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Moving Architecture: Unveiling the new Italian Pavilion Building at Expo Dubai 2020

Italy's Pavilion at Expo Dubai 2020 opens to the public as an experiment into reconfigurable architecture and circularity. It features three boat hulls as the structure's roof; a multimedia facade composed of 70 kilometers of nautical ropes, made from recycled plastic; and a natural climate mitigation system that substitutes for air conditioning. The pavilion was designed by CRA-Carlo Ratti Associati and Italo Rota Building Office, with F&M Ingegneria and Matteo Gatto.

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The Italian Pavilion building at Expo Dubai 2020, designed by CRA-Carlo Ratti Associati and Italo Rota Building Office, with F&M Ingegneria and Matteo Gatto, was officially unveiled on October 1st, 2021, as part of the first World Expo ever held in the Arab world. The Pavilion utilizes three real-sized boat hulls, which could potentially set sail after the event, to create and shape the roof of the structure. Moreover, it features a multimedia façade made of more than 70 kilometers of nautical rope, and uses an advanced system for climate mitigation that constitutes an alternative to air conditioning. Overall, the project puts forward an all-encompassing vision for reconfigurable architecture and circular design that strives to address the current climate crisis while closely involving some of Italy's most innovative companies in an engaging exhibition path. The building extends over a surface of 3.500 square meters (38.000 square feet), and uses new types of building materials - from algae and coffee grounds, to orange peels and sand - suggesting new design strategies for projects worldwide.

The Italian pavilion envisions an architecture which challenges how buildings are usually developed for temporary events such as a World Expo, in which a lot of newly-built structures end up as landfill after just a few months. Contrary to that approach, the Italian Pavilion was conceived as an architecture that is able to transform itself through time, in a sustainable fashion. Three hulls, arrived in Dubai, are flipped to become the roof of the pavilion, and after Expo, they could set sail to new destinations. The boat hulls also refer to the historic connections between the Italian and Arabian Peninsulas, thus hinting at the themes of both Italy's participation in the Expo ("Beauty Connects People") and Expo Dubai 2020 as a whole ("Connecting minds, creating the future").

The three boat hulls that form the pavilion's roof vary in length from 40 to 50 meters. They were produced with the contribution of Fincantieri, the largest shipbuilder group in Europe. The hulls are supported by more than 150 slender vertical steel pillars, each 27 meters high. In turn, they support a wave-shaped roof membrane made of ETFE pillows and a layer of perforated thin metal sheets that filter the sunlight. Seen from above, the hulls are coated in an innovative paint developed by paints and coatings company Gruppo Boero. They are the three colors of the Italian flag - green, white and red - and form what might be the biggest 'tricolor' in Italy's history (2100 square meters - 22.600 square feet).

The pavilion has no conventional walls. Instead, a curtain facade made of nautical rope, which also incorporates LEDs that can be lit to transform the facade into a multimedia surface, cloaks the exhibition space. The nautical ropes are produced in recycled plastic, using the equivalent of almost two million water bottles, and form an intricate vertical meshwork that stretches almost 70 kilometers (43,45 miles) in length. At the close of the Expo, they will be reused again, in accordance with the logic of the circular economy. The use of the nautical rope and a localized cooling system integrated with misting allow for extensive shading, natural ventilation, and better thermal comfort. The project strives to showcase more sustainable ways to cool our buildings and cities in the future.

Visitors enter the Italian Pavilion's interior path via an escalator that takes them onto a skywalk suspended eleven meters above ground level, right below the first hull's nave. From this panoramic point, people can look out over the entire pavilion from a walkway that floats above the exhibition spaces and installations. Among the main spatial features are the Belvedere, a round structure topped by a dome, covered by wild herbs of the Mediterranean maquis, which evokes Renaissance gardens. Here, spirulina microalgae, cultivated by renewable energy company TOLO Green, enables the ecological treatment of air through the biofixation of the carbon dioxide emitted by visitors. The path also includes an Innovation Space dedicated to technological research, the Second Sun and Second Moon digital installations by Enel X which create a crescendo of light effects closely linked to the visitors' emotions in real-time, and the Theatre of Memory with a 3D-printed copy of Michelangelo's David developed by the Museum of the Galleria dell'Accademia of Florence and the Ministry of Culture in partnership with the Department of Civil and Environmental Engineering at the University of Florence.

The rest of the Italian Pavilion also includes materials that were chosen in consistency with the circular approach, developed in collaboration with Mapei, which manufactures chemical products for the building industry. Coffee and orange peels left to dry and reduced to powder, are used to coat the suspended pathways and walkways. The Pavilion itself rests on a dune five meters above ground level, made out of locally sourced sand. Moreover, the path inside the Italian Pavilion is enriched by a series of green elements from more than 160 different species that live inside the building. Developed in collaboration with Italy's National Research Council (CNR) and botanist Flavio Pollano, this natural landscape pays tribute to the biodiversity and ecological beauty of the Italian and Mediterranean territories. Particular attention is given to the role that plants play in stopping desertification.

Already hailed as one of the most recognizable designs at Expo Dubai 2020, the design by CRA, Italo Rota, F&M Ingegneria and Matteo Gatto will be open until March 31, 2022, with hundreds of arts and business events scheduled for the space during this time.

QUOTES FROM THE DESIGNERS

“Our design for the Italian Pavilion deals with what I believe is architecture’s most important challenge today: advancing the double convergence between the natural and the artificial. It anticipates issues and suggests strategies that will be increasingly crucial for the future of our cities as we address the consequences of the current climate crisis,” says Carlo Ratti, founding partner of CRA practice and director of the MIT Senseable City Lab at the Massachusetts Institute of Technology (MIT). “The pavilion keeps mutating into different forms. It speaks about reconfigurability both in the long term, because of its circularity, and in the short term, thanks to its use of digital technologies.”

"The Italian Pavilion has large dimensions and a very sophisticated structure, but more than an architecture in the canonical sense it is a large experimental installation focused on the increasingly blurred boundaries between Natural and Artificial. Its construction is equally inspired by natural biotypes and the most advanced technologies that come from space research," says Italo Rota, founder of Italo Rota Building Office: "On the one hand, the building looks at the organization of tropical forests, where light filters from a high canopy and life is organized accordingly. On the other hand, a crucial theme is the production of neo-materia: new construction materials that have an organic and biological origin, whose technological production is not to be mistaken with recycling. Since the Pavilion was conceived in a circular way, one can think of this neo-materia as materials that one can potentially be reused anywhere, in different forms and with different purposes. The Italian Pavilion represents almost a sort of 'architectural banking': a catalog from which to choose the elements of future architecture."

“Supporting a roof made of three overturned hulls was a real structural challenge. After a careful analysis of the main goals of the architectural project, F&M Ingegneria took care of the structural and plant design, proposing a functional integration between the two disciplines. This solution allowed to optimize costs and construction work, ensuring the comfort of the Pavilion without affecting the overall aesthetics. The engineering work management activity, entrusted to F&M, was particularly demanding in comparison with local companies and workers but allowed to achieve the set goal, ensuring compliance with delivery times”, says Sandro Favero, founder of F&M Ingegneria. "A cross-disciplinary coordination of the project between F&M and the design team allowed for effective and punctual work, along with coordination with the operators on site during the execution phase. The BIM model was implemented to grant high efficiency from design to construction, allowing it to oversee the process. The large spaces available on the first deck, called “the great dune”, with large facades without any pillars and the structure-architecture entirely exposed, are the result of sophisticated structural analysis conducted by our specialist engineers. The complexity of the construction site, where each phase has been planned in detail, as well as the creation of highly complex geometric artifacts has turned into a challenge won with the maximum result," comments Federico Zaggia, Partner and Project Director at F&M Ingegneria.

“After the design of the Expo Milano site in 2015, it was very interesting for me to participate in the design of a national pavilion for Expo Dubai”, says architect Matteo Gatto: “Representing Italy is never easy, but I believe that the theme of travel and the technology that we developed in the concept, and then for the project itself, have managed to well represent the complexity of our country, which is rooted in its history and projected towards the future.”

DESIGN CREDITS

1) Italian Pavilion at Expo Dubai 2020

Dubai, UAE

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Architecture design by CRA-Carlo Ratti Associati and Italo Rota Building Office, with F&M Ingegneria and Matteo Gatto

Photo: Michele Nastasi

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COMPANY PROFILES

ABOUT CRA-CARLO RATTI ASSOCIATI

CRA-Carlo Ratti Associati is an international design and innovation practice based in Turin and New York. Drawing on Carlo Ratti's research at the Massachusetts Institute of Technology (MIT), the office is currently involved in many projects across the globe, embracing every scale of intervention from furniture to urban planning. Among recent designs are the Italian Pavilion at Expo Dubai 2020, CapitaSpring Tower in Singapore, MEET Digital Arts Center in Milan, the Eyes of the City exhibition at the 2019 Bi-City Biennale of Architecture and Urbanism of Shenzhen, and the redesign of the Agnelli Foundation HQ in Turin. In March 2020, CRA initiated CURA (Connected Units of Respiratory Ailments), a global open-source initiative to convert shipping containers into plug-in Intensive-Care Units for COVID-19 patients. CRA is also the only design firm whose works have been featured three times in TIME Magazine's "Best Inventions of the Year" list – respectively with the Digital Water Pavilion in 2007, the Copenhagen Wheel in 2014, and Scribit in 2019. In the last years, the office has been involved in the launch of Makr Shkr, a startup producing the world's first robotic bar system, and Scribit, the write&erase robot.

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CARLO RATTI

Carlo Ratti (1971, Turin), an architect and engineer, is a founding partner of the international design and innovation practice CRA-Carlo Ratti Associati and teaches at the Massachusetts Institute of Technology (MIT), where he directs the Senseable City Lab. A leading voice in the debate on new technologies' impact on urban life and design, Carlo has co-authored over 500 publications, including *The City of Tomorrow* (Yale University Press, 2016, with Matthew Claudel), and holds several technical patents. His projects combine a scientific approach with a humanist perspective, and have been exhibited in several venues worldwide, including the Venice Biennale, Rome's MAXXI, Barcelona's Design Museum, London's Science Museum and New York's MoMA. Listed by Wired as one of the "50 people who will change the world," Carlo Ratti serves as co-chair of the World Economic Forum's Global Future Council on Cities and Urbanization, and was nominated chief curator for the Bi-City Shenzhen Biennale of Urbanism\Architecture that will open in Shenzhen, China in December 2019.

ABOUT ITALO ROTA BUILDING OFFICE

Italo Rota Building Office is an international architectural office founded by Italo Rota and based in Milano, Italy. With over thirty years of constant and advanced multidisciplinary research, IRBO develops innovative projects where humanistic beauty and sustainability are integrated in fields that extend to contemporary art and robotics. Aiming at the priority of achieving new living systems for the city of the "extreme present", IRBO applies the most advanced technologies collaborating with labs, design firms and international universities. The office counts on the balance between art and science in its design research, creating a poetic manifestation that sustains the creation of projects with a new notion of beauty, a notion that according to Gardner "is the capacity of generating interest by a memorable form and an attitude of evoking further explorations."

ITALO ROTA

Italo Rota (1953, Milano) is a graduate of the Polytechnic University of Milan. Upon winning the competition to design the interiors of Musée d'Orsay in the 80s, Rota moved to Paris working on many important projects in France among; the renovation of the museum of Contemporary art at the "Centre Pompidou", with Gae Aulenti, the hall of the French school at Cour Carré of The Louvre museum, the lighting of Notre-Dame Cathedral, the lighting of the banks of the Seine river in Paris and the renovation of the historical center of the city of Nantes. Rota returned to Milano in the 90s to become one of the leading architects of a new architecture, designing important projects in Italy and the world. More recently, IRBO has designed the civic museums of Reggio Emilia, the new Elatech robot factory in Brembilla, the grand children theatre in Maciachini Milano, the new pavilion laboratory Noosphere at the Triennale di Milano, The pavilion of Kuwait at EXPO Milano 2015, the pavilion of Italian wine and the pavilion of Arts and Foods. Among IRBO's symbolic

projects, the Museo del Novecento in Piazza Duomo in Milan, the headquarters of Columbia University in New York, the Hindu Temple in Dolvy in India. The office worked on exhibitions in major museums, publications, installations and pavilions, including the Pavilion central theme for Expo Zaragoza 2008. Rota is the Scientific Director of NABA, New Academy of Fine Arts in Milan, lecturer at Shanghai Wusong International Art City Shanghai Academy of Fine Arts, Advisor at the Tsinghua University of Beijing, one of the most prestigious Chinese universities. Italo Rota has been awarded several prizes, including the Gold Medal for Italian Architecture for the spaces public, the Gold Medal to the Italian Architecture for Culture and Leisure, the Landmark Conservancy Prize, New York and the Grand Prix de l'Urbanisme, Paris.

ABOUT F&M INGEGNERIA

F&M Ingegneria is a leading engineering company in the provision of cutting-edge design solutions in the sector of civil engineering, infrastructures, project management and sustainability. F&M Ingegneria controls F&M Retail, F&M France, F&M East Europe, F&M Middle East, F&M Divisione Impianti and F&M Infrastrutture, with more of 150 experts in the offices in Italy (Venice, Milan, Rome) and abroad (Köln, Paris, Tirana, Dubai and Muscat). For over 40 years F&M Ingegneria has been offering highly qualified professional services in different building sectors (hospitality, healthcare, historic buildings, offices, residential), infrastructure (maritime works, airport and railway terminals, ports, roads, bridges and underground works) and the project & construction management of prestigious buildings and complex projects.

The experience gained, the interdisciplinary approach and the focus on results allow all the F&M group's companies to act as a guarantee of success for each client.

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ABOUT MATTEO GATTO

During his career, Matteo Gatto has followed many of Milan's major projects of urban transformation, has served as Chief Architect of Expo Milano 2015 and has coordinated the design for the venue of Matera2019. Winner of numerous awards and scholarships, he has been published on and writes for various international magazines, is lecturer in many universities and has been an exhibitor at numerous international exhibits. matteogatto&associati is a creative hub of architects and artistic directors, born from the experience of designing Expo Milano 2015, deeply focused on major events and projects on a metropolitan scale, and on creating experiences and raising emotions and wonder at every scale: from the spoon to the city. matteogatto&associati provides solutions and strategies for major events, urban projects and real estate, design, branding and wayfinding.