Atomized/Retrofitted Functioning

2025

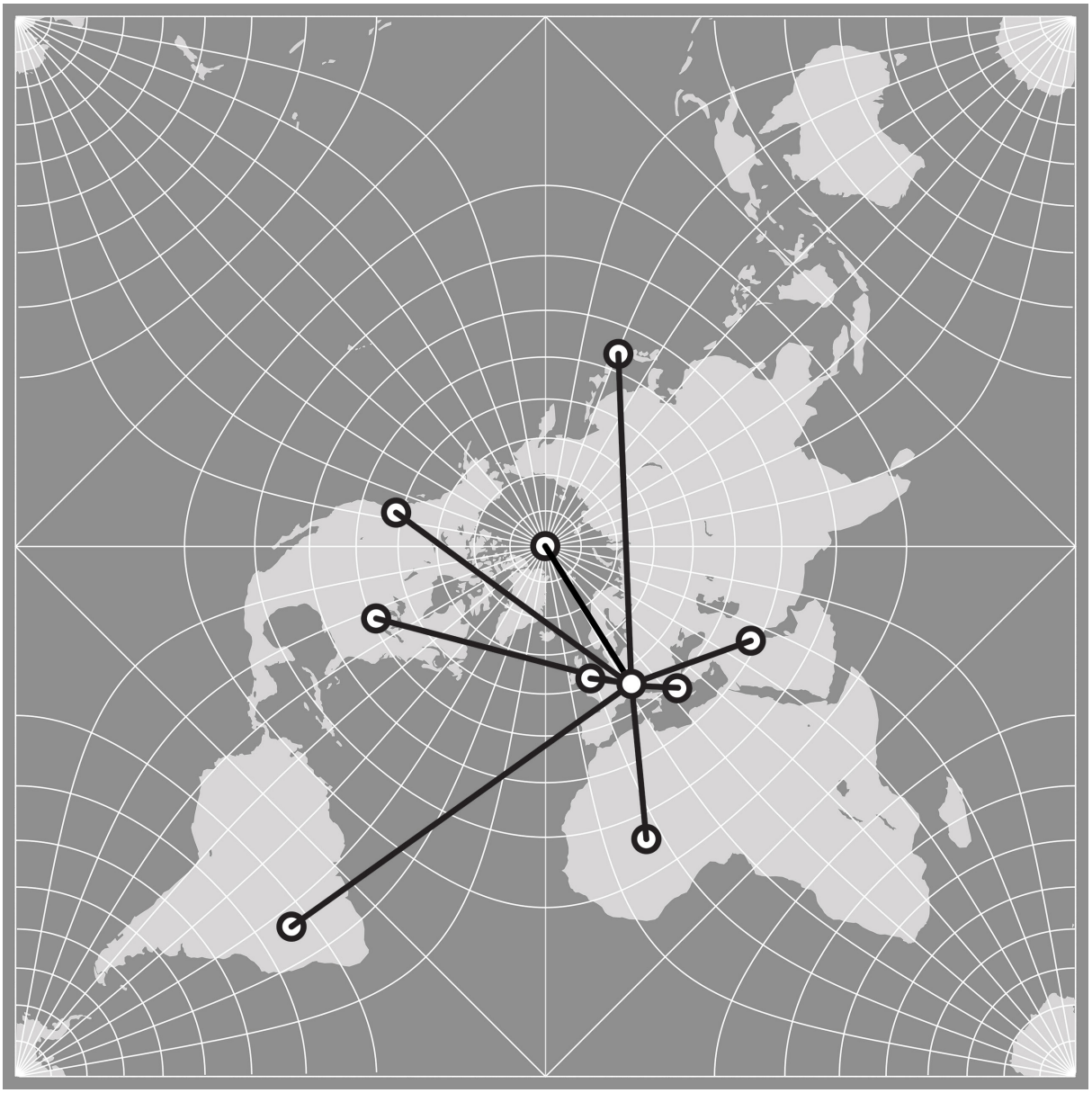
Architectural Intelligence, software piece, project by fabric | ch

Funding: Biennale di Venezia, Pro Helvetia, Computed·By

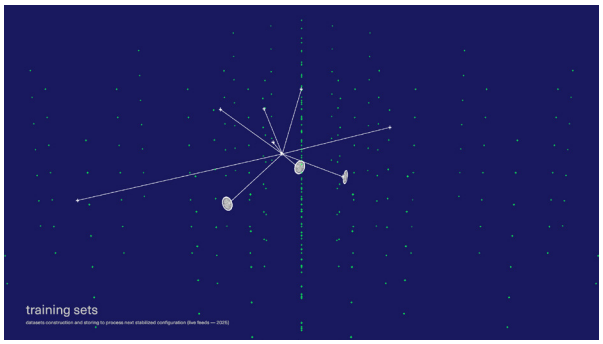
Location: Venice (IT)

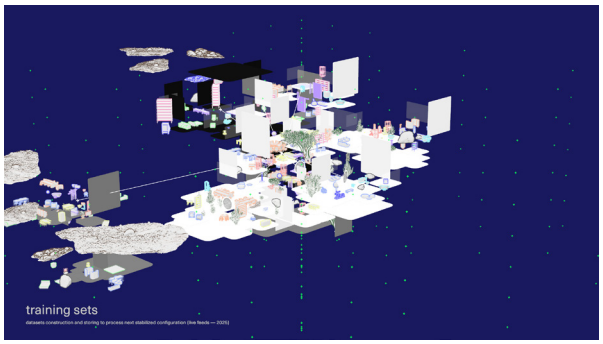
Exhibited during *Intelligens – Natural. Artificial. Collective* / spring-autumn 2025 at the Arsenale, La Biennale di Venezia

- Use: custom-automated, retrofitted, and ever-evolving habitat conception, retrofitting, and datasets generation based on live environmental conditions
- "Test-tube", abstract digital environment channeling live planetary conditions
- Live planetary conditions across historical, modern, and contemporary human settlements
- Exploring past, present, and future temporal and environmental conditions
- Radical algorithmic and feedback experiments



[Img. 1]

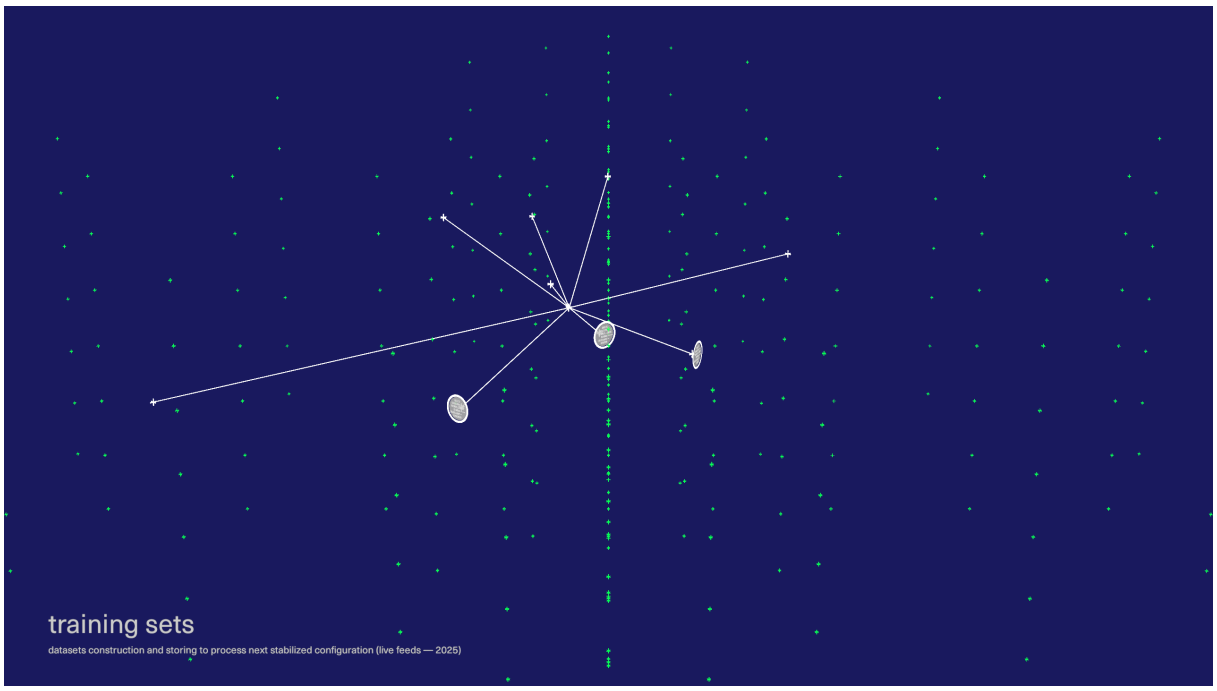


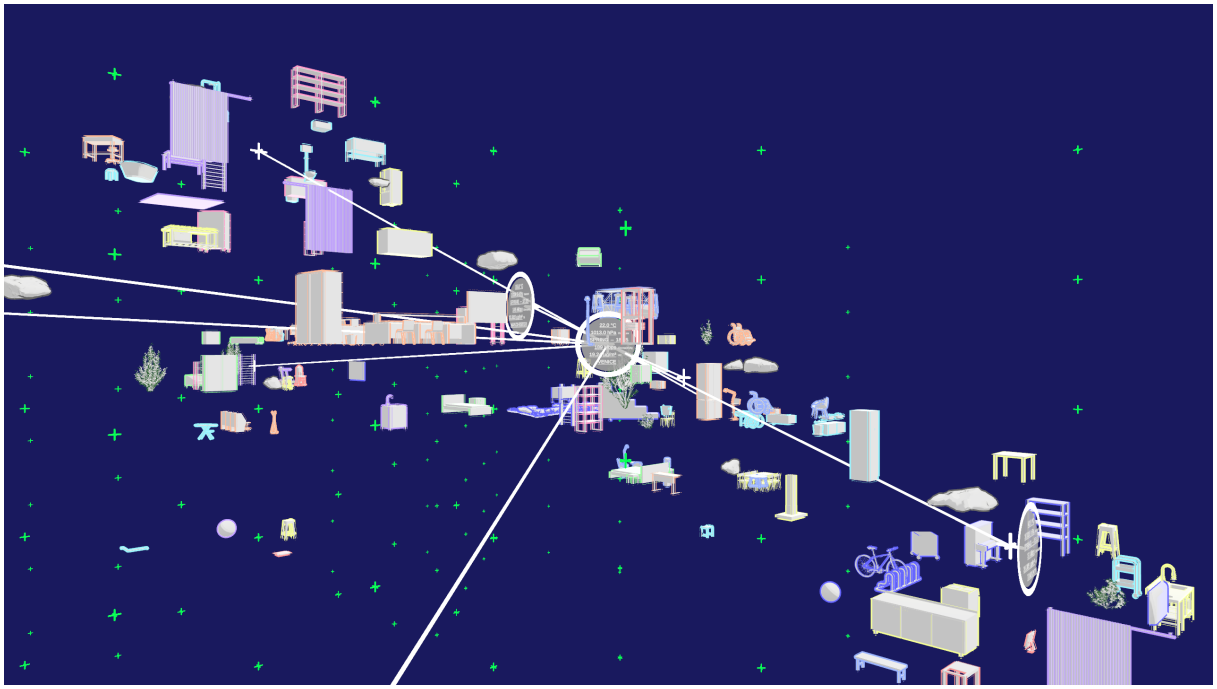


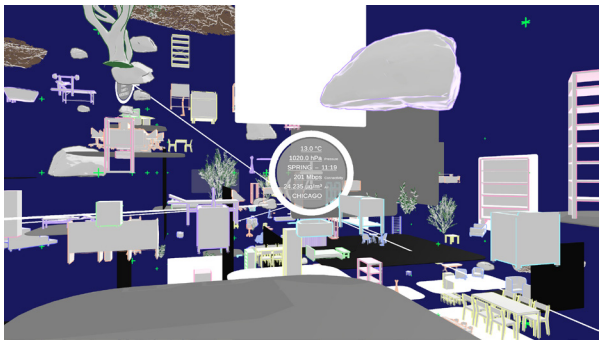
[Img. 2, 3]

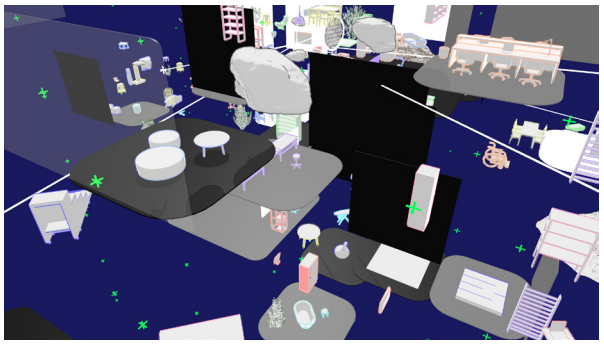
[Img. 4]

[Img. 5]

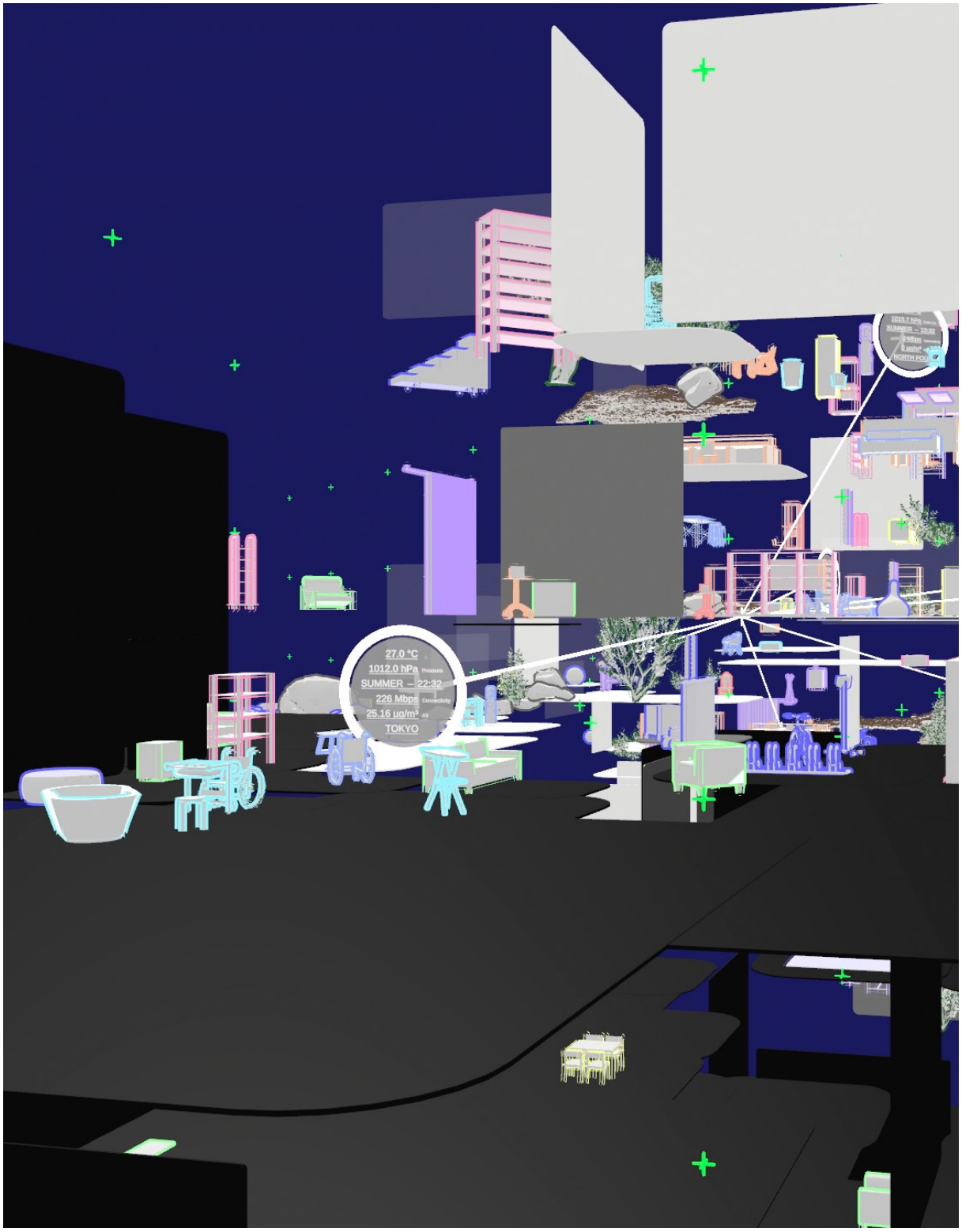

training sets
datasets construction and storing to process next stabilized configuration (live feeds — 2025)



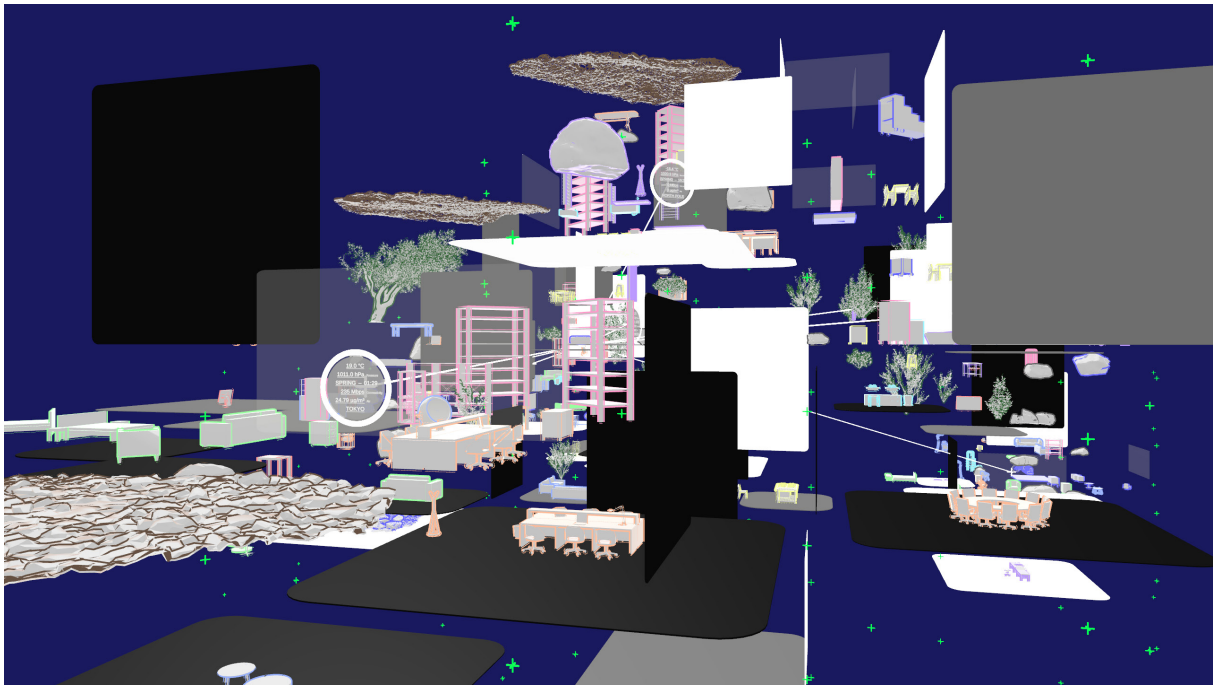


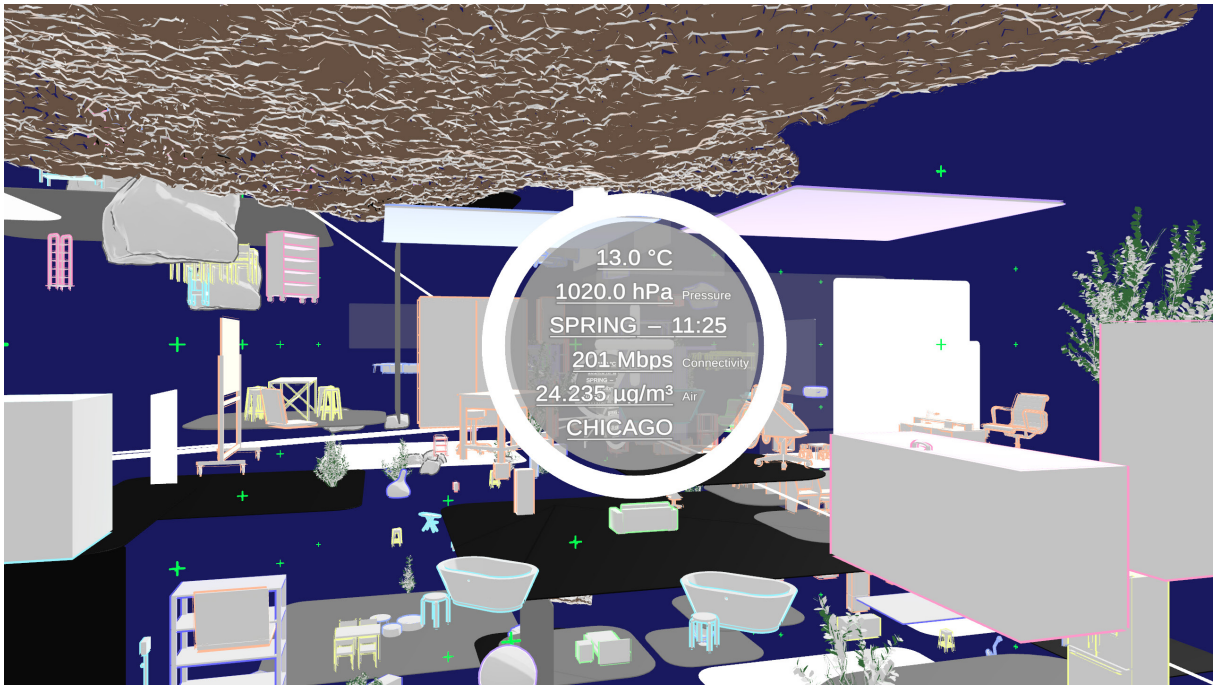


[Img. 6, 7, 8, 9]

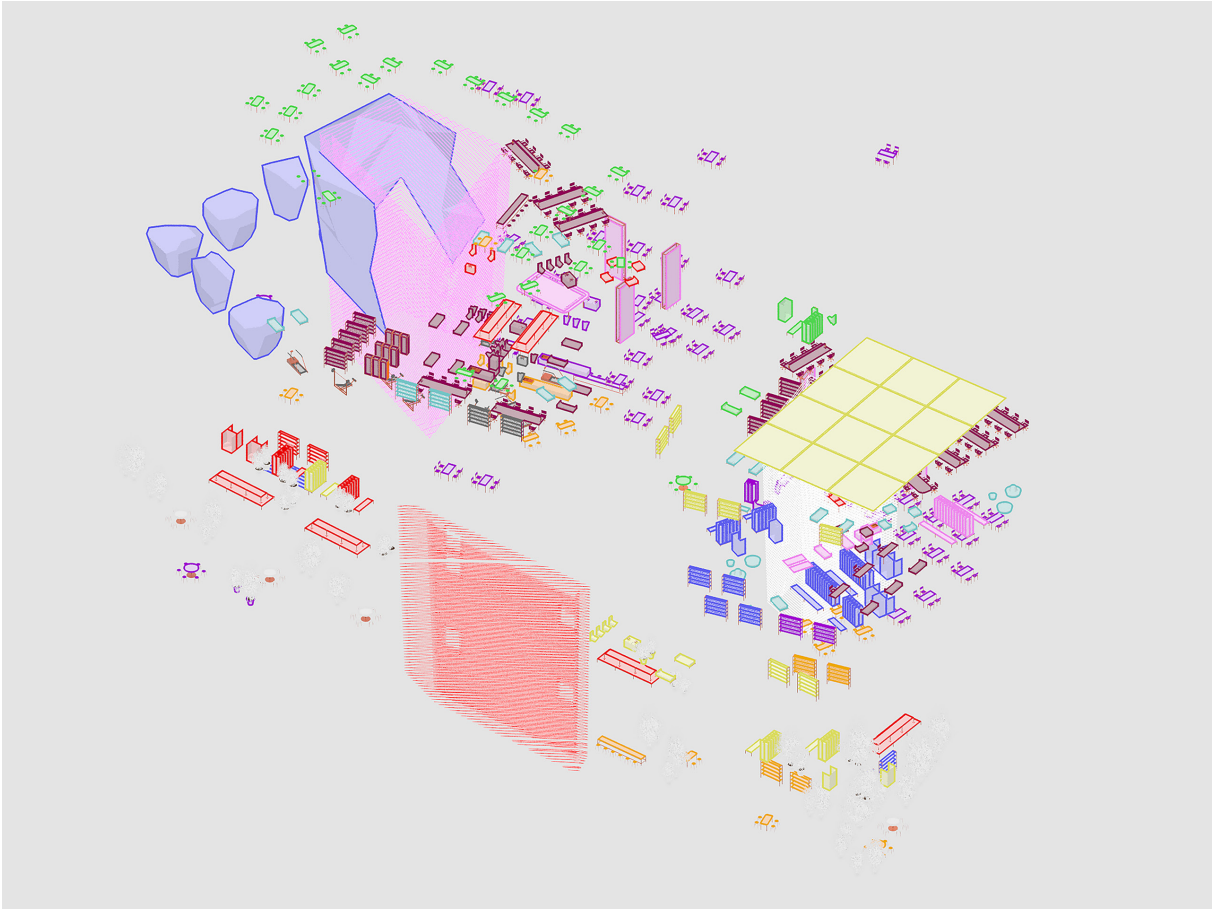


[Img. 10]

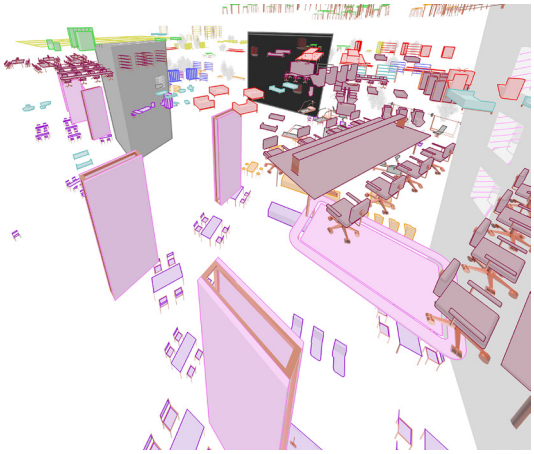


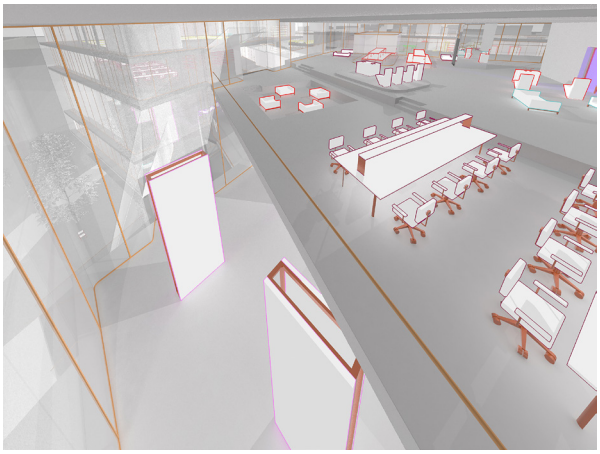

13.0 °C
1020.0 hPa Pressure
SPRING – 11:25
201 Mbps Connectivity
24.235 µg/m³ Air
CHICAGO

[Img. 11, 12]

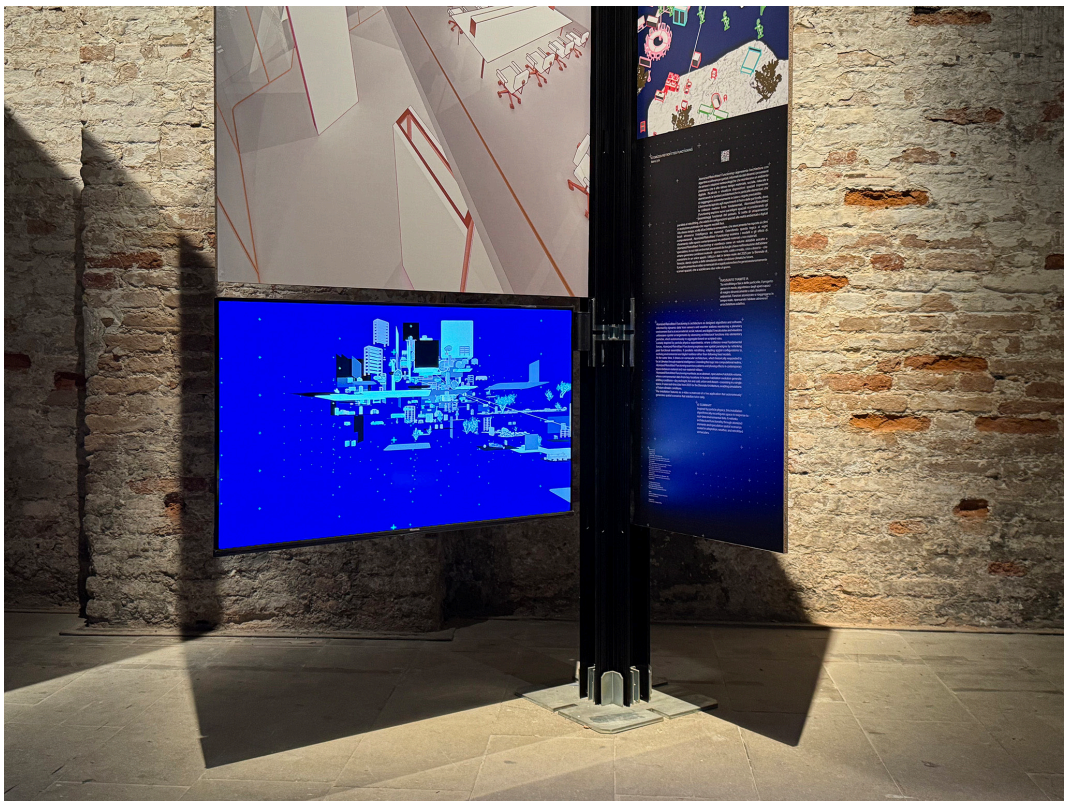


[Img. 13]



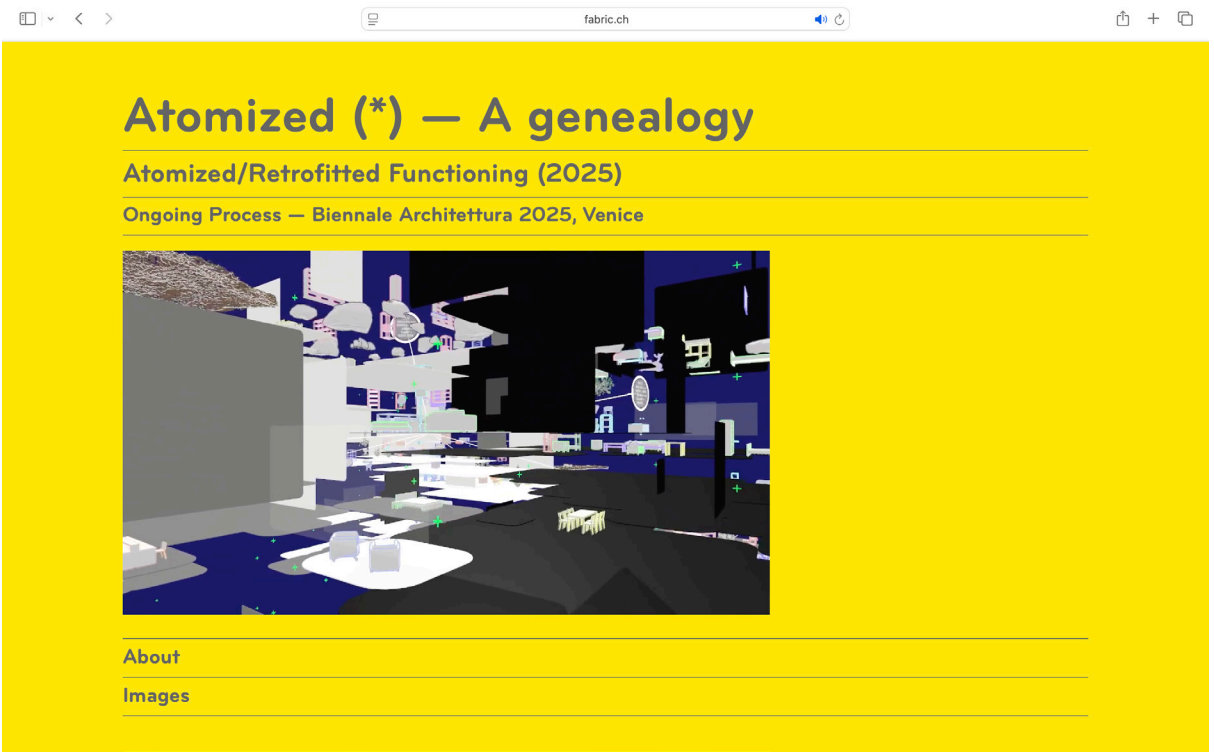


[Img. 14, 15]

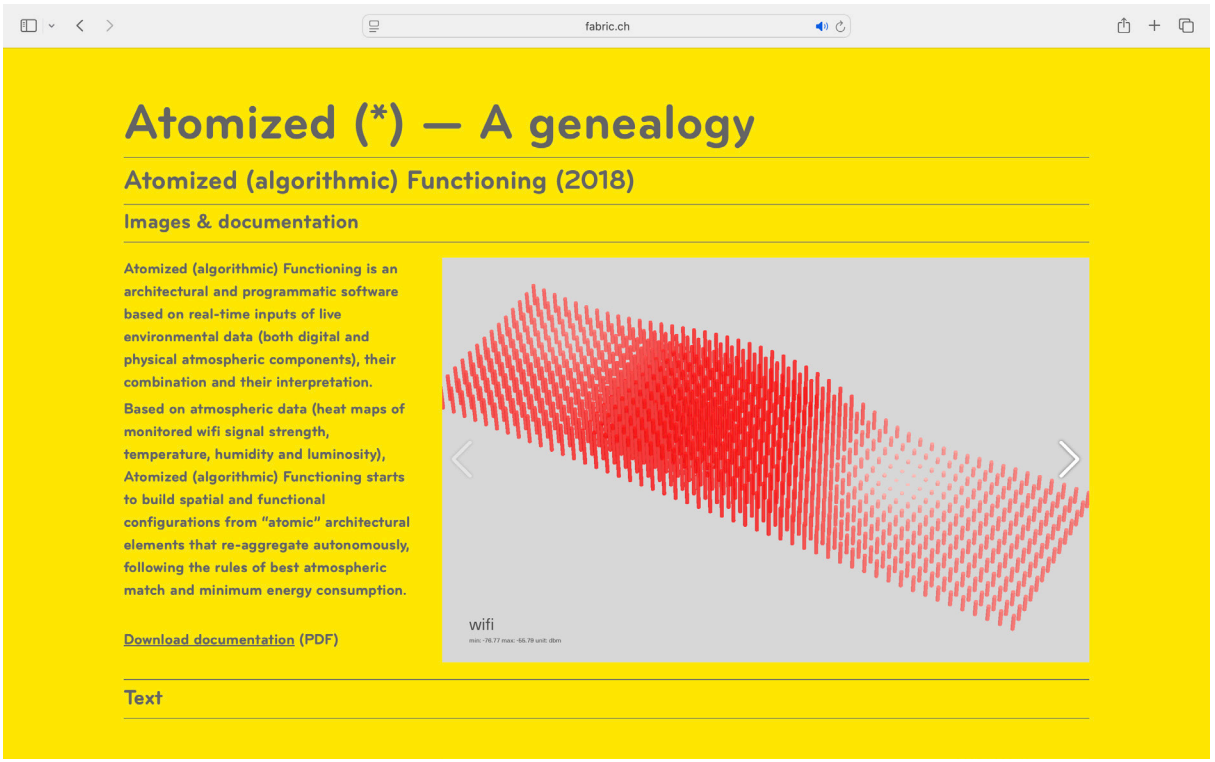


[Img. 16]

[Img. 17]


fabric.ch
Atomized (*) — A genealogy
Atomized/Retrofitted Functioning (2025)
Ongoing Process — Biennale Architettura 2025, Venice
About
Images

[Img. 18]


fabric.ch
Atomized (*) — A genealogy
Atomized (algorithmic) Functioning (2018)
Images & documentation
Atomized (algorithmic) Functioning is an architectural and programmatic software based on real-time inputs of live environmental data (both digital and physical atmospheric components), their combination and their interpretation.
Based on atmospheric data (heat maps of monitored wifi signal strength, temperature, humidity and luminosity), Atomized (algorithmic) Functioning starts to build spatial and functional configurations from "atomic" architectural elements that re-aggregate autonomously, following the rules of best atmospheric match and minimum energy consumption.
Download documentation (PDF)
wifi
Text

[Img. 19]

Image captions:

[Img. 1] The "Pulsar Map" for Atomized/Retrofitted Functioning—a Peirce quincuncial projection whose naming evokes the Voyager missions—channels live environmental and connectivity data from a selection of historical and planetary human settlements into the project. These include Venice (IT), Athens (GR), Uruk (IQ), Tokyo (JP), Vancouver (CA), Chicago (US), Manchester (UK), Brasília (BR), and the North Pole (–). This real-time data stream co-constructs a fictional, abstract, and planetary evolutionary space to be investigated through the rules and algorithms of Atomized/Retrofitted Functioning.

[Img. 2-3] On the left, the quincuncial projection map is transposed into an abstract volume filled with live environmental data. On the right, this same space is dynamically and continuously populated by "atomized" elements depicting housing functions alongside their spatial needs, guided by a set of custom algorithmic rules responding to a series of environmental principles of association.

[Img. 4] Entrance to the Artificiale section of the Venice Biennale, Arsenale Pavilion, 2025.

[Img. 5] Atomized/Retrofitted Functioning in the Corderie building, Biennale Architettura 2025 (19th International Architecture Exhibition, Venice, 10.05–23.11.2025). Exhibited within the 'Canon' section, the installation was presented alongside foundational milestones like SEEK (N. Negroponte, L. Groisser, 1969) and the Generator Project (C. Price, J. & J. Frazer, 1976–80), grouping it with a wave of past and contemporary experiments that actively re-interpret cybernetic spatial approaches into co-creation, and more-than-human conception.

[Img. 6-9] Different views of the evolving Atomized/Retrofitted Functioning environments at various assembly stages.

[Img. 10] View of the evolving Atomized/Retrofitted Functioning environments. Spatial assemblies and their corresponding environmental data were collected over a one-year cycle (05.2025–05.2026) throughout the biennale, constituting a new dataset for further algorithmic investigation.

[Img. 11-12] Different views of the evolving Atomized/Retrofitted Functioning environments at various assembly stages, with a focus on Chicago's and its live environmental data.

[Img. 13-15] Images from the project *Responsive Atmospheric Patios – extended experiments* (fabric | ch, 2016) present a process similar to that of Atomized/Retrofitted Functioning, ultimately giving shape to a "cloud of uses." Although realized prior to the *Atomized* series and executed entirely by hand, this early work directly anticipated its core algorithmic principles.

[Img. 16] Atomized/Retrofitted Functioning in the Corderie building: live video of the ongoing assembly process at Biennale Architettura 2025. 19th International Architecture Exhibition, Venice, 10.05–23.11.2025.

[Img. 17] Panel: *Cybernetic Sustainabilities – From Past Experiments to Contemporary Reinterpretations,* organized within the context of the GENS Public Program (October 2025, Corderie building, Biennale Architettura 2025: 19th International Architecture Exhibition).
Discussing historical cybernetics, its legacy, and its recent evolution into sustainable territories of co-creation, the panel featured presentations by Prof. Orit Halpern (TU Dresden), Giulia Bini (Head of Arts at CERN), Chrissie Muhr (Art Director of Experimental Foundation), Maxwell Ashford (designer, ECAL/HES-SO), Prof. Christophe Guignard and Prof. Patrick Keller (both of fabric | ch and ECAL/HES-SO), moderated by Gordan Savičić (artist, Lecturer HSLU).

[Img. 18-19] The project was also accessible online, at this address: *https://www.fabric.ch/Atomized/*, featuring a live stream during Biennale opening hours. The complete research genealogy and its previous iterations are available at the same location.

Txt

Atomized/Retrofitted Functioning

Atomized/Retrofitted Functioning is architecture as designed algorithms and software. It is informed by dynamic data from sensors and weather stations monitoring a planetary environment that is simultaneously material, social, natural, and digital. Within a game engine, the system dynamically recalculates and visualizes unforeseen spatial arrangements by "atomizing" architectural functions into elementary particles, which then autonomously re-aggregate based on scripted rules.

These evolving and adaptive rules reveal the connections between environmental data and spatial uses, which emerge fluidly from changing baseline conditions. Driven by the constant mutation of source data, these temporary combinations and aggregations manifest as dynamic 3D objects. They serve as fleeting architectural sketches, visibly mapping out emergent spatial patterns and their associated functional needs.

Loosely inspired by particle physics—where collisions expose fundamental forces—the project derives new spatial paradigms by dismantling historical functional assemblies. It mirrors retrofitting, shifting spatial layouts to meet changing climates and digital realities instead of replicating static models.

Drawing simultaneously on vernacular architecture's climate-responsive material intelligence, the project projects this logic into computational realms. It expands on the lineage of F. Aubry (EPFL), B. Rudofsky (Cooper Union), and P. Rahm's contemporary meteorological approaches, analyzing the structural patterns and phasing effects of contemporary space between material and non-material milieux.

The project takes form as an abstract and speculative habitable volume (void), where environmental data from key locations in the evolution of human habitation generate shifting conditions—day and night, high and low pressure, hot and cold, urban and desert—coexisting within a single space. This approach enables simulations of future climatic conditions while using real-time data from 2025 during the Venice Biennale, where the project is first exhibited.

Presented as the stream of an application running live on a server in fabric | ch's studio—driven by custom machine learning developed by the studio, around its architectural approach—the project autonomously generates spatial scenarios that stabilize twice a day. These latter can be downloaded as an immersive, walkable AR/VR experience.

"From this large dataset, tendencies can later be identified: What is the average presence of specific functional or non-functional content over time—for instance, across a three- or six-month cycle from May to November 2025, or throughout spring and summer? How do these spatial configurations manifest during Venetian days versus nights, and what are the emerging new patterns and structural permanence?

Future climate patterns could also be inferred from scientific forecasts—projecting what the climate will look like in 2050 or 2100—and subsequently deployed as a new dynamic source for Atomized/Retrofitted Functioning. Conversely, what was it like in 1972—the year *The Limits to Growth* was published as an early, unmistakable, if imperfect, warning of what lay ahead should growth remain unchecked?

Finally, from a cloud of potential uses and non-uses of space, we could sketch out open and closed volumes. None of them would be entirely suitable—but sufficiently so, since fixed forms can hardly adapt to constantly changing conditions. Or can they?

The project builds on previous works carried out as part of the ongoing Atomized (*) program: https://www.fabric.ch/atomized/ (2018 – 2025)

fabric | ch, May 2025

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fabric | ch (97-26)

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