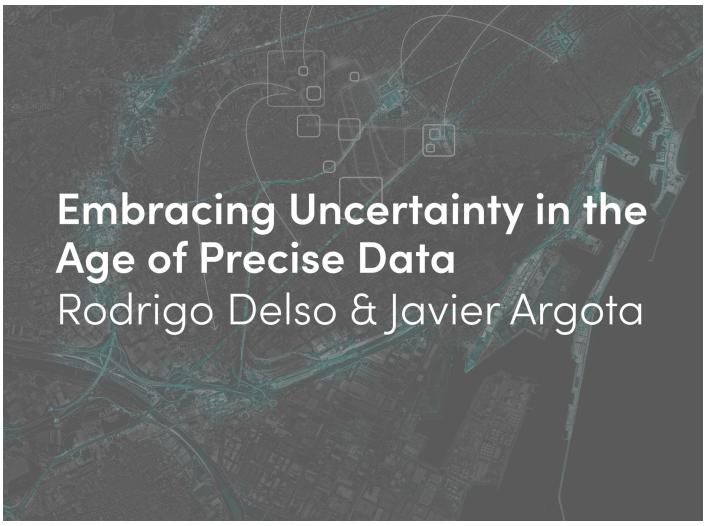

EMBRACING UNCERTAINTY IN THE AGE OF PRECISE DATA

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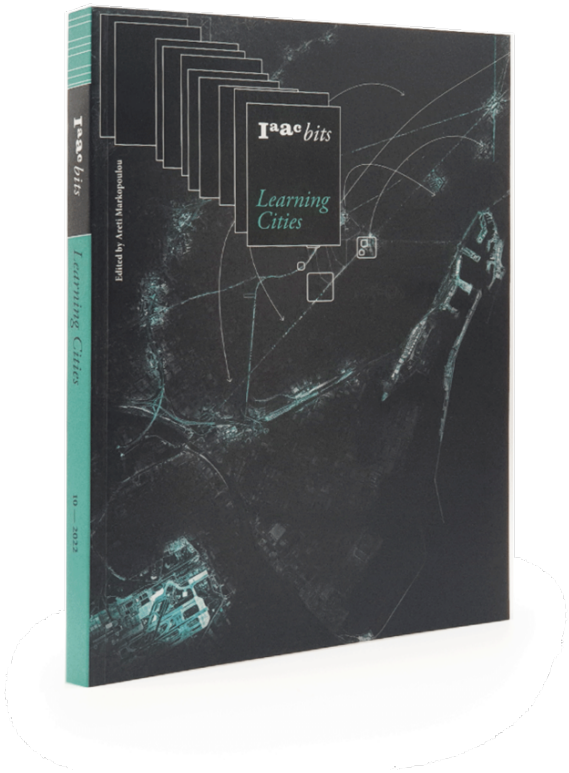

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Every second, millions of inorganic forms of intelligence move around invisible data-cities, under the threshold of human perceptibility, scavenging reality through billions of machinic eyes. These electric beings do not need to be believed in, like previous god-like human fictions, to change the materiality of physical cities. Every day, these artificial algorithms hunt inside gigantic data centers and networks of urban sensors to extract patterns, establish correlations, predict flows, and create a simulation of a metacity that determines, for example, how long you wait at a traffic light or the advertisement you see at the bus stop.

Simultaneously, billions of organic entities travel around heavily material cities, built largely with static matter, analog procedures and onsite workers. Instantaneous algorithms, moving living beings and immobile constructions coexist in a city whose shape, concept and elements have not changed qualitatively since the Industrial Revolution, rendering the digital turn nearly irrelevant in the evolution of material human habitats. Today, artificial intelligence is the version on steroids of Cerdà's vision from the 1800s: cities are infrastructures to move people efficiently from home to work.This perspective conceives people as particles and human habitats as logistics platforms: more like airports or train stations than public spaces.

In the production of cities, everything takes place in the dilemma between permanence and mobility. Some entities, such as architecture and infrastructure, are thought of as extremely static so others can be mobile: people, cars, money, information, product, etc. For now, artificial intelligence seems only to affect the latter; the low frequency city is out of its scope. Beyond using high tech simply for instrumentalizing and augmenting the orthodox industrial city, urban agents need to articulate a new urban framework with a real hybridization between human experts, inhabitants and computers. We need a new model of collaboration that addresses the ignored complex relationships associated with environmental, cognitive, cultural, economic and social issues, and prioritizes systemic urban actions in an unfinished city, leaving room for alternatives and changes. Do we dare to imagine a post-car city? Do we really want to know how people live, or is it easier to design without knowing?

Rehoboam is the name of the artificial brain that controls the human world in the TV show Westworld. Through the quantum processing of all imaginable data, Rehoboam can automatically create infinite simulations of the world in order to produce the desired materialization of reality through the control of labor, economics and mobility. Among the endless possible worlds, the

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machine decides that perfection is accomplished with the exact same urban and human reality we have today, just without any kind of friction. The AI's ideal city is the total synchronization of the current status quo with no traffic jams, protests, vacant lots or abandoned infrastructures. Rehoboam's urban utopia-dystopia is not a singularity but the paradigm of how AI applications are imagined in cities. The lack of divergence and conformism around the design of human habitats takes form in the uninterrupted replication of the industrial models based on transport analytics and secular databases.

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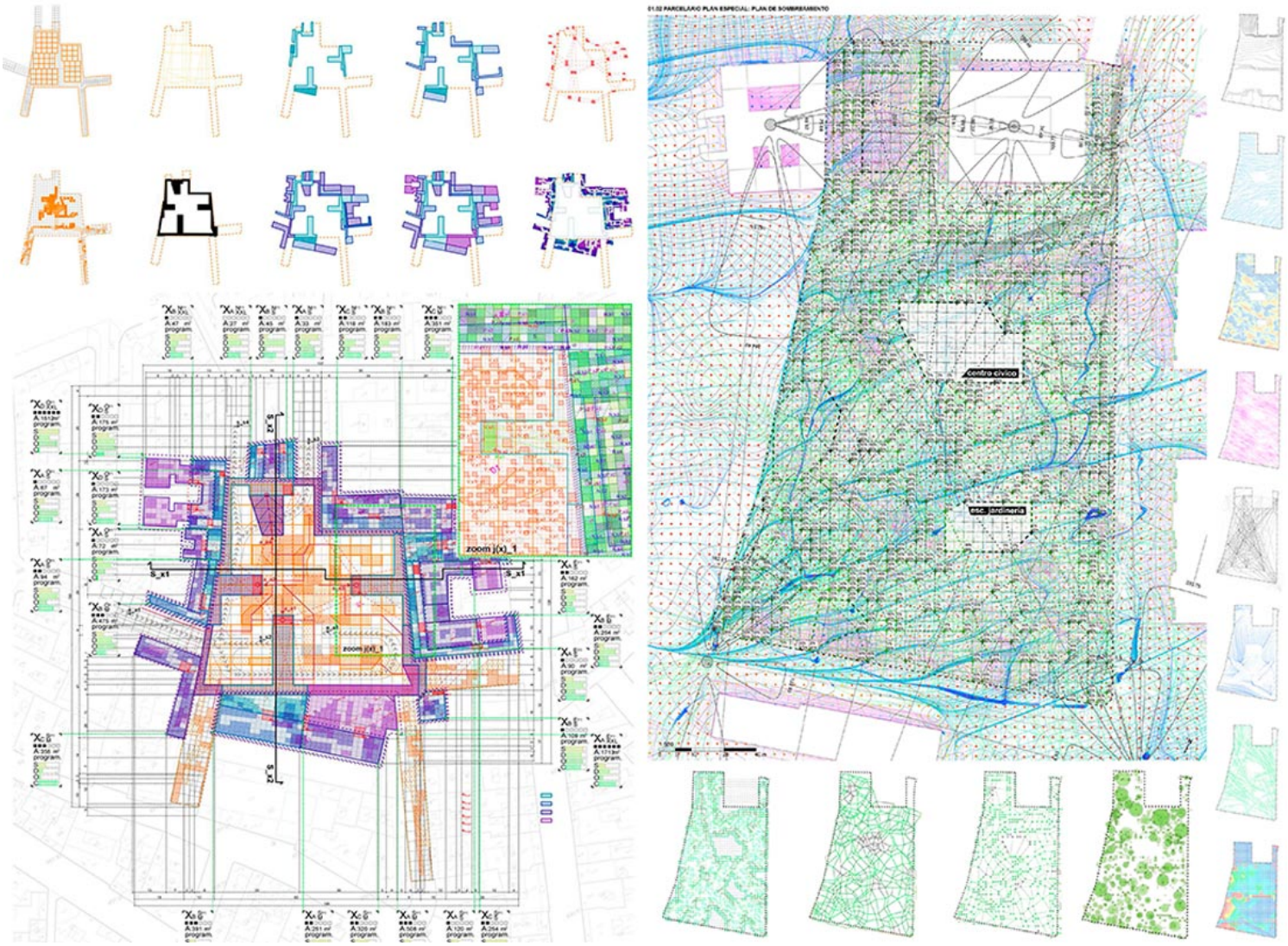

Still, cities are the most complex human creation. The built environment is the result of contradictory, opposing and diverse agencies, goals and needs, accumulated over time in an intricate network of interests in constant friction. However, urban agents dismiss in their planning the broad network of dynamic social, cultural, environmental and cognitive factors and relationships taking place in the city. This omission is a political and ideological act that takes form in the

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selection, omission and collection of certain data.

Today, almost all available urban data is related to logistics and economics, used to reinforce the utopia of a city in perfect motion synchronization. Moreover, data is mostly used as a tool for corroborating preconceived ideas and biases, instead of a tool for discovery – disregarding the potential of data-driven models to establish unprecedented correlations and, therefore, see the world through an exponentially different lens with the ability to match the different scales of organic life.

The positivist vision of endlessly feeding information into a universal machine solver, able to make sense of everything to answer anything, clashes with the contingency of the data and our existing technology. The results of such a machine are a direct consequence of the conditions set by the data and the well-bounded programming rules that depend on human dexterity. So, even the outcomes of the most obscure and deepest AI algorithm are defined within its programming; we are still far from the singularity.

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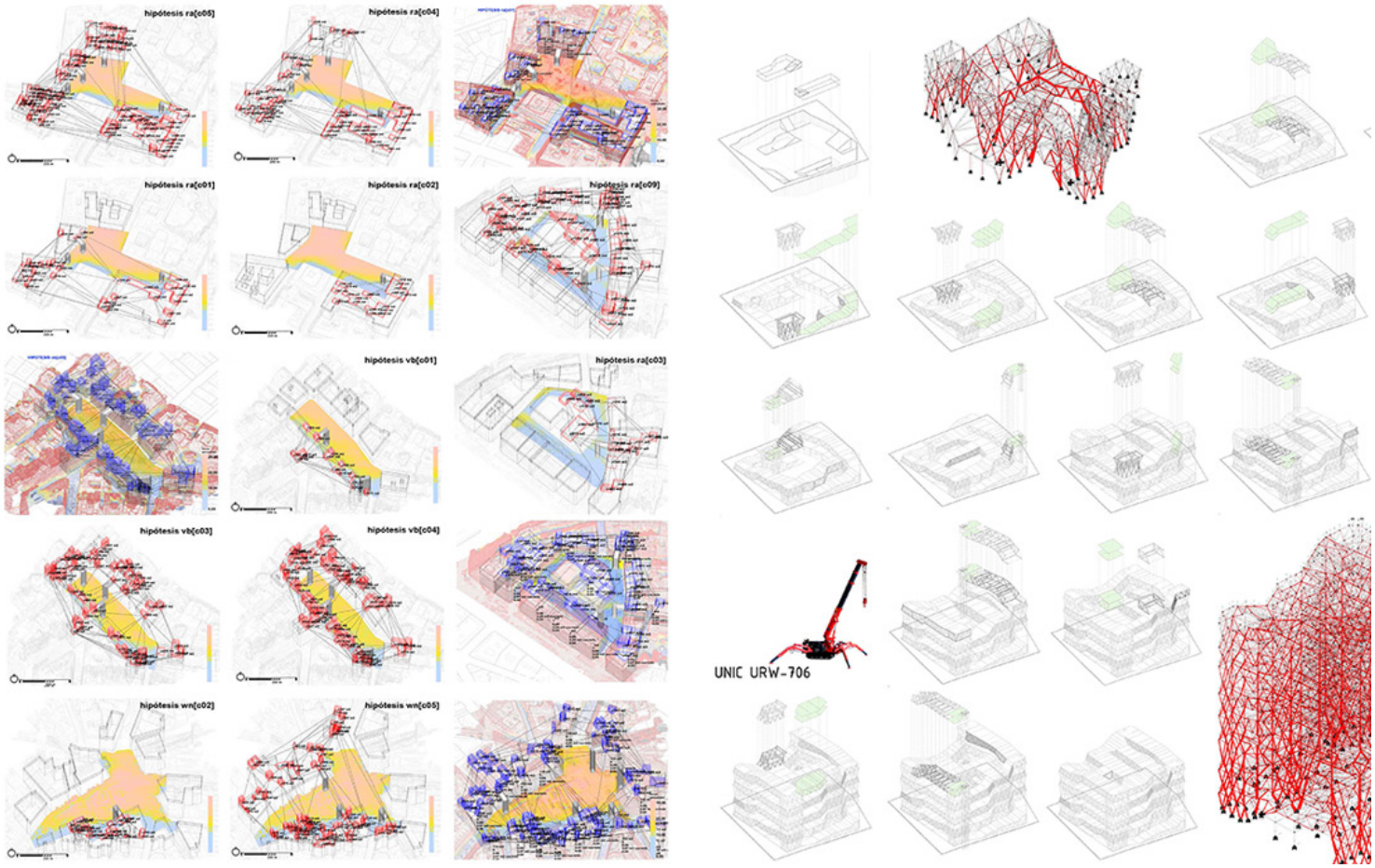

Paradigms such as the city as a “wicked problem” show the limitations of our machines for treating intractable realities, in which uncertainty, unknowns and alternatives are fundamental components. Current AI machines can seek perfection in what is given (data, an analysis or a hypothesis), but not eccentricities in what is undetermined.

Despite these limitations, data-driven machine learning algorithms are powerful tools for learning and thinking for every single urban agent. One of their main strengths is the ability to generate infinite alternatives to a question, helping to visualize the underlying logics and flows of our own reality created by conscious decision making and unconscious constructs. AI processing creates a network of available diagnoses for the urban agent, whose decision-making process can be aided by this 24/7 exploration of materialized alternatives.

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Cities are neural networks of infinite realities in continuous evolution and change. Machine learning algorithms are already capturing lots of these realities: class, gender, race, geolocation, emotional responses, social activities, sexual preferences, music trends or consumption preferences. In a context of increasing information, urban agents decide to ignore easily available or collectable information due to ideological biases, lack of interest or knowledge on how to design with it.

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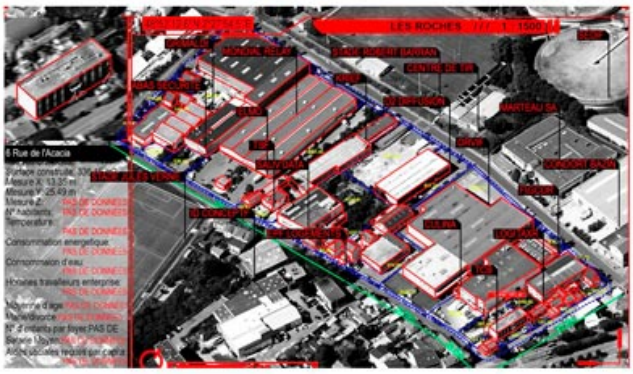

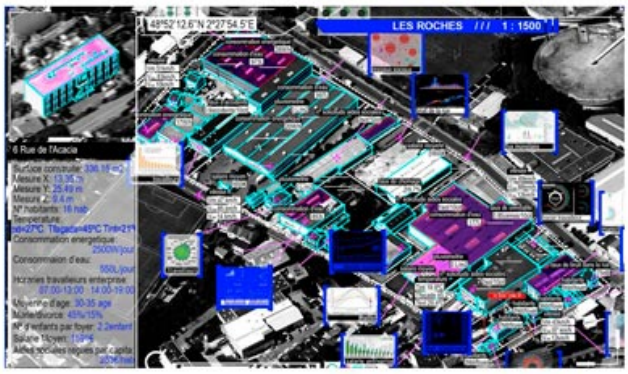

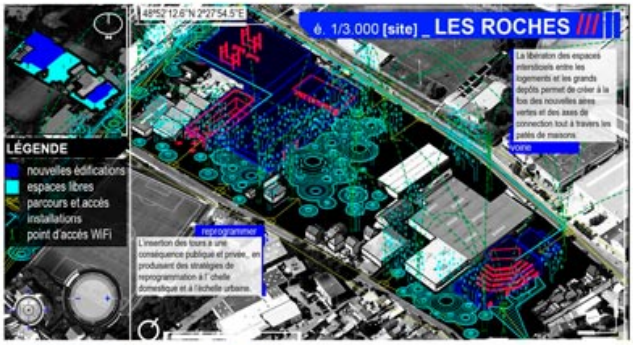

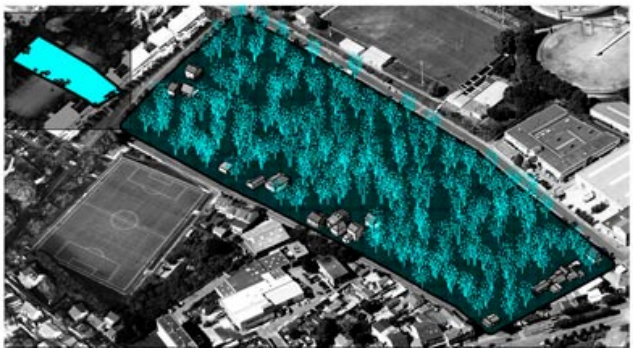

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The infinite capacity of artificial intelligence to create analytics and solutions to a given problem creates a sea of data that needs to be interpreted by human cognition. Between the extraction of the data and taking action in the urban environment, there is a huge unresolved abyss that needs to be addressed both by urban developers and citizens. New models of communication and interpretation of information are urgently needed but also new models of urban learning, negotiation and production.

Urban agents need to make a direct effort to create systems and strategies in which data analytics has an active voice and there is space for that input to modify projects – for the algorithmic diagnosis to evolve within the material context. Machine intelligence can enable a richer understanding of urbanity, complementing human intelligence in hybrid design frameworks. AI gives us access to the endless latent space of possibilities and scenarios of reality's bounding conditions and contradictions, otherwise unreachable through simple human cognition. In this context, experts become responsible for describing the design context in machine-human cooperation: they are not prescriptors of shapes and topologies, but of conditions and scenarios for informing urban operations. For that to happen, an expansion of their knowledge is required, not only in technical aspects but also conceptually, in a way that critically bridges the gap between analytics and actions in the built environment.

Machine learning algorithms are able to digest continuous flows of data and measure the smallest variations in their content or context. The endless ingestion of inputs permits a new type of quantification based on transformative variations of data and its evolution over time, in real time; this not only extracts static conclusions but, more importantly, an operative continuous diagnosis of the shifting reality. At the same time, current urban plans are built on top of static and inherently outdated data, rejecting an aspiring real-time urbanism informed by dynamic data. Live urban development could account for the different scenarios of human situations, reacting automatically to the changes happening in the environment and integrating the informed opinions and necessities of the different stakeholders.

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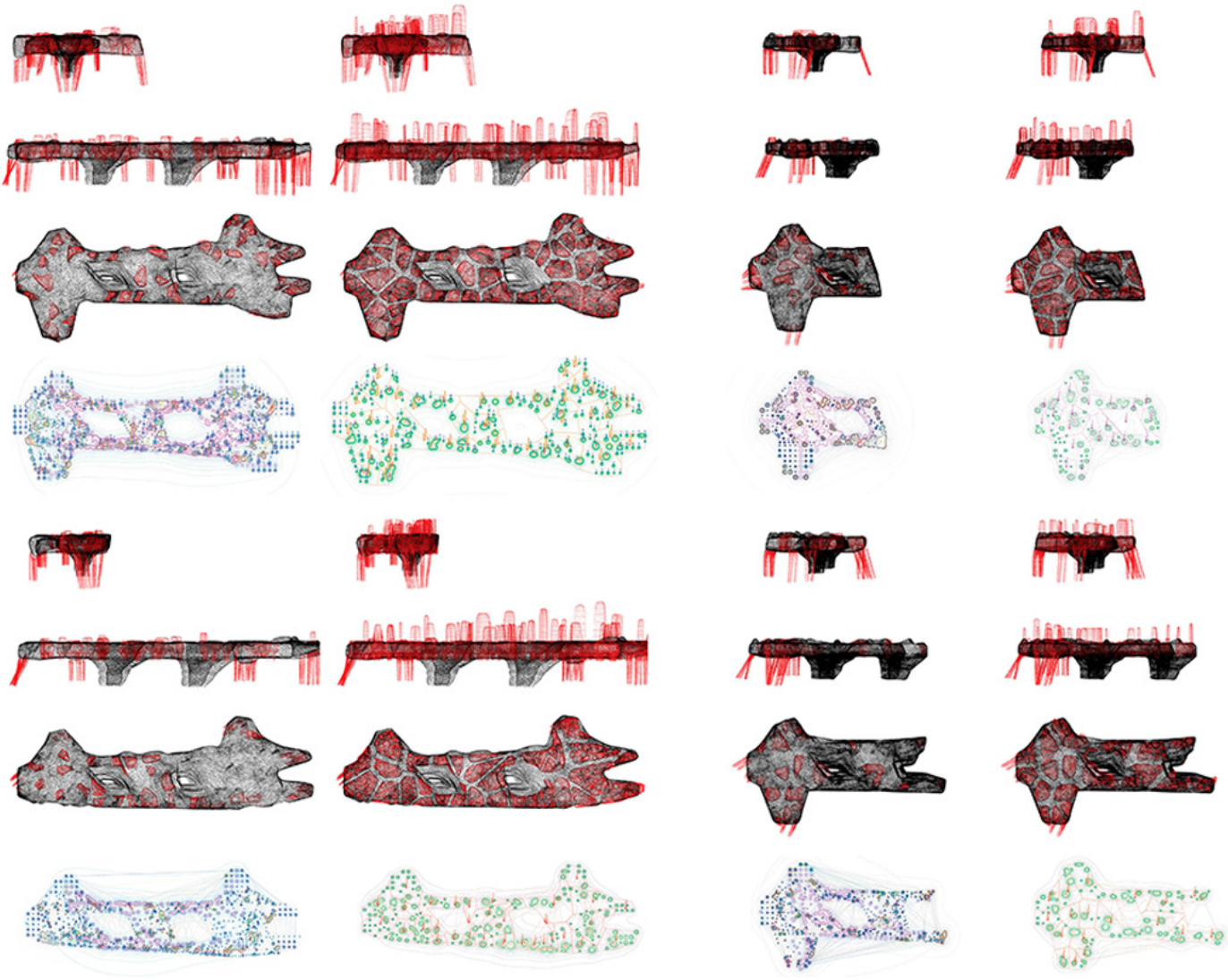

A real-time city risks being overly presentist, however, resolving only momentary necessities. It will need to actively deal with the future as something unpredictable and uncertain. Today, high-frequency trading algorithms follow the evolution of the market, analyzing both the main movements of the system as well as the minimal variations, previously known as noise. These machine-learning models follow disruptions and include errors as a crucial part of their learning processes in order to detect new trends. In the same way, contemporary urban planning needs to

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include uncertainty and noise as part of its strategy and stop seeing divergence as an enemy to the integrity of the manager's vision.

In this real-time city run by ultra-fast algorithms, data is the most valuable asset. While it is constantly needed to fuel projects aimed at improving the quality of life of citizens and the performance of urban operations, today its access is restrictive and opaque. As a result, although the most technocratic visions of Smart Cities put citizens at the center, they are despotic highly technological versions: citizens are supposedly the main beneficiaries of the improvements for which they generate data, but they have no control. This paternalistic vision of authority privileges the opportunistic concentration of power and knowledge among a limited number of urban agents, which hinders cooperative learning and discovery by citizens and other unprivileged stakeholders in the city.

Beyond learning, AI makes it possible to articulate the commoning and participatory processes of citizen information, whose coordination between contradictory and opposing agencies remains unclear to experts. Massive self-generated data from citizens does not only entail ubiquitous constant collection but access, discovery, utilization and coordination by the inhabitants themselves. Hence the value and opportunity of using post-humanistic frameworks – in other words, computer intelligence – for the coordination of crowd analytics and large-scale human organizations in an actionable way. For that to happen, we need to create effective tools for facilitating conversation, evaluation and knowledge to inform participatory city-making.

Today, we live in the nonstop city, in which crowds are envisioned as a fluid in permanent movement that cannot stand still, waste time or do nothing, whereas the material world around them is motionless, longlasting and untouchable. Machine learning analytics continuously come up against the conflict of providing a dynamic real-time data stream to inform an environment that is incapable of learning and applying this knowledge because of its extremely static conceptualization, design and materiality. There is an urgent need to propose new models of planning, legislation or construction that can reconcile the innate mutability of organic forms with the artificial rigidity of architecture. Simondon described organic forms as "metastable minds". For him, humans are never completely formed but always maintain a level of "transindividuality" that allows them to be able to change, maintaining a high level of indeterminacy.

Cities as the background for these mutant lives need to be able to match the rhythms of the present by being open-ended, both materially and strategically. However, the continuous adaptation to real-time events has the risk of reacting purely to the existing conditions of the present and eternally

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repeating the doxa: what everyone does or the majority already knows. In that sense, the continuous diagnosis of data allows for the constant creation of urban hypotheses and, therefore, the re-articulation of aims and operations in a context of changeability that needs room to accommodate that mutation of reality. Cities need to leave gaps to adapt to present and future contingencies, creating a hybrid model of humanmachine cooperation. Change is only possible when there is space or material for change; this could be accomplished by leaving a high degree of indeterminacy in urban plans or designing unfinished buildings with constructive systems that can grow but also diminish.

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