





Towards resilient communities through prototypes for human-centered public spaces

L. Palmero and G. Bernardo

MARCELLA DEL SIGNORE

Architect, urbanist, educator, scholar, and the principal of X-Topia, a design-research practice that explores the intersection of architecture and urbanism with technology and the public, social, cultural, and cognitive realm. She has been involved in evidence-based research and applied-design projects investigating the intersection of architecture, urbanism, emerging technology, livability, and emotional/cognitive spaces. She is an Associate Professor and Director of the Master of Science in Architecture, Urban Design at New York Institute of Technology. Since 2007, she has taught Architecture and Urban Design in international institutions of higher education in the USA and Europe, and in 2019 she received the NYIT Presidential Award for the integration of Technology and in 2023 the Outstanding Faculty Research Award. She has published five books on urbanism, human-centered design, and emerging technologies, including *Urban Machines: Public Space in a Digital Culture* (LISTLab, 2018; OROEditions 2020) and "Data, Matter, and Design" (Routledge, 2020).

She co-curated the *Data and Matter* exhibition during the 2018 Architecture Venice Biennale. She was invited to exhibit at the 17th Architecture Venice Biennale in 2021 in the Italian Pavilion *Resilient Communities*, and she was the deputy curator of the NYIT *Students as Researchers* Collateral Event at the 18th Architecture Venice Biennale in 2023.

INTERVIEW WITH MARCELLA DEL SIGNORE

We have the pleasure of having with us Marcella Del Signore, an architect, urbanist, and Associate Professor and Director of the Master of Science in Architecture, Urban Design at the New York Institute of Technology, School of Architecture and Design in New York City. In 2008, she founded X-Topia an award-winning design-research practice based in the US, Italy and Brazil that explores the intersection of architecture and urbanism with technology and the public, social and cultural realm. X-Topia has been engaged in a wide array of urban interventions and small-scale prototypes recognized internationally through publications, grants, and awards.

First, thank you on behalf of the editorial team and all readers for accepting our interview.

Graziella Bernardo: *The first question is a curiosity about the name X-Topia. It has an assonance with utopia. Where do your research activities take us? Wherever it is, we are ready to follow you and interconnect us.*

Marcella Del Signore: X-Topia's name comes from the ancient Greek word "topia", which means place/position/location/geographic region. The notion of Geographies, here are intended as the arrangement and interrelations of the world as a whole, or just the notion of place. And, the "X" brings the notion of multiple/different.

My research activities take us to innovative intersections where technology, design, and urban life converge. By focusing on the positive integration of enabling technology, not only in urban settings but also in enhancing overall human experiences, we aim to develop solutions that address current challenges and anticipate future needs through a human-centric approach.

These solutions operate systematically, interconnected within a comprehensive and collaborative ecosystem. Through interdisciplinary approaches, they synergistically tackle the multifaceted challenges of urban living, ultimately enhancing the quality of life, well-being, and livability in diverse environments.

Luis Palmero: *Interconnectedness is one of the keywords of your holistic methodological approach on inter-scalar spatial practices. Everything that happens in one place has consequences on the whole planet. What was the educational and professional path that led you to this acute awareness?*

MDS: I grew up and studied architecture in Italy at Sapienza University in Rome and right after moved to New York to study at Columbia University, graduating with a Master of Science in Advanced Architectural Design. I have lived for ten years between New Orleans and Rome, and currently living in New York where I direct the Urban Design Program at New York Institute of Technology.

Since the development of my thesis at Sapienza in Rome, I have always been interested in understanding how human dynamics are translated into the making of public and urban spaces and how design is able to support and facilitate these processes. Within this framework, I see the theme of "interconnectedness" as a view of the world that allows us to recognize the manifold states in which we are connected to each other, both as humans and non-human bodies. In this regard, I see the public realm as a stage for "interconnectedness" to manifest itself and heighten such conditions.

GB: *Your activities focus on the relationships between public space and socio-technological systems. They are the mirror of the collectivities, of their cultures and of the degree of knowledge everyone has of others. Can you give us a definition of both and explain how the design of public spaces can play a role in democratic access to information in the age of digitization and big data?*

MDS: My focus on the public space makes me see it as an extended field where the public dynamics of society and the encoding of matter take place, through a logic of Interscalarity. Public realm and domain refer to the expanded sphere where individuals express themselves as part of a larger collective. The public domain is a point of focus, where the politics of the body are redefined. How we relate to each other is part of how we relate to the city. The public realm, I believe, is one of the expanded fields where the deployment of socio-technical systems are inherently embedded.

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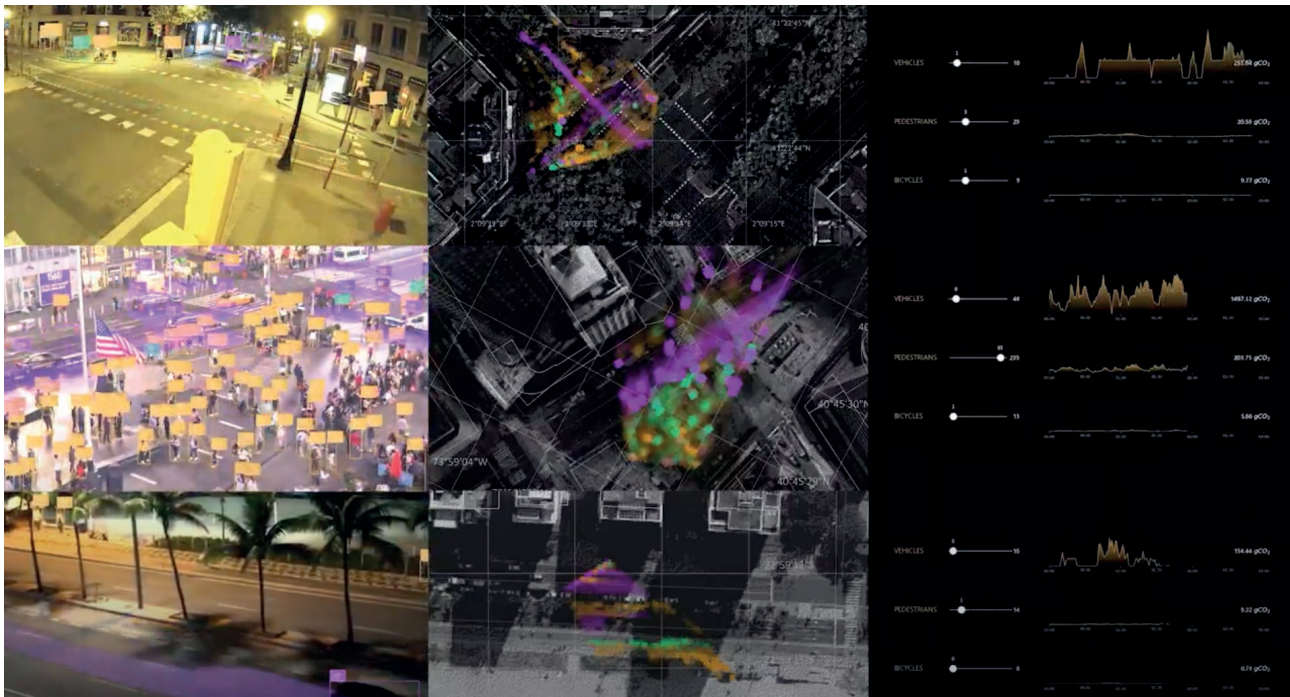


Figure 1 | Data Mapping @XTopia-Noumena ©Marcella Del Signore..

A socio-technical system engages social structures to develop the design of systems that involve people, technology, and their environment. It recognizes the inherent relations between society's complex infrastructures and human behaviors. Socio-technical theory acknowledges the fact that we need to DESIGN both aspects together through a more holistic view.

Langdon Winner wrote that *"society is not determined by technology nor is technology determined by society. Both emerge as two sides of the sociotechnical coin."* The relationship between society and technology has existed since the beginning of humankind, but the difference between the past and present technology is the extent of social binding - The more social forces it binds together, the more powerful the technology is. The "social shaping" of technology recognizes that technologies in general are the outcomes of social action.

Especially now, the reflection on the public domain is an important parameter to define how we live as a collective; we are challenged to redefine our norms in public space, and this is also an opportunity for designers to rethink and redefine the fundamentals of living.

Cities are both expressions of cultural practices and current technologies, environment, space, technology at different levels are intertwined to produce a space

that encourages new modes of urbanity for the PUBLIC DOMAIN and the emergence of new forms of public life.

As we know, the discussion on the role of data in our design process is an important aspect for how we now operate as designers, especially in the age of AI. How data are produced, who owns them, and their relative bias is directly connected to democratization and relative access. I believe for us as designers what is relevant is the positive agency of data able to support our modes of production. The *"Data, Matter, Design"* books co-edited in 2021, published by Routledge expands exactly on this topics, trying to give a glimpse on how data in design methodologies and theoretical discourse have evolved in the last two decades.

LP: *In your projects, matter and information are one. It almost seems as if information dictates the form and matter is only a medium. Your prototypes use encoded materials. How important is collaboration with ICTs experts in your design?*

MDS: The current information and communications technologies have redefined the sense of place or non-place. In my projects information technology is represented as a catalytic tool for expanding, augmenting and altering public and social interactions in urban space. It has the capacity to enhance the relationship between the city, citizens, place, and technology through feedback

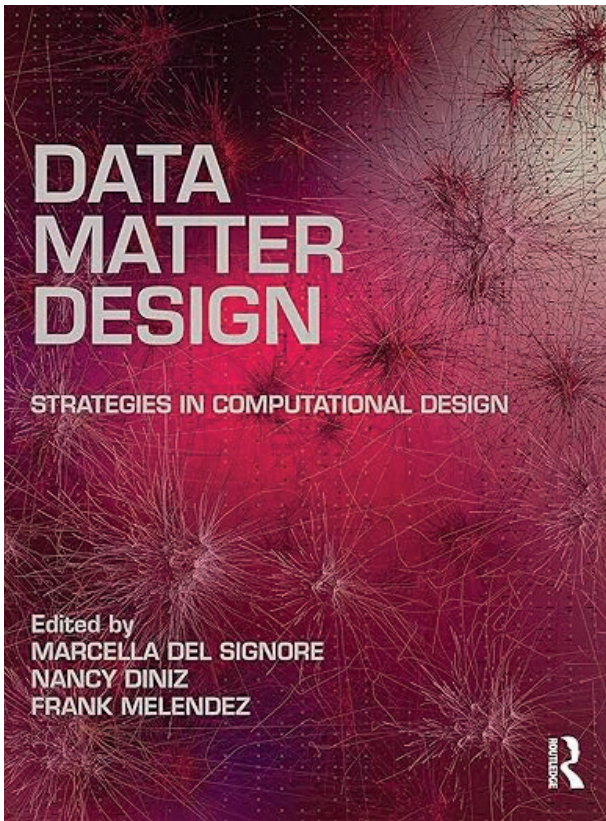


Figure 2 | Data Matter Design.

mechanisms. This research has been the basis for the co-authored “Urban Machines: *Public Spaces in Digital Culture*” that expands precisely on those themes.

We live in an age of “ubiquitous” computing”, which considers the social dimension of human environments. Urbanity is rapidly changing given the accelerated rate of globalization and the ubiquity of ICTs. The urban prototypes developed also have the generative capacity to catalyze processes of co-creation of the “open city,” a city that can be transformed through the synergy of bottom-up and top-down processes. They are interventions in the urban public space that function as a system and through ICTs, promote, test and prototype the relation between city, technology and the human scale.

GB: *In the exhibition ‘Urban Syncopation’ at the Gardiner Museum in Toronto, you brought the life and sounds of the city into the museum. Can you tell us about the project? Is it a prototype that can be replicated in other cities?*

MDS: This project explores the notion of transcoding as a socio-technical act. Transcoding in simple terms is the act to convert (language or information) from one form of coded representation to another. Urban syncopation



Figure 3 | Urban Machines.

is a performative topography and façade prototype that temporarily inhibits the city and functions as an infrastructural device that collects, transcodes, and re-transmit the collective “heartbeat” of the city. This project was developed in collaboration with architects/urbanists Ila Berman, Mona El Khafif, Steven Beites, and myself.

Each strata is defined through a series of “pixels” or modules to generate a vertical topographic pattern. The variations - as the lateral compressions and expansions the folded surface, emphasize the ways in which information is redeployed across the space. Each pixel is constructed as a flat surface to then be folded to achieve a three-dimensional configuration. These volumetric pixels operate as building blocks of the wall system. Each strata is associated with a street in downtown Toronto and receives data from each of the locations.

Sound sensors track urban activity levels throughout the day and night, and translate them into a rhythmic series of pulsing inputs and extracted data graphs. The collected soundscape was transcoded and processed to visualize the amplitude of each sound and then



Figure 4 | Urban-Syncopation ©Marcella Del Signore.



Figure 5 | Urban-Syncopation ©Marcella Del Signore.



sequenced as an horizontal array. Here, the city is understood to be simultaneously material and performative: a physical artifact as well as an infrastructure or stage for the more ephemeral activities and events of urban life to take place. These sensorial conditions of urbanity are captured in the piece in two distinct ways—one material and the other performative.

Sound sensors located along streets in downtown Toronto are used to retrieve 12 hours of sound data to track proximate and distant urban activity levels throughout the day and night. Since sound occurs more in time than in space, each track of sound was then visualized as a running barcode that encoded the rhythm, frequency, and intensity. This barcode mediates between the aural and visual realms by converting both sensorial materials into codified strings of data.

The six layers continuously stream pulsating inputs producing a syncopated effect that renders visible the ephemeral events of urbanity. In the project, the socio-technical act of transcoding operates as a translator between the material and sensorial realm. It is a mediator among body, architecture, and urban protocols, and the means by which the sensorial and experiential city is condensed and re-materialized.

The project explores forms of rematerializing the sensorial city and can be replicated in any city, since the public domain is investigated through audio and sensorial data to register public life and ultimately urbanity, in this case in downtown Toronto. This web of sonorous and visual sensory data is meant to perform, through the surface itself, as an abstract index of urban life and collective living, which enables the project to embrace material behavior and performance as a means to derive the overall form.

LP: *This installation consists of repeated modules that recall the facade of the Tod's building in Omotesando, Tokyo, by Toyo Ito. What material is it made of? With what production process have they been obtained and how have they been put in place? This idea of architecture in terms of the combination of asymmetric elements that give harmony to the architectural organism is a constant of your work or depends on the chosen material that imposes the final result?*

MDS: Each individual pixel is constructed out of a perforated aluminum composite surface. The tracery of inscribed lines, that traverse this surface, are CNC-cut and scored to allow the stiff material to bend, enabling it to capture space through its own enfolding. The resulting interlaced pattern -an undulating triangulated surface of peaks and valleys-generates continuities

MEDIA-Responsive Strategies

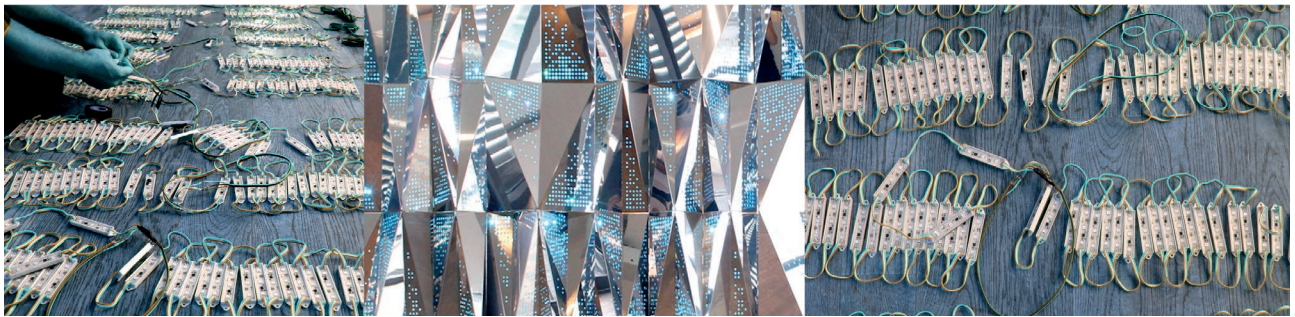
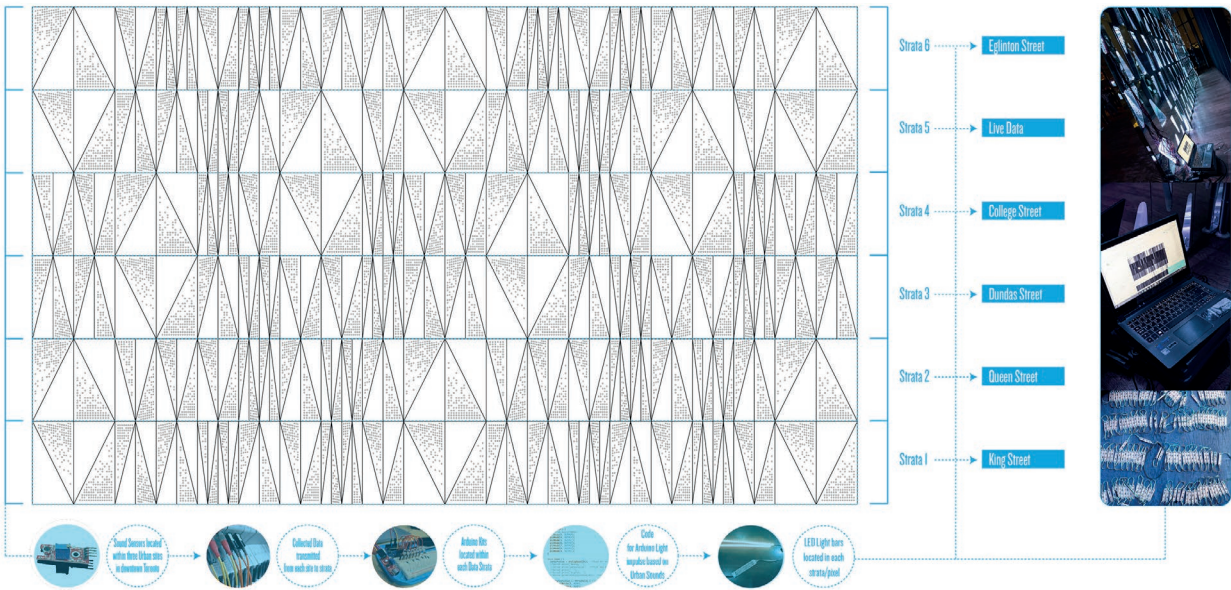


Figure 6 | Urban-Syncopation ©Marcella Del Signore.



Figure 7 | Urban-Syncopation ©Marcella Del Signore.

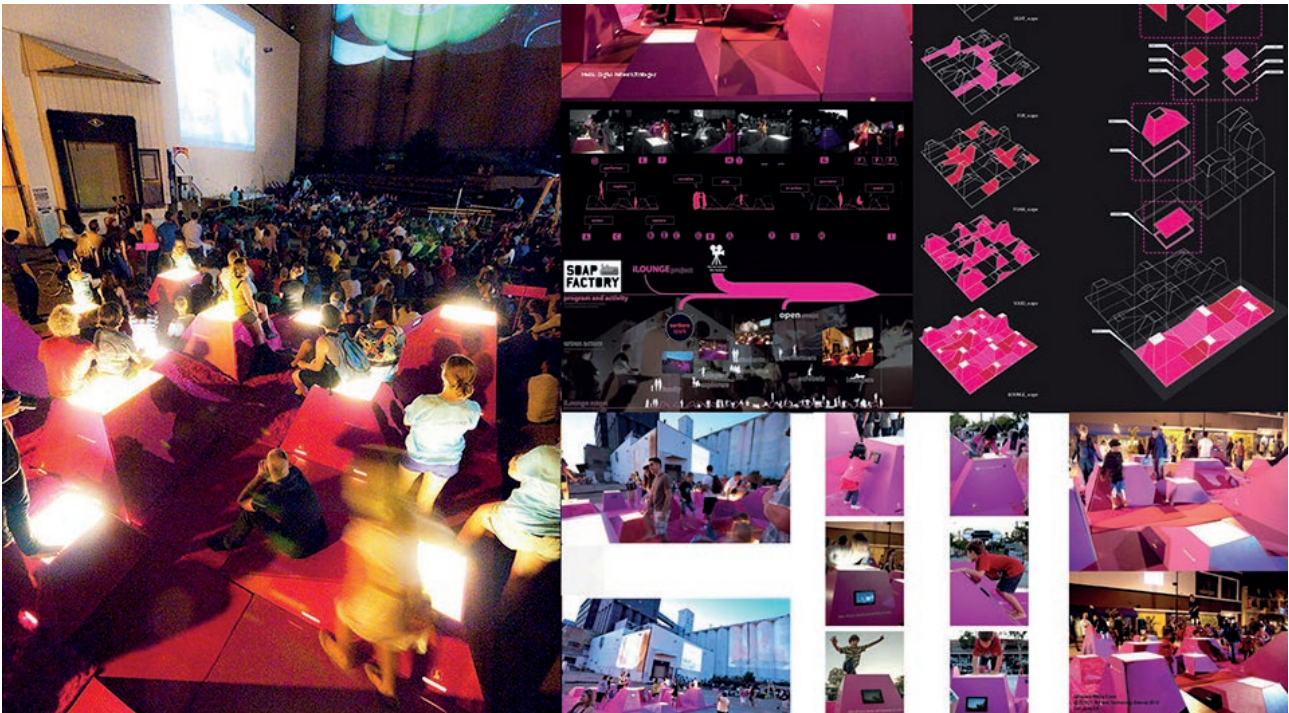


Figure 8 | _iLOUNGE ©Marcella Del Signore.

across the skin while emphasizing its interwoven logic. The rhythmic series of faceted pixels, which passively fragment, and reflect surrounding motion, are organized into the six horizontal strata, each of which receives data from a different remote downtown site and that collectively refer back to the layered streets that constitute the downtown fabric of Toronto. Sound sensors located along commercial east-west urban corridors from King to Bloor Street, along with those situated within the immediate environment of the piece, are employed to track urban activity levels throughout the day and night and transcode this data into a rhythmic series of pulsing lights that undulate and move laterally across and within each of the strata.

The harmony of the projects relies on the coherence between each individual concept and material. In my design process, the outcome aligns with the goals and strategies of the project, integrating a feedback loop that combines both bottom-up and top-down processes. In this case, the layering of passive and active systems productively recircuits the movements of collective urban life while weaving them into a single syncopated surface. As a result of its materiality and geometry, the surface reflects, refracts and fragments the surrounding space and motion of visitors who become both actors and audience in the space.

GB: *In the iLOUNGE project that you experienced in Minneapolis and San Francisco, what were the outputs? Did the community benefit from networking? Were the spaces used only for events or were they also used during ordinary days? We ask because we need spaces to dream, to talk or to rest and we believe that everyone would be happy to experience a collective way of doing this.*

MDS: iLOUNGE is a device for place-making where the visitors were an active part of its spatial production; it provided a social stage to create a temporary community. The project emerged from the existing underused infrastructures of the city, nesting within the urban fabric and operated as an infrastructure and platform that was plugged-in different urban contexts, an infrastructure for a series of digital plug-ins.

A set of instructions, or allographic notations, informed by material systems triggered a specific type of programmatic and human occupation. The project was developed through anchor programs and activities related to the multiple sites where it was plugged-in. The power of the instructions embedded in the modular system lies in the continuous exchange between the analog strategies (material systems and analog narratives) and digital strategy.



Figure 9 | DataField ©Marcella Del Signore.



Analog narratives in the form of questions to citizens were embedded in the space and triggered users' interaction and awareness of their surroundings, while digital narratives were able to create a responsive-aware network. The project emphasizes networking as a socio-technical act and the ability to connect people, thus creating a diffuse system of networked communities. The largest potential here lies in the strategic choreography of bottom-up participation as a form to improve the intelligence of our cities. This approach is based on the notational practice as a direct and powerful agent of change, able to embody open source strategies as an instrument of collective empowerment.

The project was first built in San Francisco, then moved to Minneapolis, then back to California and it was tested in different public realms for about one year. The power was the capacity to work with different communities and ages every time to be able to catalyze social practices and urban interactions.

LP: *In the Datafield project in New Orleans, the architecture is information on the operating level of the complex water pump system. The resilience of communities depends on access to information. Kudos for this work. It is a concrete example of a resilient socio-technical system. Can you explain how the operating data of the pumps were used for the physical layout of the public space? What kind of materials did you use and how are they interconnected to the pump system?*

MDS: DataField makes a connection between the city's topography and its intricate water infrastructure network essential for the existence of the city itself. Using parametric modeling software as a means of conceiving the desired geometry, a network of macro and micro points establish the relationship between pumping stations and their respective capacities. Linking these points to the sectional representation of the topography, the project becomes a responsive and inhabitable 3d map of the City's water infrastructure while acting as placemaking machine along one of the main water canals in the city of New Orleans.

The gradient from light to dark blue poles show the inverted topography of the city and how data begin to inform matter in its manifestation. The macro poles are placed in direct conjunction with pumping station locations responding to real-time data of water capacity. The layered machine allows for the cohabitation of people, communities and the constant mutation of informed phenomena.

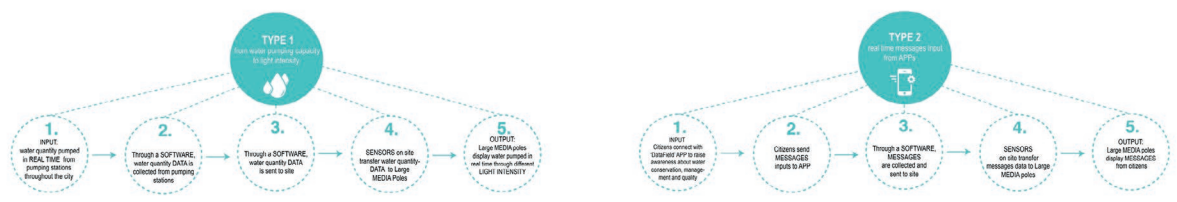
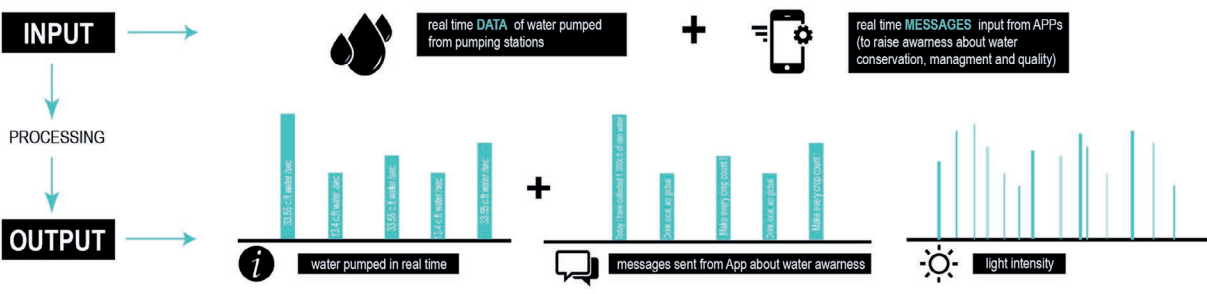


Figure 10 | DataField ©Marcella Del Signore.



Figure 11 | Urban-Syncopation ©Marcella Del Signore.

The vertical linear Led fixtures are programmed through custom software connected to a light system manager registering the overall water fluctuation in the city and translating it through light intensity; as soon as the water flows at a pumping station, it triggers an immediate response that is displayed through a change in color/intensity in the Led poles. The installation becomes a REAL TIME MAP of the dynamic water conditions of the city, always experienced differently according to the input received.

The technologically-mediated narratives work across scales, from the individual to collective. The hyper-mediated environment is generated by a range of data related to water dynamics, rendering a reality in constant mutation while increasing awareness on how we can live with water.

GB: *In the prototype Aério, exhibited at the 17th Venice Architecture Biennale in 2021 in the Italian Pavilion "Resilient Communities", the interrelationships between public space and socio-technical systems are extended to health, opening new scenarios of collective ecology.*

The architecture is a macro-breathing organ that acts as a cleaning/filtering/processing air device through the performative textile material embedded having the property to mineralize primary greenhouse gasses polluting the air we breathe (CO₂, NO_x, and VOCs). Could you explain how the techno polymer Wearpure.Tech used is made and what the working principle is?

MDS: WEARPURE.TECH a 100% natural mineral compound that has the property to mineralize primary greenhouse gasses polluting the air we breathe. It can adsorb and neutralize CO₂, NO_x, and VOCs, converting them into active minerals. The technology operates through several phases, including catalysis, photocatalysis, carbonation, and nitrification and acts as a cleaning/filtering/processing material through the performative textile material embedded and woven into the surface.

The catalytic additives in Wearpure.Tech facilitate chemical reactions that transform harmful gasses into less harmful substances. For example, NO_x gasses can be converted into harmless nitrates. Photocatalysis occurs when the material is exposed to light, particularly



Figure 12 | Aério ©Marcella Del Signore.

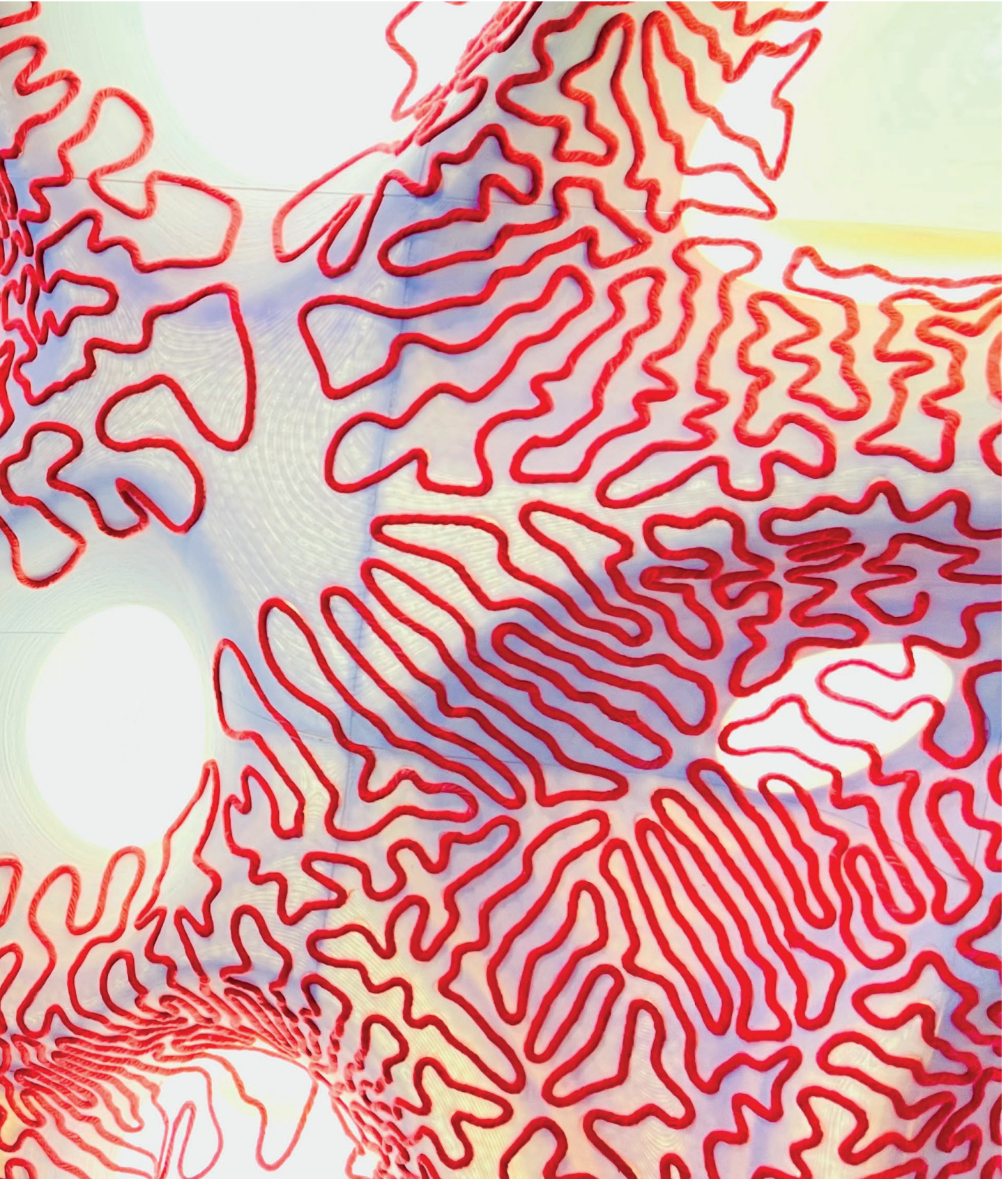




Figure 13 | Air Ecology Machine ©Marcella Del Signore.

UV light, activating photocatalysts like titanium dioxide (TiO₂). This activation enhances the material's ability to break down pollutants, such as converting CO₂ into carbonate minerals under light exposure. During carbonation, the captured CO₂ reacts with the material to form stable carbonate minerals, effectively removing CO₂ from the air and incorporating it into a solid form. Nitrification transforms NO_x gasses into nitrates, which are less harmful and can be safely integrated into the environment.

LP: Can you give us some results of the *pneuSENSE* project that you experimented in different areas of New York with the monitoring of biometric and environmental parameters? Are there healthier parts of the city than others?

MDS: This project gives me the opportunity to discuss the politics of the body, giving form to the BODY as a relational system. The project engages simultaneously two sets of data and sensing devices: environmental sensors (sound, light, temperature, humidity, and CO₂) and body sensors (heart rate, stress sensor, skin conductivity) to understand their codependency and how these relations affect our physical and mental wellbeing in the urban environments of New York.

The project invited us to rethink the relationships between the individual and the collective in cities, through the body as a site, and how to reciprocally influence each other. The project goal was to embody the dynamic relationships of interdependence and reciprocity, between micro (body) and macro (environment) systems, within a diverse range of urban conditions found within New York City. Users were able to 'plug-in' to the physical prototype reading various biometric

data providing actuated feedback through breathing (inflating/deflating) and pulsating (lighting) effects. The result was an inhabitable Neuro-responsive space where people were able to experience what it would be like to walk in certain areas of NYC and the relative effect on the body..

GB: In your works the material is almost irrelevant in terms of volume. In most cases they are temporary, mobile, easily assembled and disassembled architectures. Once the exhibition is over, in the case of temporary exhibitions, is their reuse or re-use planned in other public or educational spaces such as schools or kindergartens?

MDS: We always consider the post-life of our projects during the design phase, aiming to ensure they can continue their journey in diverse spaces and scenarios. Our goal is to create urban prototypes that can be repurposed and applied in different contexts, sparking new outcomes and discussions. We've seen this vision come to life with projects like *Aërio*, which is now part of the collection at the MACCA Museum in Peccioli, Tuscany, Italy, and *iLounge*, which has traveled extensively. These are some examples, but in general we intend to design adaptable, impactful solutions that extend far beyond their original settings.

LP: During your research, teaching and design activities, have you noticed differences in the reactions of stakeholders (communities, government agencies, universities, designers, students, etc) in the different geographical places where you have operated? Were there any differences in the pre- and post-pandemic

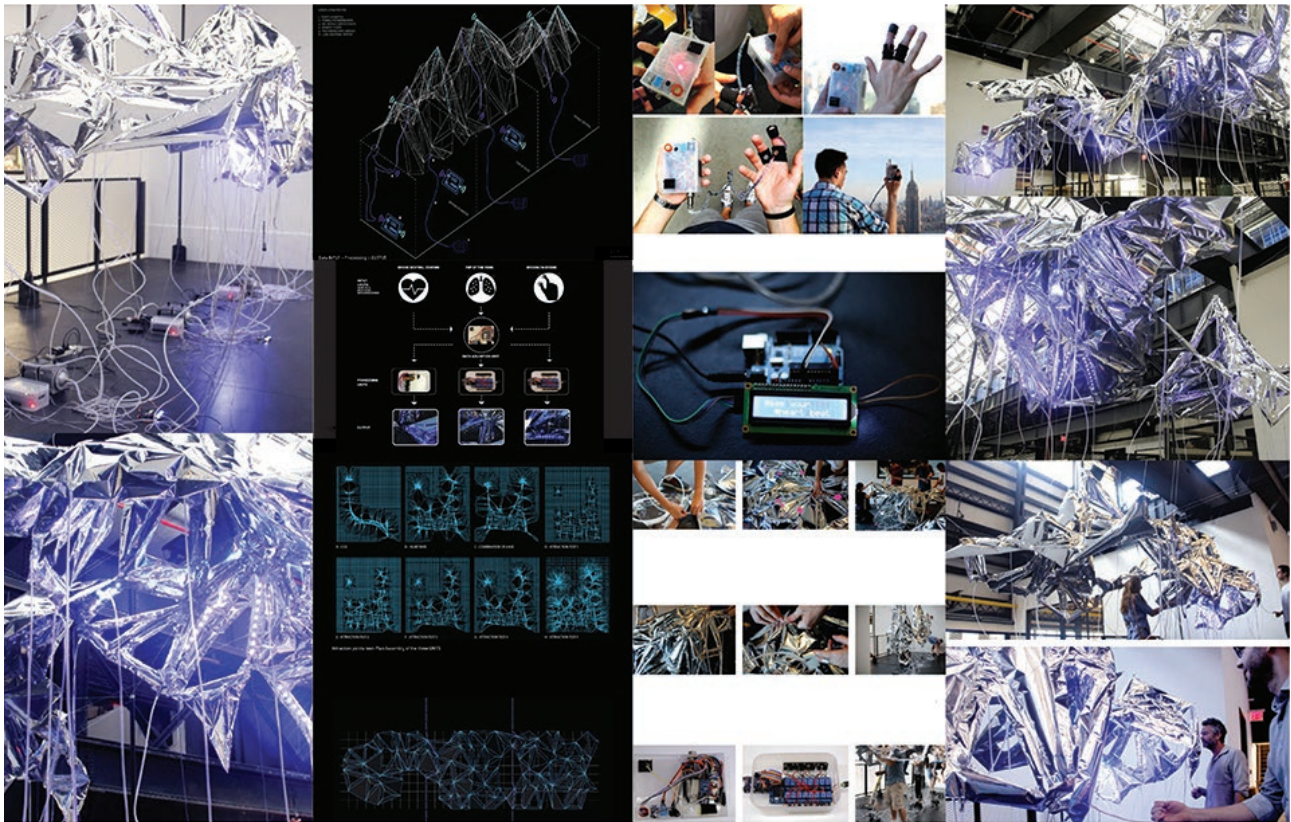


Figure 14 | PNEU-SENSE ©Marcella Del Signore.

period? Currently, are some places less ready than others to understand and use this type of architecture?

MDS: During my research, teaching and design activities, I have seen a variety of interactions with communities, stakeholders, institutions, etc., as well as modes of working. This has been the richness of the work, working with real people in real contexts that are very different from each other. Moreover, people's engagement in any form and modality has been paramount for the success of some of these projects. For sure, geographic and cultural differences have impacted but the people we have worked with have been quite receptive and proactive in their engagement.

GB: *Each of your projects is a prototype experimentation tailored to the places and needs of the public space and the socio-technological system. Have you ever thought about combining these objectives to bring them together in a single prototype with the possibility of small variations for adaptation to the context, a kind of Marcella Del Signore brand?*

MDS: In some projects there is definitely the possibility of combining some of the processes into a single

solution, but also I believe in their capacity of being "heterogeneous" by nature, being adaptive to community and places in and of themselves. I have followed for many years "urban prototyping" as a strategy for design; this follows a pretty rigorous sequence of actions comprised of prototyping (develop a fully built prototype to be used as testbed), replicate (in other type of urban contexts), and adopt (eventually work with cities and governments to make certain solution be adopted and implemented in the long-term) working both with bottom-up and top-down strategies. My hope is that through projects that directly engage the public realm we foster a higher level of livability and quality of life for all.

LP: *Thank you, Marcella. We believe - and we are sure our readers too - that the uniqueness of each place deserves always a prototypical design of public realm, which are the highest expression of collective living and the driving force for promoting the well-being of individuals and the resilience of communities.*