from?*

CR: The Valencia disaster is a warning. Extreme events like DANA will always be topical, sadly. But after centuries of being part of environmental degradation (the consequences of which are also manifested in such events), we must make architecture part of the solution. Through technology and innovation, we have a duty to think of cities that can respond resiliently and adaptively to climate change.

GB, LP: *Thanks again. The interview was very enriching for us and for our readers. We are very grateful to you for having shown us, with the effectiveness and synthesis of your skills as a great communicator, a path to follow: to build meanings before to build constructions.*

ITRUVIO
International Journal of
Architectural Technology and Sustainability