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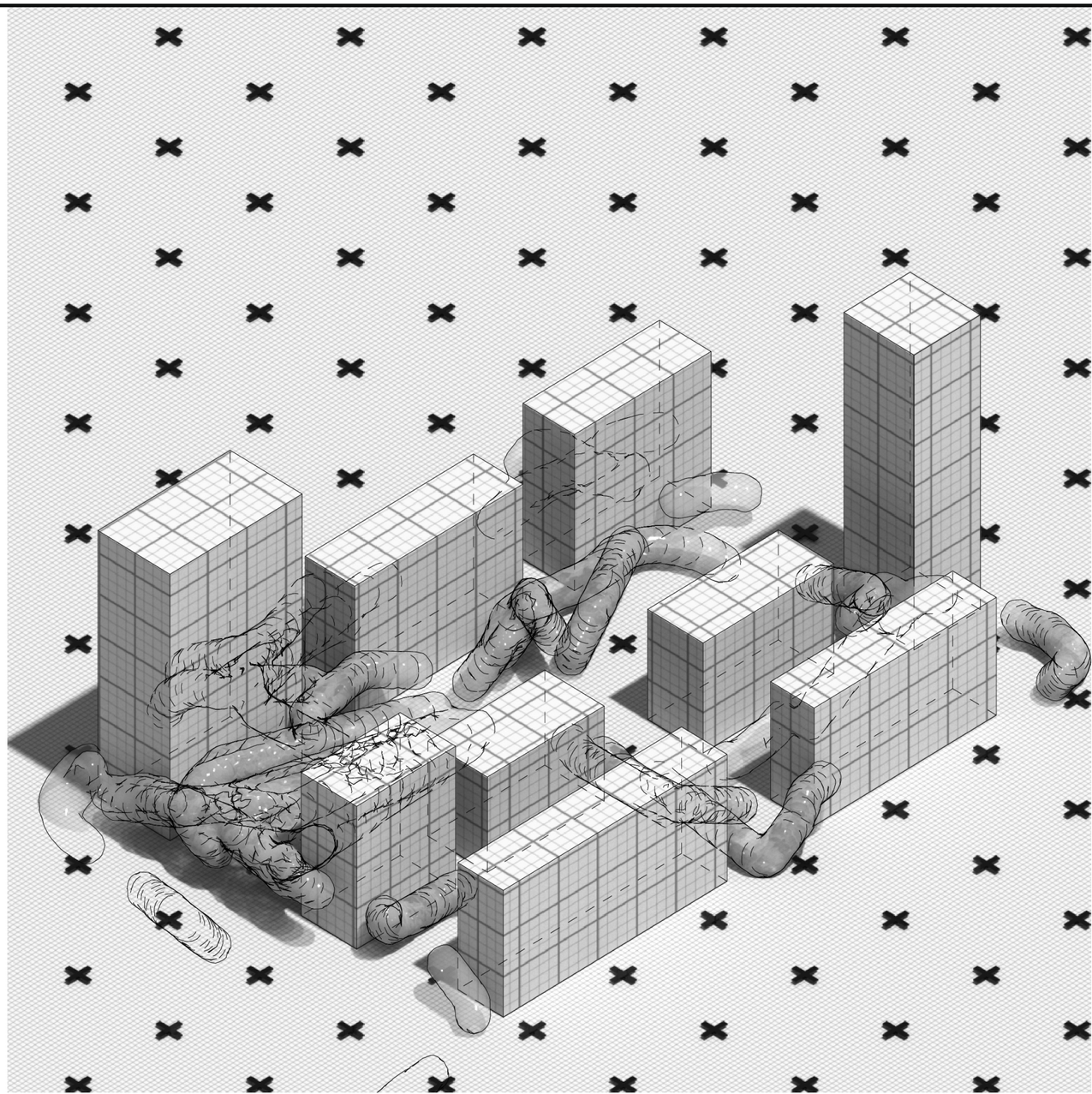

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FORUM A+P
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Science and the City. In The Era of Paradigm Shifts

Table of Contents

Scientific Research Papers

TelQuel architecture

Book Review

Drawings

Introduction from the Editors

SKENDER LUARASI
POLIS University
VALERIO PERNA
POLIS University

The 23rd Issue of *Forum A+P* investigates and speculates on the relationship between the city and *techno-science.* The term 'city' is understood in two ways: first, in a discursive sense – as an object of study and a set of practices – epistemological, aesthetic, architectural, political, economic, and social among others - that deal with such object; and second, as a *reality* that both delimits and challenges the very notion and possibility of representing and knowing it as an object. In its hyphenated form, *techno-science* is understood - in Bernard Stiegler's words: "as a *com-position* of science and technology, meaning that science submits to the constraints involved in becoming the technology that formulates the systematic conditions of its evolution."[1] The hypothesis we anticipated the contributions collected in this volume to reveal was that the discipline of architecture is not and has never been 'safely' situated in a discursive niche; that its boundaries are always shifting in relation to the changing relationships of techno-logy and science; and more importantly, that architecture – in various discursive scales and modalities –is discursively implicated in the network among technology, science, and the city.

Of course, such implication has a long history, and it goes back to the origins of enlightenment, when Claude Perrault, for instance, used scientific epistemes of classification to classify, represent, and order the classical architectural orders. The work of naturalists like Georges Cuvier and Étienne Geoffroy Saint-Hilaire, and later, Charles Darwin also had a deep impact on the work of nineteenth century architects like Gottfried Semper. The international expositions, on the other hand, displayed the advancements of science and technology in their unprecedented steel and airy structures. The advancements in engineering technologies and the science of mathematics and geometry also had a deep impact on the curriculum of the schools of architecture, triggering divergent pedagogical approaches – such as those oriented toward a polytechnic model and those in line with a Beaux-Arts tradition. Theories and projects of urbanization that emerged in the nineteenth century were profoundly affected by the scientific epistemes of the time. They aimed to deal both with the expansion of capital and those of diseases… Nietzsche already saw the earth as a body without organs infected by man. What *form* should the modern city and its architecture take? Not a particular one, because for modernity *"form is nothing,"* to quote Ildefons Cerdà, the great theorist of urbanization. The form should be rather general, that of the organism. Such was the question Cerdà, Camillo Sitte, Hilberseimer, and Le Corbusier asked. Yet those epistemologies of extension and self-generation that made possible such questioning in the first place were already laid out by enlightenment, scientific theories, and critical philosophy in the eighteenth century. It was the main characteristic of the 19th century to find to *bridge* the schism between science and art through the rich rhetorical tradition of organicism. From an epistemological standpoint the 19th century did not couple technology with science into techno-science but subsumed the latter under the former. It was only in the 20th century that the 'polytechnic' and 'artistic' traditions converged in and through the paradigms of the industrial machine and cybernetics, vis-à-vis a synchronization of the latter with the traditional discourse on organicism and nature. In 1946, Le Corbusier met with Albert Einstein in Princeton and took a picture together under a tree. Seeking 'scientific' validation for his *Modulor* from Einstein, Le Corbusier's pursuit represents Architecture's eternal desire to be bound to Science, while keeping its natural and organic origins. It is through 'scientific metrics' that norms in architecture – from ADA to the stability of structure, from light and acoustics to indoor air quality – are defined, measured and legitimized. While Architecture employs science for assembling material realities, it also embodies its scientific thought processes in form. For example, in their *Electronic Poem* Iannis Xenakis and Le Corbusier captured the dynamic physics of sound in ruled surface-structures; Gaudi's hanging chain models informed his catenary masonry arches; and Frei Otto used the material reactions between wool and water as a 'model'

to form-find and to design structure. Furthermore, notions of space, time, form, architecture, atmosphere, and so on – matrices of objectivity that architectural historians inevitably employ – are also legitimized by allusions to science. Empiricism, objectivity, and rationalism in architectural history are indebted to methods and discourses in the Sciences. The History of Architecture is thus analogous with the History of Science.

The relationship between form, techno-science, and the city may be taken less for granted and become less obvious, given the fact that our expectations and anticipations are more uncertain than ever. Such relationship must undoubtedly be revisited again in our new, irreversibly changing world. How is the relationship among science, technology, architecture, and the city reconfigured in the context of technoscience? Our reality today is not only mediated but steadily trans-formed, re-produced, and re-invented through technoscience both at a macro and microlevel. The "com-position" of increasingly miniaturized hardware with increasingly personalized and *personalizing* software implicates scientific knowledge at every scale. Such "com-position" points to spatio-temporal realities that can hardly be accounted for through the traditional concepts of composition, geometry, boundary, or threshold. If we agree with Fredrick Jameson's hypothesis that postmodernism is a "force field" that affects a wide spectrum of cultural, economic and social practices, then what form will architecture and the city take under such technoscientific dominance? Are the 'archipelagoes' of gated communities with smart homes amid a chaotic sprawl in the margins the only form that the contemporary city can take? How does architecture figure in the "com-position" of techno-science?

Such questions only become more tangible and urgent during crisis, such as these pandemic times. The world resembles a complex web where everything is entangled in a knot: technoscience, politics, economy, health care, media, morality, popular myths, conspiracy theories, history, education, as well as urbanism and architecture. As often happens in postmodernity, the high and the low come dangerously close to one another. Our techno-scientific milieu contributes to this polarized and oversaturated landscape, rendering us fragile and powerless: on the one hand, we have a lot of information; on the other hand, we don't have a clue what and how to deal with it. The city becomes the empty stage where the crisis *body without organs,* to borrow a term from Gilles Deleuze, is played out Some of the questions the 23rd issue of *Forum A+P* addresses are: -How does digital design and modeling technologies influence and figure in the design process of architecture and the city?

- How do the technological and scientific methods, product and applications figure in the construction and occupation of buildings, and how they bear on the social experience of architecture and the city?
- How do the disciplines of architecture and urban planning define and frame their object of research, and how does techno-science influence the way we research architecture and the city?
- What are the epistemological intersections between science and architecture and how they are mediated through technics and technology?
- How does techno-science relate to the housing rights for a Security of tenure, Affordability, Habitability and Accessibility?
- In line with Nietzsche's dictum that there is no such thing as an eternal return, and Bruno Latour's argument that we should not "go back to the pre-crisis production model," what things should we forever change or not change, do or not do, in architectural practice and education?

Such questions were first explored in various workshops and Conference contributions inTirana Architecture Week 2020 - *Science and the City in the Era of Paradigm Shifts.* The workshops were conceptualized and directed by young architects and planners whose work was selected from Future Architecture Platform. The workshops dealt specifically with multiple dimensions of the city of Tirana; its tangible and intangible qualities, its history and contemporary urban conditions, its people, and its built environment, and how these different aspects intersect with new information technologies. Sonia Lakic's workshop maps "the fabric of the everyday life that unfolds in the form of the intimate and individual experiences of residential space through the perspective of the 'open architecture'." Fabio Ciaravella's workshop "Architecture of Shame [Matera]" investigates the shifting legacies of the avant-garde architecture in Tirana in history and today. Eduarado Corales workshop "Daily Monoliths" explores placemaking through furniture. Matilde Igual and Luis Hilti's workshop "Parallel T" investigates the "scientific spatial systems imposed upon territories" and how could architecture critically and creatively tap into this systems. Miguel Braceli's workshop "Body Politics of the Pandemic" explores the "ephemeral architecture and social practices in the public space," and such architecture enables "a critical perspective facing the social, political, and health challenges of the present." Renzo Sgolachia's workshope "Learning from Films" explores the intersection of architectrural representation and film. Diego Sologuren's and Brad Downey's "Architecture on the Move" explores "the urban potentialities of a set of spots of the city of Tirana through the conception of architectural interventions which share a common feature: movement." Marcio Sequira's and Nikolla Vesho's workshop dealt with exploring structures through form and statics, while Enkeleda Kucaj's and Eriona Canga's workshop dealt with the topic of the resilience of rivers.

The contributions of the invited keynote speakers explore the intersection of artificial intelligence, the city, and environment. In "Altect: Can AI maker designs? Architectural Intelligence/Artificial Intelligence," Makoto Sei Watanabe probes the limits of digital technologies in relation to the design process and how architectural intelligence is irreducible to algorithmic thinking. He concludes that AI will make designs only when the machines, like people, will have dreams: "Getting ready for

[1] *Bernard Stiegler*

that day will involve exploring that path of fortunate cooperation between the brain and machines."[2] In "This City Does Not Exist: An attempt at a theory of Neural Urban Design," Matias Del Campo takes Watanabe's hypothetical conclusion as a starting point, by suggesting that big data is indeed a form of unconsciousness that can produce machinic dreams, and that different strategies of mining, analyzing, and interpreting big data can change the way we arrive at news forms, authorship(s) and fiction(s). If the machine can dream, could, then, the plugged-in city of today as the ultimate stage of neural exteriorization also dream new fictions of its past and future? Such question drives Antonino Saggio's "TEVERE CAVO: An Ecological Infrastructure for Rome between Past and Future," which proposes to reconceptualize Tiber River "as a new generation infrastructure based upon five essential principles: *multitasking, green systems, slowscape, information technology foam and galvanizing.* Such proposal ranges from "multifunctionality to ecological systems, from mobility to information networks, up to the relaunch of the civic and symbolic role of the infrastructures to foster interventions in the built environment."[3] Tracing different discursive genealogies of the science(s) of complexity in "Science and Urban Planning In Times of Climate Crises," Alessandro Melis proposes that we must come to grips with marginalized conditions – or the 'dark matter' of our built environment in order to learn to address the complex and indeterminate issues of the built environment and climate crisis.

The very same issues are investigated in a more detailed and methodical way in a series of peer reviewed scientific papers. What is at stake is the very possibility of urban intelligence, and how such concept can be embodied in different scales and with different meanings. Luca Lezzerini's paper "Autonomous, real-time, and dynamic configuration of public space in smart cities" explores how the smart, plugged-in cities can "temporarily reconfigure the use of their public spaces, either autonomously or in a human supervised way." If space is reconfigured in and through the 'Internet of Things', then how does our perception change among such things? Jacopo Costanzo and Valeria Guerrisi's "Urban Architecture: Eyes from the city" attempts to map and understand the intelligence or 'smartness' of our gaze through eye-tracking technologies and then instrumentalize it toward the design of urban architectures. How such architectures can be built through robotic processes is the topic of Sara Codarin's "The Robots are Leaving the Cage." Etleva Dobjani's and Dorina Papa's paper "The [dis]position of Albanian Adobe Constructions" shifts from 'high' to 'low tech' to deal with the traditional adobe constructions in Albania at the turn of the twentieth century, and how such methods could extend and expand the notion of building's sustainability. The latter, in its literal sense of the building being upheld, is the topic Steisi Vogli's and Kristiana Meço's paper "Non-Normative Buildings After Earthquake in Durrës," which investigates normative and non-normative building and planning practices in Durrës, in light of the 2019 earthquake. As per its tradition, Forum A+P ends with the Tel Quel - or as is – section, which deals with quick but informed opinions and observation among crucial local or international issues or events, recent publications, and speculative ideas embodied in drawing. Here Llazar Kumaraku writes about "Downtown One" building in Tirana where the Albanian Geography of the façade collapses into one access point in the entrance. Skender Luarasi writes on the Albanian Pavillion "In Our Home" in the Venice Biennale in 2021 and suggests it is only from outside home that one can re-invent one's own home and language…

Immaterial Lab: Body Politics of the Pandemic

MIGUEL BRACELI
FA Platform
KRISTIANA MEÇO
POLIS University
ARMELA LAMAJ
POLIS University

It is an interdisciplinary course on ephemeral architecture and social practices in the public space. The exercise seeks to approach the place from a critical perspective facing the social, political, and health challenges of the present. The emphasis will be on embracing and understanding the complex nature of public space in the context of the pandemic. With the appearance of the covid-19 the ways in which we relate and inhabit the public space have changed dramatically. This project seeks to rethink strategies for collective actions in the transition to a new normality. These strategies can be translated into modest design operations for the creation of devices, spaces, models, systems, and any forms of haptic interactions. We will investigate materials, methods, and concepts that serve as the foundation for restoring the encounter in public space for the sensitive aspects of our human condition.

From a base methodology, students will generate their own works in specific places, working in groups and dealing with the challenges of social distancing as a subject and a problem to solve. Collaborative practices are a fundamental part of the experience and a first step in this research about the body politics in public space. The students will use the city, the university campus, and their own bodies as a case of studies. The goal of this project is to understand the relationships between body, site and place in its most intimate scale within the context of a worldwide paradigm shift. As the world heads for a transition to the virtual, we will turn our senses to the real. This course is an approach to reality in terms of its tangible dimension; and to reality in its true existence, as the inescapable challenges of a global crisis. The course culminates with a several collective works, an ephemeral interventions in the city developed through people participation. The interventions will be light structures, small devices or simple gestures to restore human interactions In public space. The interventions will be a repertoire of project strategies that enhance human interactions in public space. Learning Outcomes. As a result of completing the course, students will be able to:

- Understand and apply methodologies in the analysis and de velopment of site-specific projects, in terms of activism and community engagement.
- Demonstrate a familiarity with an array of contemporary art related to social practices, installation, performance, ephem eral architecture and participatory art.
- Demonstrate skills in critical thinking about the social-polit ical contents of public space.
- Demonstrate skills in making ephemeral architecture.
- Demonstrate skills in collaboration in order to develop a sense of community, citizenship, and social engagement.

The length of the workshop will be created according of the Institutions demands.

Workshop Process Imagine

Introduction

The introduction consists of the definition of the problem and the place to work during the entire project. This stage aims to select a sense, an strategies and a site to work with, arguing the selection in the social, political and health variables to enhance human interactions in public space.

Sense. Study the context of the city where you live. Through haptic researches, students will approach possible senses to focus on, selecting some properties of that senses and they it works through people interactions.

Strategie. Present possible strategies to work through. After a preliminary research, students will present possible strategies to related with some sensorial experience; explaining their relevance, characteristics, and ways of manifestation in the public space. These strategies should be develop with a main material.

Site. Present possible places to work in. After field research, students will present possible places to address the challenges in their community. These places could be public spaces like squares, parks, common areas, abandoned areas, and institutional buildings, among others. This place would be the site to develop an installation, performance, or other project. The selection of this place should be guided by its ability to engage with the subject matter. How does this place relate to the strategie and sense?

Mapping. Mapping the challenge in public space. This task seeks to represent the dynamics of the chosen challenge through a two-dimensional medium: drawing, collage, photography, video and digital media in general. These dynamics will work as infographics of your project. Your data will become the subject for modeling in the next stage.

Shaping. Shaping the challenge. This task seeks to create three-dimensional models that can generate possible responses to the topic under study in infographics: the translation of the mapping to space. For this, it is possible to use any three-dimensional medium like installation, performance or sculpture. The proposals and models can be developed in any space as an object and space exploration. In this phase it is not necessary to work directly on the place.

Building. Building the challenge in public space. This task seeks to work directly on public space, translating the ongoing exploration in the selected place. That means: executing the performance, constructing the installation, or any other particular response of each project. This stage consists of the final development of the research carried out through mapping and shaping of the place studied. The documentation of the work would be the final product.

Miguel Braceli, a Venezuelan artist and architect, has developed his practice in many fields, including landart, performance, and relational art. He has presented his work in institutional spaces and art biennials throughout Latin America and Europe. He currently resides in the United States and is a Fulbright fellow and graduate student at the Maryland Institute College of Arts.

Learning from Films

RENZO SGOLACCHIA
FA Platform
DORIANA MUSAJ
POLIS University
DORINA PAPA
POLIS University

After the age of architecture-sculpture we are now in the time of cinematographic factitiousness: literally as well as figuratively, from now on architecture is only a movie.
Paul Virilio, Aesthetics of Disappearance

Brief
Filmic mapping as an experimental design methodology to (re) compose existing architectures in Tirana

Motivation and basic premise
Nowadays, it seems like architecture does not keep up with the constantly changing visual culture characterised by an increased density of visual information. It is possible to assume that there is a deficiency in the contemporary theory of architecture.

The basic premise of the proposal for the Tirana Architecture Week is to consider alternative actions in the field of architecture. This process can be developed arguing on the importance of methods and constructs that have not been considered as significant devices from the common academic discipline. The ambition of the workshop proposal Learning from Films is to encourage architecture students to test instruments by combining them with those of another profession, specifically with filmmaking. Exploring the productive relations that can be established between architecture and filmmaking, the workshop stimulates students to investigate experimental methods of architectural analysis and design in order to cultivate innovative instruments for the development of their work. With the goal to reveal the explorative power of filmmaking, the proposal focuses on new modes of perceiving, representing, and conceiving architecture.

Topics of the five-day workshop
In his book, The Vision Machine (1984) Paul Virilio introduced the concept of "logistics of perception" to criticise technological systems that connect distant locations. Subverting the common knowledge of distances and dimensions, the proliferation of visual prostheses and the consequent ubiquity of images have affected the human capacity to perceive an object, as he argued. This "tele-topological phenomenon" indicates the reality of a site as viewed from a distance while the "topographical system", a cinematographic method, reorient the viewer through recognisable distances, dimensions and objects.

During a film screening, the viewer generates its own mental maps that localise his/her position in the represented filmic space. This is the case of the single set films that are perceived as entirely shot in a single building, such as Last Year at Marienbad (Alain Resnais, 1961) and High-Rise (Ben Wheatley, 2015). The former takes place in a baroque hotel, which is, in fact, an imaginary building created by editing scenes shot in several locations, namely three royal palaces in Munich and a film studio in Paris. The latter is situated in a brutalist- styled tower that consists of a monumental garden and a leisure centre in Bangor, a ferry terminal in Belfast and a 3D model for the

exterior. In these cases, the filmic space can be considered as a "Frankenstein" location, a mix of different buildings, which appears to the spectator as one. It is a re-composition of various building fragments. When the entire film is located in a single spot, the architecture becomes autonomous from the plot and the camera movements.

Methodology and assignments

The design workshop aims to cinematically re-compose the spatial fragments of the existing and analysed buildings. Based on the construction of an imaginary building, this approach establishes an alternative method of spatial analysis.

By introducing the filmic mapping, the workshop aims to help students to get familiar with multiple aspects and knowledge that characterise the first phases of a design process, such as diving into architectural history, working with references, studying the distributive space of a building and developing three-dimensional visualisations. Within working groups of three or four, students are invited to design a "Frankenstein" building selecting one of the following options: hotel/hostel, office/factory, museum/school, market/supermarket, apartment block/villa, place of worship, and cinema/theatre. Within the end of the workshop, students are requested to deliver and present four A3 panels with floor plan(s), section(s), perspective(s) of the interior, 3D view(s) of the exterior and a three-minute short film. Conceived as a continuous sequence of the interiors, the short film will verify the composition of the "imaginary" building. In order to facilitate the shooting activity, this practical task will be held in Tirana within built and public architectures selected by students.

Objectives

The proposal explores the possibility to define an alternative field of research and the transgression of disciplinary borders between architecture and filmmaking. Rather than a study on typology, the workshop reflects on topological connections of the architectures in Tirana. The innovation of the workshop proposal lies not only in the transdisciplinary approach but also in the way students can use and manipulate architectural space in order to translate this into multiple visual forms, breaking free of pre-established conventions in architecture. Deconstructing and reconstructing the architectural space depicted in their film, engages the students in an active process of discovery.

Renzo Sgolacchia is an architect and urban researcher active in Rotterdam and PhD fellow at the IUAV, University of Venice. Filmmaking has always played a crucial role in his activities. He is the founder of Cinema Architecture, a project combining research and film screenings, which investigates architectural space through cinema.

Daily Monoliths

EDUARDO CORALES
MOB Projects Director
JOANA DHIAMANDI
POLIS University
ERIDA CURRAJ
POLIS University

"We know that only the technical means of artistic achievement can be taught, not art itself. The function of art has in the past been given a formal importance wich has served it from our daily life; but art is always present when a people lives sincerely and healthily."

Walter Gropius
Bauhaus prospectus

This workshop is a project exercise that uses furniture design as a critical tool and as a possibility of experimental tectonic exploration called Daily Monoliths. Through the use of a material in particular and its diverse compositional variations, this instance aims to establish links between an object and the context in which it is inserted, being contemporary architecture in Tirana our focus of attention and study field.

Political and economic changes in Albania in the 1990s have dramatically influenced the architecture and urban development turned Tirana into a giant canvas where diferente artist and architects from all over the world could display their talents. Maybe could be a good chance to take a look into this thirty years of contemporary architecture throught an exercise that confront a building with a interpretation of it. Using the monolith enigma and its multiple interpretations, we'll look for relationships between an architectural work interpretations and its consequent materialization in a particular object, which concentrates a critical discourse both of the reading of a building and as a curious reflection on employment of the technique for its execution.We will seek to accommodate a concept and interpretation of a place through the liberties and experimentation of a handle scale such as furniture design, which at the same time will be a domestic approach to the construction problem and the complexities that it presents in the relationship between architecture and design.Daily Monoliths is about the deliberate use of furniture to establish a conversation between the architecture of the city and the architecture of objects.

The course aims to provide critical tools on product design and the relationship between architecture and furniture. Science and the city are connected in infinite ways, the scales of the devices being a common field of research and experimentation for architects and designers. Knowing how to interpret the built environment keys ideas and putting this into functional and conceptually strong elements will be one of the objectives of this workshop.Experimental dimensions of a specific material, testing its possibilities and limitations through a imposition-free exercise. Daily Monoliths is a project and critical exercise that uses furniture design as a common field of research between architecture and construction, through experimentation on new concepts for architectural materials and alternative design methodologies.The main tasks of the workshop are made up of three main phases:

Theoretical framework. A presentation will be made with the main topics of the workshop, field of study, methodology and objectives for the students, at which time the case studies

Workshop Outcomes

to be considered and the main axes of production of a furniture object will be announced.

Technical framework. Based on a series of construction procedures, techniques and protocols, the constructive possibilities of an object and the expressive limits of a specific material will be studied. Through a series of artistic and architectural references, we will testing the limits and the experimental universe of construction.

Communicative framework. A fundamental part of the transmission of knowledge is its communicative dimension, for which various presentation strategies of the results obtained from the workshop will be studied, with the aim of materializing an exercise and presenting its results clearly and uniformly. There will be three talks / presentations by the workshop tutor that will serve as guides for each tasks to be carried out, being a reference to operate in a short period of time and seeking to achieve objectives in a executive way. Each task will have associated a daily specific student work developement, which will be compiled in a final fanzine including texts, images and photographs of each action. The final product of the workshop will be a piece of furniture built by each group from a specific material, considering its interaction with the chosen building/ public space (as its critical aspect) as well as its constructive dimension (technical and experimental aspect of the same)

Eduardo Corrales Eduardo Corales Architect Universidad Católica de Chile Architect at National Monuments Council in charge of interventions in heritage areas and historical monuments after which begins its independent practice. He has participated in conferences at the Goëthe Institut in Santiago de Chile and in the Master program of Cultural Heritage at the Universidad Católica de Chile. Teaching at UNIACC Arch. School in Studio of industrial architecture with heritage value. Since 2014 he worked in a series of projects with a special attention in their preexisting elements and the exploration of new possibilities of use, centered in concepts like austerity, economy and authenticity, understanding the built context and its heritage value as key analysis elements in the development process of the city and the territory. Since 2018 he works on POWERPOINT: audiovisual and graphic survey of portuguese large dams with EDP Foundation and DG Artes support. Actually he works in Lisbon and Santiago de Chile.

Workshop Report

Tirana, I Love You: Open Architecture and Everydayness in a Contemporary City

SONJA LAKIĆ
FA Platform
EMEL PETERCI
POLIS University
ETLEVA DOBJANI
POLIS University

This workshop makes an original scientific contribution to understanding of the city of Tirana and, more precisely, the fabric of the everyday life that unfolds in the form of the intimate and individual experiences of residential space through the perspective of the "open architecture" (Akcan, 2018). The open architecture, by its definition, stands for the plurality of meanings of architectural design (such as flexibility) and is all about democracy and social citizenship. Here, it is the inhabitant, or, more precisely, "the resident architect" that has the final say: he/she acts as a subject who inscribes space with his/her personal values, assigning a dwelling with a new meaning, different than what the architect originally designed and prescribed. Participants will join on (an autobiographical) endeavor of observing the relationship between the resident and a (wo)man-made built environment by focusing on rather specific architectural elements – i.e. self-glazed balconies, to begin with – and, moreover, contribute to understanding the new paradigm, that is, the era of the do-it-yourself architecture, and narrate the contemporary Tirana by adopting (auto)biographical approach and doing the storytelling through in-depth explorations of personal housing histories. The workshop is all about seeing, reading and writing the everydayness from a micro-level perspective, painting the love story between the inhabitants and the city while contemplating architecture and authorship. Outcomes of the workshop will be publically presented and discussed at POLIS University and compiled into a simple and cheap do-it-yourself informal booklet. The workshop will begin with an introductory lecture on the open architecture that will simultaneously bring to light the phenomenon of the do-it-yourself apartment modifications in the Western Balkans region, as well as the examples of research conducted in a similar manner. Prior or after the lecture, the students participating in the workshop will take on the role of organizer and leader of the urban exploration walk of Tirana, choosing the urban flaneur path in accordance with their own preferences. This will be time to reflect on the city and do storytelling by making drawings and photographs. In the following days, students shall narrate the everydayness of Tirana using drawings of dwellings as well as photographs of intimate interiors, compiling them into a simple booklet.

Sonja Lakić is a researcher with a PhD in Urban Studies, formally trained as an architect, urban designer and planner, with her work evolving around the everydayness of contemporary cities and architecture. Sonja nurtures a particular interest in anthropological and sociological aspects of architectural design and the built environment and, most of all, lived forms of buildings.

Workshop Report

Architecture on the Move

DIEGO SOLOGUREN
FA Platform
BRAD DOWNEY
FA Platform
STEFANO ROMANO
POLIS University
GREGOR ANDONI
POLIS University

The purpose of the workshop i propose is to explore the urban potenialities of a set of spots of the city of Tirana Through the Conception of Architectural interventions which share a common feature: movement.

Movement has been the essence not only of the architecture settling process but also of the creation of the notion of urbanity, culture, civilisation and place. It is through moving that the space of chaos has been explored, discovered and inhabited. Conceiving Devices that contain in its defintion the notion of movement, may go from site specific projects which solve a particular cinematic situation, to the construction of moveable artifacts which can apply to different spotS or the conception of a dematerialised strategy which can add a Non visible Layer to the complexity of communication in the phisicaL space. as a way of making these startegies possible and coherent, I envision to Carry them out in a specific context of the city of Tirana, as a means of defining a common narrative. from a particular neighbourhood which has some specific demographic or phisicaL characteristics, to an iconic street which offers a variety of urban typological residual spaces, or a random condition such as acting in bus stations, or having a time frame intervention plan (Rush hour, religious moment…), These actions could be programmed under a common strategy but leaving space to students to be creative and explore the environment.

Diego Sologuren is an architectural intervention aiming to encourage a porous ecological interdependence between architecture and its environment, through the installation of an experimental liminal ecosystem. A parallel proposal from this project work, exploring the same intentions within another architecture, is also being installed in Lausanne, Switzerland.

Brad Downey is an American artist who was born in 1980. Numerous key galleries and museums such as Krobath, Vienna have featured Brad Downey's work in the past.The maker's first piece to be offered at auction was "4 Works: Doyumsuz" at Bukowskis, Stockholm in 2017. Brad Downey has been featured in articles for Hyperallergic, JUXTAPOZ and The Guardian.

Photos during Worshop

Parallel T

MATILDE IGUAL
FA Platform
LUIS HILTI
FA Platform

Parallel T is conceived as a 5 day theory and practice workshop Parallel T will be an open investigation on scientific spatial systems imposed upon territories. The geographic coordinate system binds together earth and organizes us into time zones, degree latitudes and longitudes. It was a brainchild by Eratosthenes of Cyrene over two millenia ago and has been refined ever since by ever more powerful scientific devices and mapping technologies. Instead of subordinating architecture to this abstract space, we use it as a tool of research and design. Investigating a straight line through Tirana (fig 1.) by walking will give a new insight into the city, the system once invented to simplify the world will reveal its complexity.The research along a straight line will lead us to unforseeable spaces and urban conditions, cutting through walls, and running on roofs. Based on this research we will engage in speculative designs along the investigated line. The workshop challenges the ever more immersive systems that channel the way we move and orient ourselves in space. We will defy google by ignoring it, and take the abstract systems at face value, seeing where they lead us. During the workshop the participants will discuss How does our everyday world and life intersect with specialized knowledge(s) from natural sciences to technology and economy? And how can these entanglements be interrogated through architectural design?
Parallel T is a parallel line to The Line (fig.2) and part of the emerging coordinate system initiated by the Institute for Linear Research.

The outcomes of the course
The workshop will encourage discussion and thoughtful reflection on the science/everyday world entanglements as they spatially manifest within the city. The participants will analyze through different perspectives a segment of the city and will represent their insights employing cartographical tools. The insights gathered will be the starting point for a speculative design in which participants with have to collaborate with others, transfer the knowledge they acquired through their personal mappings and find ways to represent and communicate the architectures they imagined.

The content of the course
Tirana's cityscapes are undergoing rapid transformations. Critically mapping today's contemporary landscapes through walking offers insights that include not only the predictable but also the surprises, that take into account the visible and the hidden, what is and what could be. The method developed during the workshop brings architects to rethink the multiple relationships among science, technology and social processes within the urban fabric through individual documentation.
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ever since by ever more powerful scientific devices and mapping technologies. Instead of subordinating architecture to this abstract space, we use it as a tool of research and design. Investigating a straight line through Tirana (fig 1.) by walking will give a new insight into the city, the system once invented to simplify the world will reveal its complexity.

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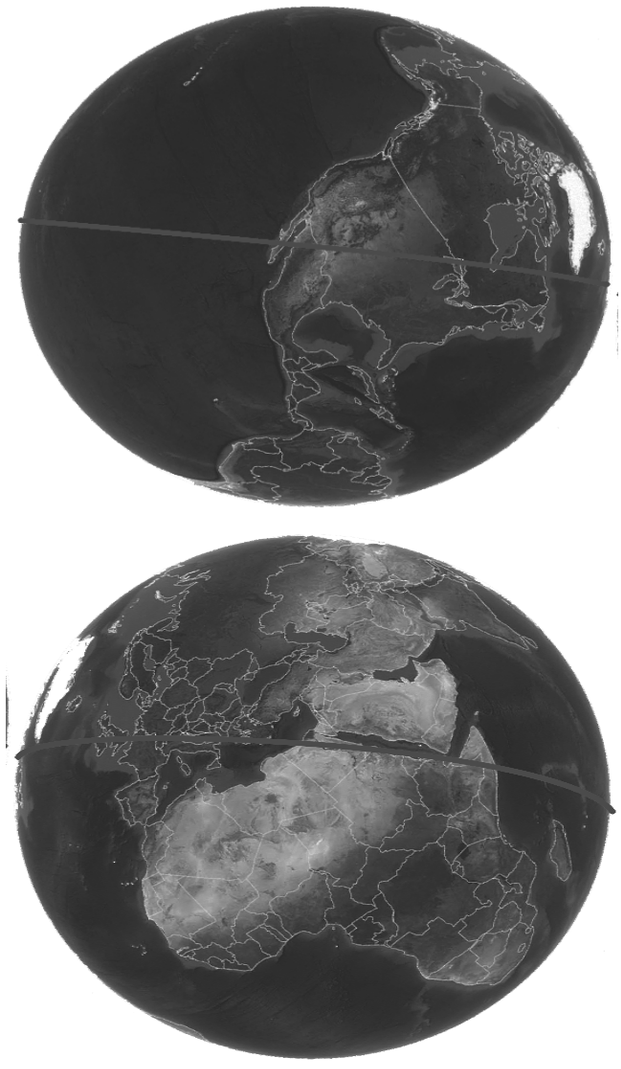
Parallel T across Tirana



The Line across the world

Luis Hilti (Schaan, Liechtenstein) Architect (ETH). He has his own architecture practice in Liechtenstein and develops participatory processes. He is currently a PhD candidate at the University of Liechtenstein under Prof. Anne Brandl.

Matilde Igual (Valencia, Spain) Architect (ETSA Valencia). She has a MA in Art & Science from the University of Applied Arts Vienna and is currently a PhD candidate at the Academy of Fine Arts of Vienna under Prof. Elke Krasny.

Let's Talk About Shame and Avant-garde

FABIO CIARAVELLA
FA Platform
XHOANA KRISTO
POLIS University
REMIJON PRONJA
POLIS University

Workshop will involve students, the University community and Tirana professionals/citizens from different disciplines into a "group psychoanalytic session" on the topic: Shame and Avant-garde Architecture. The topic will be developed in between traces of the past and results/ambitions of recent/ brand new architectures. What are the failed examples of avant-garde and innovative architecture of the past in Tirana? Which one of them has been considered a failure/ ashaming architecture for a while and today can be re-considered as a resource?What are the key points of Tirana new architecture? Why could it fail tomorrow? What are the mistakes that would transform best innovative ideas into sources of public shame?

Shame will be a tool to analyze critically the strongest beliefs that drive architectures, to remember mistakes of the past, and keep in mind the regenerative potential of time. The general frame of the workshop can be placed into the" architecture and socio-political debate" field;Target Audience. The workshop should trigger a Urban dialogue involving students as well as citizens and professional (to be decided with TAW team). The ambition is to involve an audience as different as possible in terms of cultural backgrounds and perspectives on architecture. Process.

The workshop will be divided in five steps:

Remote/On line: (ten days before) Students and participants will be invited to fill a form where they will select and motivate a "place of shame" for the past and a "place of shame" for the present/ future. (An introduction on the way we suggest to look at "shame" will be sent as a workshop presentation); Some proposals (from 5 to 10) will be selected to compose a "Tirana tour of shame".

In situ (first day): Participants will run the "Tirana tour of shame". In Each stop participant who proposed the place/architecture will be the guide will present the case study. In each stop we will engage a quick debate: what is ashaming here, what shouldn't be considered asahming at all? (for instance places of shame could be Popular houses blocks; socialst monumental architectures; abandoned buildings; oversized new buildings etc etc).

In situ: (from second to forth day) Researches: Images and videos from archives or as part of documentation process;
Interviews to "shame stake holders" about selected places (citizens, professionals, politicians etc etc);

In situ Overview (fifth day): a public meeting to debate topics emerged during the workshop (stage of the meeting should be organized with daybeds). An exhibition will present materials collected.

Off line Publication (10 days later) Materials will be collected in a booklet (for printing and/or for PDFing) The relationship between Shame and Architecture can be a resource for critical thinking about contemporary ideas, and a tool for better understanding the past. Whatever we believe in a period, insofar as it seem the best belief, it can fail. History has been teaching the weakness of certain ideas we were thinking as the best, and to the other side demonstrated, ironically , the progressist value of others we considered secondary for long time. When we say that a certain architecture is "shameful" and some others are not, we create a frame that draws our culture. But..

Workshop Photo

what if times change and we understand to be wrong? Shame is changing time by time, place by place, so what about architecture and shame in Tirana in 2020? Science is one of the most meaningful ideals of our time. We trust in it, and we leave to the science perspectives to change and shape our way to see, design and perform the city and its architectures. In the past other ideals had the same power: religion, political ideology, war. The way we consider today this strong factors of historical changes is filled of doubts, and Europe is full of "architecture of shame" driven by by them. Why this should be different now? It is quite impossible that we are absolutely right, as well is non plausible that the past has been producing only mistakes. The way today we can face architecture of the recent past, is somehow what we are. The workshop main aim is to activate a critical discussion that uses shame, the most social among feelings, to understand architecture, the most social among arts.One week to talk about shame, Tirana and Avant gard. A public dialogue on social and political ideas about past, present and future best architectures in the city. An invitation to find new ways to see what we consider shame, and to doubt about what we consider proud in architecture today.

Fabio Ciaravella Architect, artist (founder of the Studio ++ collective) and International PhD in Architecture and Urban Phenomenology (UniBas), former Fellow 2013/2014 at the Art, Culture and Technology of MIT in Boston and part of the Urban Sociology group City Lab of the 'University of Florence. I deal with the new relationships between art and architecture for the public space in terms of analysis methodologies and contaminations in the project.

Tevero Cavo:
An Ecological Enfrastructure for Rome between Past and Future

ANTONINO SAGGIO
Sapienza, University of Rome

Abstract
We believe that the new frontiers of Information Technology have to deal with the central role of Infrastructures in the existing city. Indeed, this new generation of infrastructures will allow the 'redirection' of the development. To arrest developments in "Green fields" outside the cities and redirect developments towards "Brown areas" in the existing cities we need infrastructures of new generation. In this historical moment, a development phase has to focus on the use of urban voids in the existing city to stop the endless urban sprawl. As an example, here I present and discuss the urban project "Tevere Cavo" in Rome.

Introduction
Tevere Cavo is the name of an urban project developed between 2012 and 2018 – in the Faculty of Architecture at 'Sapienza – Università di Roma' – within the university chair of Antonino Saggio. This project involved Ph.D. students, graduating and senior students, in designing almost three hundred projects for the northern sector of Rome, which is marked out by the presence of the river Tiber. The design proposal sees the river Tiber as a new generation infrastructure based upon five essential principles ranging from multifunctionality to ecological systems, from mobility to information networks, up to the relaunch of the civic and symbolic role of the infrastructures to foster interventions in the built environment. In this way, the river acts as a flywheel to invert the direction of the development, shifting from the constant erosion of the agricultural land to the rehabilitation of small and significant abandoned urban areas.

Rome: Two Foundings one Tiber
The project 'Tevere Cavo' profoundly relates to the city of Rome, and Rome displays a peculiarity. It has two origin myths, and both connect to its river, the Tiber indeed. The first is a pastoral and autochthonous one; it has a damp culture, made of woods, forests, and animals. Romulus and Remus, sons of rape and abandoned in the water, were found inside a basket in the Velabrum (the swamp area between the Capitol and the Tiber Island) and breastfed by a she-wolf. The second one is a myth of foreign extraction (anti-autochthonous); this myth is grand and heroic: the light of the fate takes the place of the wood's moisture. At dawn, Trojans arrived at the Tiber's mouth: defeated indeed, but valiant and beautiful. In the Aeneid, there is a passage that recalls the docking at the Tiber's outlet: "At this moment, gazing from the sea, Aeneas saw a vast forest. Through it the Tiber's lovely river, with swirling eddies full of golden sand bursts into the ocean…"

Indeed, the more you study ancient myths, the more you find the components of reality. It was thought that the Iliad and the Odyssey grounded in legends, then Troy was conclusively discovered by Heinrich Schliemann. It is a fact – thanks to years of archaeological excavations and Andrea Carandini's scientific work – that the base upon which Rome developed has its roots in the Etruscan culture. Therefore, do not the two different origin myths regarding the founding of Rome – one autochthonous and the other one cultured and of foreign extraction – clearly explain the marriage that characterises the Etruscan culture itself? A culture that does not arrive as pre-formed, but comes into the world following the hybridisation between a na-

tive culture – the Villanovan one, deeply connected to the earth – and an external that is more advanced in the fields of thought, art, and writing.

The Tiber digs

Rome strongly links to its orography. The city develops on a volcanic area, continuously moving and waving. Volcanoes are within its DNA: from Bolsena, Vico and Bracciano in the North, to Albano and Nemi in the South, large mouths of fire surround the city. It seems to be shaped by lava elevations that draw a shifting landscape, endlessly variable.Lava's solidification processes – deeply related to rainwater flows, wind, and vegetation – outline the space: the gorges in which water streams erode tuff. In this sequence of movements, and ups and downs, we see the rise of the first villages. The Tiber is a sort of big rift between lithospheric plates emerged after the drop of the sea level. As much as the fissures that create within a dry soil. The river, volcanoes and eruptions shape places, and model the renowned hills.

Giambattista Piranesi, in his drawings and etchings, knew how to represent this magmatic nature made of digs, vegetation, and ruins. Piranesi staunchly fights against both the classical and neo-classic Greek myth in favor of a vegetal, stratified, magic, ancestral, and Etruscan, world of Rome. He repeatedly drew Rome and the Tiber. His drawings are beautiful, touching, and indeed projects 'in fieri'. Therefore, Rome was born on rough and volcanic soil, its founding relates to two myths that see the Tiber in their hearts, and rooted in the Etruscan culture. Fragment and stratification are present: these are the reasons that set the scene for the 'Tevere Cavo' project. However, why does this adjective, "cavo", appear in the title?

Tevere "cavo"

The idea regarding the slit in the ground where the Tiber flows is only the first reason why Tevere Cavo (empty or void in English) is the name of the project showed up here. The second one deals with the 'Vie Cave' or 'Etruscan Tagliate.' Let us try briefly to understand. We have spoken about the articulation of the land and, on this territory, the Etruscan civilization set itself up and developed. Now, in this land, the Etruscan culture creates a relationship between architecture and environment that cannot be anything else rather than a marriage, a twine between nature and artifact. The section is the key. However, we do not refer only to an operative process. Indeed, the section and the digging reveal a deeper connection. According to the Etruscans, the Earth is sacred and endlessly sends a message. The Earth 'speaks'.

This relationship wholly reveals itself in the so-called "Tagliate". or, indeed, Vie cave. These are processional paths, dug by men in the tuff even fifteen meters high and for hundreds of meters. Vie cave are the symbol of a holistic approach – or systemic as we would say today – to the topic regarding the relationship between nature and artifact. In these, a set of meanings overstepping mere functional data to insert cultural, symbolic, and religious reasons, condense. What we call 'a road' is, at the same time, a processional path, a celebration of Mother Earth and – functionally and prosaically speaking – a 'quarry' where to extract building material that is used in the construction of temples and most relevant public buildings.

Nevertheless, if we relate with the modern conception of a quarry, and with the Etruscan Tagliata as a proper quarry itself, then we understand the presence of a systemic twine that profoundly inspires us. An action – the digging – made not only for one reason but roundly for many. Much of our work on this topic cobbles together these ancient echoes - these endlessly recalled 'imprinting' - and the issues related to Information Technology, to develop a critical consciousness that without IT cannot face contemporary crises. Indeed, if on the one hand, the word 'cavo' refers to the orographic history of the fracture and on the other hand to the Etruscan world, the word 'cavo' also mean in Italian electric wire and rope. And a substantial aspect of the work Tevere Cavo is indeed related to the implementation of Information Technology within the Design of new generation. But 'cavo' – and this is the fourth meaning – also stands for 'space' as the substance of architecture, if not the idea of a hollow (cavo) ground that is possible to inhabit and use even below the ground. Hence, if naming means to 'place' something in the sphere of desire, more prosaically we would like to place our action in the design field.

The space of Tevere cavo becomes an ecologic new generation urban infrastructure that orographically roots in real environments and, symbolically, in history. An infrastructure that turns toward the future in the belief that, on the Tiber, depends not only on the past of this city but also most of its future.

The urban sector

Beside this deep soul, the Tevere Cavo project consciously moves around the urban and architectural debate towards the role of the waterways and the city recovery. Let us briefly look at some points. Rivers have always been large natural infrastructures that allowed – and encouraged – the development of cities and civilizations. These are at the base of many large cities in the world. From Paris to London, from Vienna to Rome, from Berlin to Budapest. As places for trades and exchanges, for energy use – like in the case of watermills – or water supply, but also for symbolic and ludic events in the ancient world, big rivers had a critical development even in relation to the manufacturing and industrial civilization. Indeed, watercourses have been the symbol themselves of growth arranging along their bank substantial industrial areas using the river simultaneously as a means of transport and receptacle for production waste. But, once the industrial model entered into crisis, cities found themselves with polluted waters, vast and unproductive industrial areas, and with a bet on how to change this situation

At this point, it is clear that the issue of livability concentrates around and along rivers, and the livability of the urban environment is the fundamental element of competition through which today's cities can attract a highly qualified labor force. Moreover, the effects of the riverside rehabilitation are not circumscribed to the nearest banks, but their

consequences also reverberate in more extensive areas. Indeed, the Tevere cavo project does not only relate to the riverside but also to a deeper area approximately one kilometer of depth from the river itself. Mainly, we are talking about the part of the city that follows the flow of the Tiber from the dike of Castel Giubileo in the North to the door of Piazza del Popolo in the South, and it is enclosed by the vast hills of Monte Mario in the West wand Monte Antenne in the East.

Within this large setting, marked precisely by the hilly areas on the Western and Eastern side of the river, we see the rise of at least five urban sectors that we named: the Olympic Bend, Northern Rome, Foro Italico Vittorie, Parioli-Flaminio, Prati. Particularly, in the Olympic Bend area – but also in part of the other sector – we have run the first census of abandoned and underutilized spaces.They belong to these different categories:

- Abandoned or underutilized industrial and productive buildings;
- Under the viaduct areas, traffic dividers;
  Green areas and abandoned and underutilized river bands;
  Free areas, build-able but unused lots, unfinished and in the state of abandoned buildings and urban complexes.
- Areas belonging to public buildings that are visibly under or misused – these include garden, parking lots, storages, schools' common areas;
- Gas stations and small stores, both still productive or al ready abandoned.

The areas eligible to these categories have been recorded in a shared map (search for "Tevere cavo" in Google Map or go to goo.gl/HSmviY). Each of these areas links to a specific record in the designated Blog that contains further information regarding the specific area and, above all, the titles and the authors of the different projects proposed for that lot. Every link progressively leads to the project development. Overall, we are dealing with almost three hundred proposals allocated to approximately 50 areas. Now, let us see the principles that move a "next generation urban infrastructure" like Tevere cavo is.

Five Principles

As said, infrastructures, whether artificial like streets, highways and railways or natural like waterways and water paths, have always been a fundamental tool for development. They have been the fly-wheel that – in a few decades in the XIX century - led us to the doubling, the triplication, and the decoupling of the building stock. But starting in the 1960s of XX century with the crisis of the traditional industrial society and model of production, many industrial areas were abandoned and furthermore the more our cities expanded, the more abandoned areas, empty and dilapidated buildings they left behind.

As is known, in the current historical phase we have to entirely limit the agricultural soil consumption. However, even though we have to restrict soil consumption, we surely cannot stop the development! The answer to address this topic is simply "to invert the development direction". From the expansion toward free land to the re-use of existing but abandoned or under utilized parts of the cities. Anyway, to do this and to focus towards the recovery and the usage of urban voids, we need, indeed, new generation infrastructures.

Five fundamental features mark the latter. They have to be ***multitasking***, that is doing multiple things at the same time, and active towards the direction of a sustainable development, and able to create ***green systems*** (specifically not only the do not have to pollute and waste a few energy, but – above all – they have to insert active cycles of decontamination and depollution). They have to guarantee quality mobility, which we call ***slowscape***, and a vector towards digitization of the city to form an ***information technology foam***. Lastly, they have to be able to ***galvanize*** souls and instill citizens value in public space.

Multitasking

A new generation infrastructure must be able to carry out multiple functions at the same time, weaving and strengthening them with one another. The world changes, and in the Third Wave of the Information Society, the idea of multitasking erased the concept of monotasking that belongs to the industrial civilization; the Mixitè erased the Zoning, and the Tablet, coming from the Silicon Valley, replaced Henry Ford's Ford T. Indeed, one of the most incomprehensible things for one who has never seen a computer is that it can simultaneously do many things and be structurally multitasking. After all, if we had the chance to visit an assembly line in a car factory, we would discover that, also there, the assembly line and the conveyor belt do not exist anymore. What we would find is a sort of neo-artisan that makes all by himself, and that we would call a robot.

Therefore, a new generation infrastructure has indeed to be multitasking like our computers. The new productive models have changed and shaped the city in their image and likeness. If the Zoning represented an optimized monotasking idea applied to the town, today's parallel and coexisting cycles of the IT society go in the opposite direction. Indeed, the idea of multitasking infrastructures is not new. It only has been erased by the monotasking vision of the world that came with industrialism. Immediately, our thoughts go to the bridge as a place for commerce and living, as a custom or a market. From Ponte Milvio in Rome to Ponte Vecchio in Florence or Ponte di Rialto in Venice, we Italians have many models to which we can refer.

However, also elsewhere there are fantastic examples of them. In Iran, for example, there is an exciting multitasking infrastructure, the Khaju Bridge, where the dike serves the bridge, the bridge serves strolling, and the shelters are useful to public spaces. All the Tevere cavo projects try to be intrinsically multitasking. To make an example, if we have a green area we want this to produce energy and to be an exciting aesthetical and educational space. If we have a sports facility, we expect that the athletes' movement will contribute physically to shape the public space instead of only contributing to the building's energy supply. If we design a bridge, this must be a collector for rainwater, a device for air purification using particular algae inserted in the guardrail, and an emitter of information and performances. Moreover, the asphalt has to produce energy

through the presence of piezoelectric elements underneath the road surface. Is not e river per sé one of the most multitasking structures one can think of?

The second keyword is Green systems. If the manufacturing industry had to dominate and exploit natural resources, the information one could give value to the latter, and the post-industrial civilization man can finally deal with nature.At least in high-tech countries, this change of direction opens up new opportunities for a historic "reparation". Today we can reconstruct nature within the city. In high-density built areas, which have regions and buildings abandoned by factories, we can inject green, nature, and facilities for leisure.

Therefore, our challenge is to let the Tiber be an active element within the city's ecological system. It is not only a matter of de-pollution, but concerns a more complex project that deals with making the river a proper "driving force" for a series of principles and behaviors that connect with culture and technology to operate a concrete turnaround: from being a pollution and decay collector, to become a fly-wheel for a significant shift. From this point of view, the Tiber – in an ecologic terminology – takes on the role of a "source area". The presence of Green Systems, and in this specific case the Tiber, permits the creation of a system of green and leisure areas for citizens. Citizens can indeed move along its course, and this uninterrupted navigation is also guaranteed to the plant species – and partly to the animals – in the soil and the subsoil, along with the banks and naturally in the water and the silt. The existence of these significant source green systems allows additionally connecting and giving value to smaller areas and systems – in jargon ecologic islands.

The ultimate goal is to help to control the climate, to create shaded and cooling areas, to have green lungs, to foster the accumulation of rainwater, and to ensure uninterrupted fruition for inhabitants, animals or botanical species. On certain days and hours, proper mobile ecological islands can connect to the Tiber and transport-nest-seed botanical and animal species (this idea comes from Robert Smithson and inspired the astonishing project – designed by Diana Balmori's office – that imagine a series of movable and floating islands on barges over the Hudson canal in New York), or work (it has been already done in cities such as Amsterdam, Dresden and Zurich) with special "cargo carriages" that nightly bring waste to clearing houses.

Furthermore, the active role of these infrastructures can also deal with times of crisis. Many cities are gearing up not only for what regards standard problems (traffic, pollution, temperature increase) but also for catastrophic events. Forefront of this topic is the city of Rotterdam that studied the implementation of water squares, and underground water storage basins that can help in case of flooding or, instead, be used in other times of the year. Of course, the processes are not supposed to happen in one fell swoop but gradually. They have to match de-pollution systems and civic re-appropriation process, often implementing multifunctional ludic/athletic and – at the same time – depolluting and environmental. Another way is to develop remarkable systems to enhance the status of green areas, and that will be injected like filamentous systems into the architecture, into new bridges, and in the recovery of abandoned buildings.

Slowscape

Clearly, the Tiber cannot live detached from the idea of being a means of transport. It is a common belief that speed is not the only parameter for urban mobility, but other quality parameters can be taken into account: landscape and natural ones, others regarding healthiness and sociability, etc. This is a well-developed trend line that includes pedestrian paths, maybe suspended like the New York's High Line or the Paris' Promenade Plantèe, or focused pedestrianization or with bikes routes. WThe hypothesis of using the Tiber this way has been suggested many times, but it always failed because mobility along the river is not seen as a "system" to be reactivated according to the others, but rather as a mere "plug-in" to insert – as it is – in a system that doesn't accept and en-'More slowly' allows inhaling the 'scape', the urban, the archaeological and the natural scenario (and often all the three together). In a country rich in historical, artistic and environmental resources, these are the ideas on which we should build policies, plans, and sustainable projects for tomorrow.

Various Tevere cavo projects work towards a direction that connects to archaeological and landscape issues. Among the many designs, we can find dockings that graft into vast urban parks, and simultaneously host technological centers and inhabited bridges, or reconnect Ponte della Musica with the layer of the river. Other projects deal with paths and accesses to the Foro Italico complex, and also with cycling routes and surface mobility that connect different functions and buildings that are compatible with the docking.

For example, let us think of what it means to leave our car near Castel Giubileo's dike, visit the technological center there developed, and then take a boat and reach Ponte della Musica and then the Foro Italico, or take a bus to arrive at the Auditorium. Maybe, the technical time can be shorter using a car (as long as you will not get stuck in a traffic jam along Via Flaminia) but the quality of your experience will be incomparably better. Hence, reflecting upon how to implement mobility that also uses the course of the River has to be done systemically, taking into account all the links with the other mobility systems, and the many functions hosted on the river banks, with a totality of elements that stay together and coexist.

Information Technology Foam

We are getting used to the existence of Open Data (authorities, companies, public offices, organizations, and individuals, more often are obliged to network some information). Through Open Data small revolutions are accomplished. Indeed, they can be captured by whoever wants and, for example, be used to develop an app that permits us to know in how much time the bus will arrive at our stop. These are 'free apps': not necessarily created by the company that supplies the service. But this is only the simplest level. Actually, information can "interconnect" to shape new models: do the buses are delayed according to temperature? Or according to the age of the driver or economic incentives and rewards?

At this point, we can accomplish an unexpected jump. Not only the infrastructural systems in the existing city can spread primary or secondary information regarding themselves to build up interpretative models, but they can also collect other kinds of information. Imagine an urban train, a bus, a taxi or a means of transport on water. Along with this past, it is possible to collect data as if in a satellite that, instead of being in orbit, moves within the city and through its infrastructures, either the natural or artificial ones. Necessary information like the one regarding security and traffic, but also pollution, heavy rainfalls, water density, etc.

Furthermore, as said before, information can connect to create models, not only interpretative models but also implementing ones. And here architecture and urban planning are coming off the sidelines. This information can transform physical facts within the city to make the latter real-time responsive to the change that information and models - in which they are connected - require. If pollution triples, if the city is under a terrorist attack, if rivers are about to flood, we suddenly realize that the questions that bind information and physical transformations are merely essential.

Even an intermediate informative state, between gaseous (the cloud) and solid – when information turns into objects as a printed book or as a constructive/technological component – does exist, and we can imagine it as foamy. This kind of information is already structured in models linked to physical elements like materials, components, and systems: indeed, they are models almost ready to be operative and quickly to shape spaces, situations, and structures. This information technology foam wraps up the urban environment in which we live and where we will increasingly live. Indeed we can start to crew new generation infrastructures implementing information technology foam first! Our infrastructures can be activated with sensors that capture data of different typologies and collect them in the control room. The data can serve specific goals (imagine water pollution or water rise or security), but on the other hand the data can be used to create models and apps to activate a new way to use the infrastructures. While in a traditional way of thinking it can be considered important to start with major and very costly interventions (for example in the area of water de-pollution), indeed the contrary can be true and is exactly information technology that can ignite a new process to use infrastructures. "Soft first" in this respect can be a good formula.

Galvanize

Therefore, the idea lying behind Tevere cavo deals with the existence of a series of different components. The Tiber becomes a place in which "we can invert the development direction", and where converge positive and virtuous practices for environmental, social, sustainable, and economic issues. The effect is reverberating: it does not affect only the Tiber itself, but instead, it is systemic. Now, one of the critical aspects of the whole operation is the role of new infrastructures that must have a deep meaning for the community to galvanize souls and hearts, to represent the necessary existence of the public and collective sphere. In ancient times, big walls ran for kilometers to fence the city - or for thousands to divide countries – but, as Romulus had in mind when marking Rome within hills of lava with a plow, walls performed the highest symbolic meaning rather than a mere practical function. They used to denote the existence of an entirely new system of values and laws. The sense of these infrastructures was often so crucial that it was rooted in myth and, within this, in drama and crisis (Michel Serres, Rome le livre des fondations).

The design of an infrastructure connects shape and meaning, a meaning that must be civic, to let the infrastructure be a catalyst of aims and will.In this idea, the Tiber acts as a "new" contemporary landscape, neither nature nor panorama. The landscape is the aesthetic representation, collectively and culturally shared, though still in constant evolution, of a part of the world. The breeding ground where it happens to be is, exactly, the one regarding the design of infrastructures and – in our case – Tevere cavo. Indeed, if the recovery of the Tiber is an indispensable compensation for a city that needs to retrieve green and naturalness, we are not merely dealing with designing a "Park" but rather a new piece of the town and a new urban landscape. This means that – from a functional point of view – the new part of city will characterize itself by a mix of productive facilities, linked to the Information society, that at the same time are ludic, commercial, tertiary, and related to communication and leisure. To work correctly, they have to be strongly technological innervated. We mean cables that provide for networks, both traditional and informative ones, lighting systems, control systems, tools to produce images and messages, and a widespread presence of art. From the depths of history and the overlapping and stratified physical layers, as if new shapes and new potentialities would emerge from the Tiber's banks. The latter are bottom-up inhabited as if they "emerged".

This leads to the multiplication of the zero quota, a multilevel intersection of geometries and morphologies, and design for the soil and objects with different degrees of permanence and stiffness. The strategy of emergency, besides leading the formativeness of the project, indeed has a suitable component because it becomes innate to think about these terracings in relation to the flooding risk of specific areas along the river. Within Tevere cavo, we do not aim to optimize only a single feature, but rather to create a network of connections – and interrelations – in which the collective meaning is the catalyst. An infrastructure that does not aim for what we have dealt with that does not strive for being magically beautiful to galvanize people, remains deaf. In one word we are convinced that the public value of infrastructure have a multiplying effect in the entire society: they not only create the possibility for further development but they create the mental infrastructure for a shared future. They raise the sense of citizenship.

Examples project

Functional mixitè, Rebuilding nature, multitasking, Information Technology Foam, Green systems. We need to skim the projects – particularly the ones located within the Olympic bend and the Foro Italico – to grasp what the city could be

after a development project based on designs which are not self-referential, rather open to relationships, to contemporary economies and that strive for collective meanings and values. The current political and environmental situations and the incommunicability between the political world and the administrative one – and the scientific and cultural ones – must not discourage. Project must be thought as necessary act, as it does not stop thinking about change and designs to make it real.

Let us start visiting Tevere cavo from Castel Giubileo's dike in the North, leaving our car nearby the GRA (Grande Raccordo Anulare) or the Labaro stop of the Roma-Viterbo railway. The first project we encounter is "ex.[PO]. A new bridge at the furnaces of Castel Giubileo and technological center for the development of constructive experimentations". We are in an area that since ancient times always had a productive vocation, and now has been transformed into a pole for technological and constructive innovation. The complex extends its field lines in the surrounding park. A boat stop can lead us to the following projects "Rolling Stones. Design for mobile dwellings and riparian zone at the mouth of Tiber". Here, instead of a vast scrapyard, we create a cove t10o shelter ships but also to have mobile dwellings on the water that be temporarily anchored to live in significant places along the river. If we go further down south, we reach "TeC. Therapy and rehabilitation for horses, in Tor di Quinto", that supplies an extensively requested service in an area where horse riding is commonly widespread. The surrounding rural area becomes systemic for the stables. (all the projects can be examined at the site http://www.arc1.uniroma1.it/saggio/teverecavo/ from which it is possible to buy or download the book "Tevere cavo una infrastruttura di nuova generazione per Roma tra passato e futuro" eds Antonino Saggio, Gaetano de Francesco, Itools-Lulu.com 2018.

Another not far significant environmental project is "Logica Eco-Logica. Productive and depolluting park at Inviolatella Borghese," which activates sustainable technologies and uses agricultural production in a depolluting way. Just beyond, in a big intersection between Collina Fleming and the Tiber's bend, we encounter "Eco District Park: urban park, industrial district, and center to educate about recycling", a project that inserts a sophisticated strategy and defines an underground industrial level for recycling. This level is linked to the railway and to the upper park that connects to the city and contains cultural episodes and a proper Museum that aims to give value to the topic of recycling. When the Tiber crosses the big Ponte Flaminio in Corso Francia, we find many projects. First of all, a vast "Park for Renewable Energies and campus for ecological education and consciousness" that extends all the way to Ponte Milvio and – at the same time – designs the banks. The park hosts an education center, produces energy and shares culture. In this park, three projects graft: a "Campus for the study and depuration of water", an "Infopoint and Communication center", that reuse the pillars of a fallen into disuse Bailey bridge, and "Share.It: time bank, youth tourism, swap market".

Continuing along Corso Francia, we find "PARK [ing].A node for the development of sustainable intermodal publicransport and for the biomonitoring of pollution to create oxygen and electric energy". We are in e Olympic Village, and the project prefigures an innovative intermodal junction starting from the stop of the Metro C line. The proposal deals with the topic of intelligence within multimodal programs, as well as in developing bioclimatic solutions (like the geothermal energy that exploits the heat of the underground Tiber, the collection and depuration of rainwater, the implant in canopies of particular algae and lichens able to produce oxygen. In this case, it is obvious the urban project is not only a matter of mere design, but an arranged set of choices, orientations, and necessities. Moving around the Olympic Village, many urban voids are solved with the new buildings that support the idea of mixité and the five categories that we marked as the keys to operate in information city (living, creating, exchanging, rebuilding nature, infra structuring). For example, the projects "CRISALIDE: Ark of native seeds and farm-to-table market; "Exile on Main Street: center for music production and sharing"; "Jump. It: horse riding between sport, culture, and science"; "On air, on line, on site: radio station to make the Olympic Village heard"; or – on the slopes of Monte Parioli – "Dream's Factory: repair and sales center for motorcycles", and "E-motion system: wellness centre and Smart Tower at viaduct of Corso Francia".

Within this framework the Olympic Village keeps his peculiarity of functionalism's model city, nearly a symbol of the CIAM's Athens Charter, but his abandoned voids, some areas under the viaduct, and the big parking lot along the axe called XVII Olimpiade, are thought over according to the whole new strategies we referred before in this text. Of relevance is the project "PARK [ing] Hub for the intermodal transportation and bio-monitoring". Between Ponte Milvio and the Foro Italico we find "Smart Plat" a newly designed shelter that performs multiple tasks: it creates shadowed areas, and a small covered square, gives access to information and presents itself as a sort of urban lounge.

Heading back to Ponte Milvio we encounter "Water Playground: Urban happiness system for the phytoremediation and the reconquering of the Tiber", and a series of punctual operations of urban homeopathy marked by the projects "Side by side, Microprojects on the river bank of Tevere,", that gives new value to abandoned and neglected areas along the Tiber, and "Rescue Islands", that uses the river as social infrastructure system.

Furthermore, Ponte della Musica becomes a multitasking infrastructure that accomplishes multiple bio sustainable tasks. A new urban ramp that hosts recycling laboratories, and connects a docking on the Tiber with Foro Italico area where "TTC_Table tennis Centre: a building dedicated to table tennis" shows up. This project employs innovative technologies to accumulate and produce kinetic energy.

Finally, in an abandoned and neglected area along the Tiber, over a space called Pinedo, "OverFlow An institution for mother in detention with children close to Porta del popolo," hat proposes protected dwellings for jailed mothers, spring up. An intricate work of social – and historical – compensation on the edge of the old town. From here we can start again sailing the river to find many other projects.

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http://www.arc1.uniroma1.it/saggio/TevereCavo/

Figure 1. Via Cava presso Norchia

Figure 2. Mappa con una selezione dei progetti di Tevere cavo

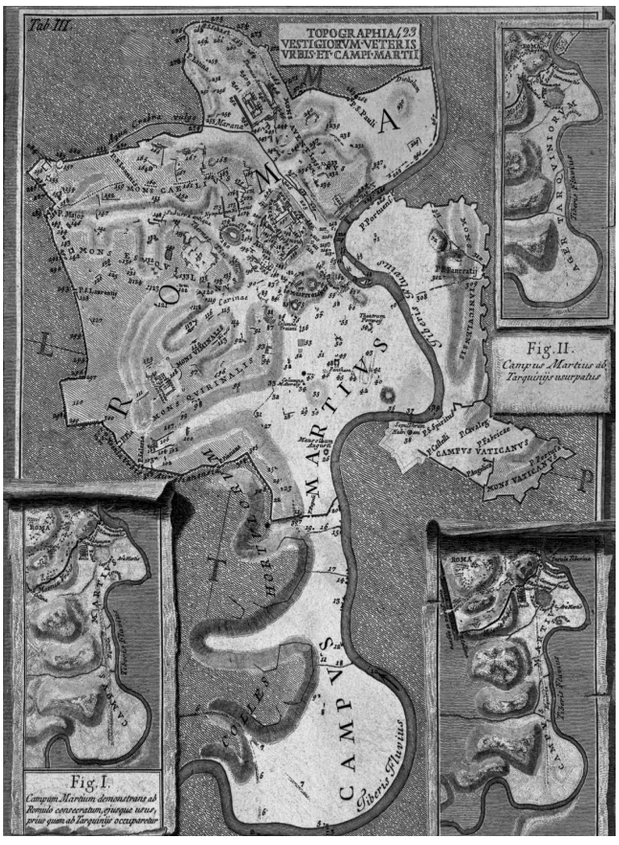

Figure3. Gian Battista Piranesi, Campus Martius, Roma 1762

Figure 4. Prospettiva con l'inserimento dei progetti di Tevere cavo nell'area Flaminia (immagine di L. Cavallo con V. Perna)

Science and Urban Planning In Times of Climate Crises

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Curated by Skender Luarasi and Valerio Perna, the *Tirana week on Science and the City*, *in the Era of Paradigm Shifts* was among the most significant events of 2020, as I believe it anticipated a pivotal research trend of the next few years.

Science, understood as a manifestation of transdisciplinarity, will result in architecture, traditionally enclosed in its own disciplinary niche, opening up to a variety of possibilities for the benefit of community resilience, understood as the capacity of urban settlements to respond positively to the challenges of environmental crises (Melis & Medas, 2021).

Considering that the architecture "puritanism", as described by Richard Sennett (1970), has favoured design determinism and, consequently, transformed our cities into unstoppable climate change engines, a new taxonomy, based on resilience and corroborated by science, will arouse the interest of many, even outside the field of architecture.

Promoted by Polis University, and fuelled by TAW's lectures, the debate regarding science's contribution in fostering urban planning in times of global crises is obviously vast.

Thus, this text focuses on TAW's contribution to the discourse on the extension of the current architecture taxonomy, supported by up-to-date transdisciplinary knowledge, towards more ecological urban planning forms, consistent with the idea of community resilience. Recent research in the biology of evolution, and physics, shows that taxonomic revolutions become necessary when aspects described as marginal, and even exceptional, take on a value both qualitatively and quantitatively relevant (Gould & Vrba, 1982). This need becomes even more urgent when environmental, social and economic conditions change very quickly and dramatically.

However, the authors of the aforementioned researches may encounter resistance, both from their more orthodox colleagues and from society, given that the abstractions of reality, such as taxonomies, are often the object of reification and, therefore, considered immanent and immutable (Gould, 2011). In architecture, the cultural inertia of tradition can be even more evident, despite the fact that the environmental crisis has now abundantly demonstrated the inadequacy of our city paradigms (Melis & Medas, 2021). If, therefore, we were to consider today the heuristic value of sciences, such as the biology of evolution and physics, we should pay more attention to the marginal phenomena of architecture, which today have assumed qualitative and quantitative dimensions such that they can no longer be underestimated (Gould, 1996, 2011). These marginalisation components surely include the peripheral phenomena of the cities understood in an urban, geographical and also a design sense (Melis, 2021).

The paper will also highlights how design biases depend on the reification of architectural taxonomies, from classicism to the present day, and that this reification can be overcome through the up-to-date scientific knowledge, especially focusing on evolutionary biology.

So does dark matter also exist in architecture?

The peripheries are the result of a cultural bias, or reification, to which the puritan reading of architecture has accustomed us. Transdisciplinarity can contribute (heuristically) to draw a parallelism among the periphery of the known universe, be-

fore the discovery of dark matter, the centrality of Mankind, before the publication of Charles Darwin's *Origin of Species,* and the marginalisation of several architectural phenomena within architecture history and criticism books, which, perhaps, still awaits a taxonomic revolution in the scope of the events mentioned in the physics and biology of evolution (Melis et al., 2021). The hypothesis of the periphery of architecture is not a novelty. On November 9, 1964, Bernard Rudofsky inaugurated the memorable *Architecture without Architects* exhibition*,* at the MoMA in New York, and stated that "The history of architecture, as written and taught in the Western world, has concerned only a few selected cultures." In the same year, physicists Arno Penzias and Robert Wilson proved the existence of the Big Bang, which corroborated the shift of the then cosmos model, year after year, towards the periphery of the universe dominated, today, at 85.3%, by a hitherto invisible dark matter (Melis et al., 2021).

So does dark matter also exist in architecture? According to the United Nations, in 2018, 23.5% of the population lived in slums (slums) or informal settlements (https://unstats.un.org/sdgs/report/2019/goal-11/). Slums are settlements in an urban area devoid of one or more of the following components:

- Durable dwellings of a permanent nature that protect against extreme climatic conditions.
- Sufficient living space (i.e. that no more than three people share the same room).
- Easy access to drinking water in sufficient quantities at an affordable price.
- Access to adequate sanitation in the form of private or pub lic toilets shared by a reasonable number of people.
- Security of property. (UN Habitat Report, State of Cities of the World, 2006-2007).

However, the phenomena of informality and slums are not always superimposable. A research from the Martin School of the University of Oxford shows that informal cities operate outside the common legal and regulatory framework and yet are closely intertwined with the functioning of the city. This informal sector covers all the social and economic conditions of places such as the Brazilian favelas or townships of South Africa. Globally, the informal sector is estimated to account for over 60% of urban-city activities, with the vast majority of jobs in many of the world's emerging economies considered informal (http: //www.oxfordmartin .ox.ac.uk / about /). This last observation, corroborated by recent studies on the temporary appropriation of public spaces (Khemri & Melis, 2020; Lara Hernandez et al., 2020), implies that a large portion of urban settlements does not respond to the planned city logic and does not fall within the definition of slum. Thus, some form of dark, quantitatively and qualitatively significant, architecture exists. This is clearly the object of marginalisation, due to the prejudices and reifications enunciated by Rudofsky regarding the centrality of the Western perspective, and by Sennett on urban puritanism. In addition to the global environmental crisis, therefore, the evidence of the marginalisation of relevant phenomena, which could instead contribute to the resilience of cities, also confirms the initial hypothesis of the need, today, of an extension of an architectural taxonomy able to read more adhering to the dynamic reality that surrounds us.

Non-deterministic planning as a paradigm shift

The search for dark matter in architecture is not a purely intellectual and theoretical fact. The data on the environmental crisis show that most of the emissions that we attribute to the city and to buildings concern the formal city designed in a deterministic way. This consideration raises the doubt that the 'dark' architecture might, instead, be intrinsically ecological. Cultural bias, therefore, prevents us from hearing the background noise that diachronically and synchronously comes from a large part of the urban fabric that we really inhabit. As in physics, even in architecture the dark part, although marginalised by a dominant thought, is quantitatively greater than the known one and can be found anywhere: in the most distant regions; in the informal settlements of the southern hemisphere; and in the suburbs of western cities; The periphery of the world, therefore, does not belong to a specific region or city, but essentially concerns the prejudice towards non-deterministic design processes and the marginalization of diverse architectural manifestations. The images of "Architecture without Architects", El Houma of Algiers, the historic centre of Mexico City, and Shibam, Yemen, are just some of the infinite possible cases which demonstrate that indeterminism is a phenomenon that extends far beyond the informal urban fabric, and does not end with the phenomenology of the vernacular (Khemri & Melis, 2020; Lara Hernandez et al., 2020). Underestimation and disinterest in non-deterministic design are perhaps due to a reification of linear progress and human intelligence as a product of rationalism, both of which are fuelled by the 'mismeasure of man' (Gould, 1996). This bias has much deeper roots than the history of architecture and periodically emerges as a critique of philosophical structuralism. We could, therefore, imagine rewriting a history of architecture beyond reification. This alternative history could include, perhaps, intrinsically ecological works in distant places and times. In the Global South, the bias is oriented to slums, often described as a degenerative form of (deterministically) designed urban fabric despite the environmental crisis is mainly due to the formal city. The slums instead suffer (and will suffer) the negative effects on health due to the tropicalisation of the climate, for example in the transmission of Dengue fever, the reduction of rainfall, which favours the spread of the West Nile Virus, and the urban pressure exerted on reservoir animals, as in the cases of Ebola and COVID19 (Melis, 2020). The inhabitants of informal settlements will also be the main victims of the impact of climate change on air quality, drinking water and food supply, which will cause, between 2030 and 2050, about 250,000 more yearly deaths worldwide from malnutrition, malaria, dysentery and heat island stress (IPCC Report, 2014; UN Human Settlement Program, 2014; WHO, 2018), in addition to having to review the victim-executioner relationship between formal and informal cities, architectural scholars could instead consider informal settlements as case studies on the survival strategies (with low environmental impact and in the absence of infrastructure) of its inhabitants (Melis, 2020). Even the suburbs of Western cities are victims of determin-

ist prejudice, albeit from the opposite perspective. Post-war planning, based on the modernism principles of specialisation and homologation, tried in vain to regiment, in a mechanistic form, the organic nature of communities. The monofunctionalism and reductionism of the zoned suburbs have contributed considerably to the environmental crisis, and to its feedback phenomena like the urban heat island and the limited resilience of marginalised communities in the dormitory neighbourhoods.

Architectural exaptation as a possibility for the construction of a resilient city

To understand the reasons for the reification of design determinism, it is necessary to consider again the transdisciplinary research. Determinism implies: a design capable of describing a future scenario, at least probable; uses and functions of the city which reflect that particular scenario both qualitatively and quantitatively; spaces, forms and (architectural) structures that derive from these two starting conditions.

Although historians and architecture critics love to squirm over the type of scenario and the methods of attribution of uses, functions and structures, the discussion on this sequence, net of the sophisms and fashions of the moment, is almost non-existent.This does not mean that tectonic manifestations of habitat modification without intention have never been observed. These manifestations have simply been relegated to the margins of architecture and, from time to time, catalogued as artistic expression, mannerism, conservation, informal or in any way that does not compromise the uniqueness of deterministic design (although equally varied). The dichotomy between the apparent unity of determinism, the only one worthy of the prefix 'arche', and the fragmentation of all the rest, is an involuntary and *ante litteram divide et impera* of the architect who keeps intact a shaky taxonomy of architecture as old as Aristotle (Melis et al., 2021).

Between the 1960s and 2000s, a similar argument in the field of biology concerning the definition of evolutionary mechanisms of adaptation led to the publication of a fundamental article by US palaeontologists Stephen Jay Gould and Elisabeth Vrba (1982). With this text, the authors intended to challenge and extend the traditional taxonomy on adaptation by highlighting that it referred exclusively to that process through which the form (i.e. the morphology of a trait or the pattern of a behaviour in nature) follows a certain function.

Many scholars, and even Darwin in his second edition of the *Origin of the Species,* had been able to observe cases of functional co-optation of structures that had a different function or that had none at all. Exaptation is the term coined by Gould and Vrba for functional co-optation (Melis & Foerster, 2021). Before Gould and Vrba, in fact, a taxonomic definition was lacking, which would underline the relevance of the mechanism described, in contrast to the determinist prejudice of the most orthodox evolutionary biologists, who, up to that moment, had fuelled the marginalisation of functional cooptation.

The deterministic position, in biology, had, therefore, led to the exclusion, from the evolutionary process, of all those cases in which pre-existing structures (evolved in other ecological contexts, with other functions or none) were subsequently co-opted by natural selection. In this description, we can observe an extraordinary similarity with architectural design, as described, genotypically, in the literature of the discipline.

Equally extraordinary is the similarity between exaptation and non-deterministic tectonic transformations, described above. This reflection, if shared, could have a heuristic implication. The structures capable of acquiring new functions and the spandrels, structures without functions, constitute an indispensable resilience reservoir when environmental conditions change rapidly and unpredictably. During the current environmental crisis, therefore, the same criteria of diversity, variability and redundancy of the structures intended for functional co-option (exaptation), would guarantee levels of resilience that, evidently, the intentionalism of conventional planning was not able to do.

Conclusion

Almost forty years after the 1982 publication of Gould and Vrba's essay on exaptation, the reactionary rigour of a part of architectural criticism raises a question: if diversity has now been acquired as a social value to be promoted as opposed to homologation, why is it that, in urban planning, one is forced to propose the opposite? Yet many, in the most diverse research fields, have described the limits of dexterity homologation, with respect to unpredictability, uncontrollability and the scale of events, such as environmental crises. The question of the opposition between order and disorder is still open, in architecture, precisely because it reflects a political relationship, difficult to unhinge, between order, hierarchy and authority, which pervades the entire organisation of society. When the reifications crystallise into prejudice, what is culture, etymologically understood as the cultivation of knowledge, risks becoming a cult, and the discussion on order, from abstraction, takes on a dogmatic dimension on the part of those who hold authority and control.

According to Lebbeus Woods (1994), authority resides in the hierarchies and static balances of rational determinism to which it is necessary to contrast a fluid dynamic reality. Already in 1970, Richard Sennett had sensed that the confusion, between the use of the machine as a tool for the city with the vision of the city as a machine, would have convinced planners to create the conditions to intensify the impulses towards purity and, in this way, they would have promoted the voluntary abandonment of social participation and the desire to use violence as a final solution (Sennett, 1970, p. 86). For Sennett, therefore, "The growth of technological complexity in modern society and the decrease in the complexity of its social forms have proceeded on entirely separate levels" (Sennett, 1970, 85). Sennett concludes that a new urban anarchy, which includes creative disorder, could be the alternative to the puritanical, rigid and violent city. In this context, it is less surprising that the design and thoughts of many architects who work on the margins of the taxonomy of order are still described today as an individual and solitary journey, albeit relevant to a limited range of enthusiasts.

Although they use different definitions and have even distant cultural and philosophical references, in the work of

these ‘solitary’ architects there are expressions that can be superimposed on the mechanisms of exaptation and the concept of spandrel. Woods, for example, argues that radical architecture is that in which one does not yet know how to behave (Woods, 1997). Maximalism is, for him, a ‘wonderful complexity’, as opposed to the rhetoric of reductivism and modernist mechanism. As for Gould, therefore, also in this case, order, Platonic idealism and the binary vision of the Cartesian reality are at the origin of the reifications, which we carry with us like millennial burdens. They are counterpointed by the creative possibilities of indeterministic, antihierarchical and fluid dynamics networks and relationships.

Reflecting today, in an organic way, and with a historical perspective, on the apparently distant works and ideas of Woods, Fredeick Kiesler, Raimund Abraham, Haus Rucker Co., Gunther Domenig, Vittorio Giorgini, Giovanni Michelucci, Emilio Ambasz, and many others, would allow to place their thinking in the right perspective, as a contribution in favour of a more articulated and complex reading of reality. The re-emergence, in their texts, and in the projects, of themes that describe in advance the impact of global crises, and that expose pioneering proposals regarding possible architectural strategies, in response to the crises, instead confirm the inability of at least two generations of architectural historians and critics to keep pace with paradigm shifting and to recognise the continuity and coherence of research. The dominant reading of architecture, as order, and of planning, as determinism, is, therefore, at the origin of the marginalisation of those who have instead promoted alternative ideas, perhaps perceived as subversive.

In addition to having a responsibility on the effects of environmental crises and on the marginalisation of those who could have contributed to their mitigation, architectural determinism has also helped to increase forms of cultural exclusivity that have prevented a historical, organic and coherent reading of the work of those who have promoted the extension of the taxonomy of architecture towards non-deterministic forms of design. Although unconsciously (in most cases), the ‘divide et impera’ action of ordered, autonomous, homogeneous and rational architecture, which promoted postmodern historicism as the only form of antagonism, favoured a reading of alternative tendencies, as fragmentary, incoherent, formalistic (in the sense of the orientation to the geometric form) and informal, at the same time, always assigning a negative meaning to each of these categories.

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This City Does not Exist
An attempt at a theory of Neural Urban Design

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2015 was a turning point in the application of techniques derived from AI research to the arts. This year saw the introduction of the Generative Adversarial Network (GAN) by Ian Goodfellow1 and the paper *A Neural Algorithm of Artistic Style* by Leon Gatys et al[2] In recent years, these novel methods have taken hold in the arts[3] and music4. The newly emerging artform is fittingly named Neural Art[5]. The source of this term can be found in the title of a paper by Leon Gatys[6], which forms the base for the work of several of the most prolific Neural Artists, such as Mario Klingemann (who describes himself as a *Neurographer*) and Sofia Crespo, who's series of works named *Neural* Zoo reflects a keen interest in the estrangement and defamiliarization of deep-sea creatures. There are many more artists in this area[7]. How is the result of these artists related to architecture and urban design? Maybe an example will help to clarify how provocative this novel method, in a good way, is for architecture. Mario Klingemann uses databases of Western art, mainly portraits, as a base for his StyleGAN[8] applications. Thousands of images from the Renaissance to the 19th century are fed through a StyleGAN algorithm. In a conventional case, StyleGAN would be used to create images that convincingly represent a known object to the observer. Most famously demonstrated with examples like *This Person does not exist* (Fig.1), a website that generates compelling images of persons based on an extensive database of portraits. It might be necessary here to understand that Neural Networks are Function Approximation Algorithms[9]; they will always strive to approximate the number 1. Or in other words, in building the training dataset, it seeks to adapt a curve to a given condition based on input weights. A curve can also describe function approximation; thus, the famous quote "Machine Learning is just glorified 'Curve Fitting'"[10]. As much as this approach can produce convincing images of objects, it is the area outside the perfect fit of the curve that produces the more interesting results in that they maintain a certain familiarity, despite their alien appearance. To come back to the work of Mario Klingemann as an example of what I mean by that: His images and animations maintain elements of the database informing the StyleGAN. This results in images that show contorted bodies and distorted faces that have a surreal quality to them – bizarre Janus heads with multiple faces, strange Cyclops, monstrous Chimeras between humans and animals. (Fig.2) The trained eye will still recognize features of historical paintings and drawings. A bit of Goya here, some Whistler there, glimpses of Jeanne-Etienne Liotard, Eduard Magnus, Lenbach, Winterhalter. But none of the images is designed to approximate the particular artists, as 'This Person does not Exist' would do. Instead, it renders the features recognized by the Neural Network and re-combines the pixels into a new image outside the conventions as to how we as humans understand the depicted object. In doing so, the emergent pieces of art provoke questions of authorship and agency. In addition, the question of the value of a sensibility that was created somewhere between human input and machinic output is raised. Is this the art of the posthuman age? Does this development take into consideration the possibility to reconsider the role of humans in a world where the boundaries between human and nonhuman creativity are blurred? In architecture, we can observe a similar tendency with architects increasingly

Figure 1. Philip Wang, A grid of faces of people that do not exist - https://thispersondoesnotexist.com/

Figure 2. Mario Klingemann, Memories of Passersby I, 2018. (Credit: Quasimodo)

picking up novel techniques in machine learning and machine vision. I would describe this new tendency in Architecture as ***Neural Architecture,*** borrowing from Computer Science and Neuroscience from the language used in the arts and music (Neural Art, Neural Music). Increasing the scale allows, of course, to speculate about the value of a ***Neural Urban Design.***

Familiar but Strange: Bits, Pieces, Features & Neurons

I have relied on Neural Networks to train databases, exploring them in a reverse flow of information in my work, which means that algorithms that are typically trained to recognize objects, such as in automated cars, etc., are used to perform *generatively* instead of *analytically.* A similar technique to the ones used by the artists mentioned above. Unbeknown to myself, for example, Sofia Crespo uses a very similar 2D to 3D Style transfer technique to the one I have been using in recent years[11].To give you a more concrete example, let me rely on an image-based approach: Using a database with several thousand images of Baroque plans (Fig.3), we experimented how a Neural Style transfer would imprint the learned features from the baroque plans to a modern plan. Echoing the conversation about the work of Neural Artists, we achieve results that are familiar but strange at the same time. The nature of Baroque architecture reflected in the dynamic opposition and intersection of elliptical volumes of space, the thick poches, undulating walls, and rich surface treatment are features that are learned by the Neural Network and applied to modern plans (Fig.4). Even though this is a simple experiment, it was a proof of concept as to how this method does not simply imitate a style or create a crude collage of elements. Still, instead, it produces unexpected, highly provocative, and yes – inspiring images.

With these new toolsets come a whole set of questions regarding their ontological and epistemological qualities. How do they change the way that architects conceive of their projects?

What does that mean? To unpack this problem, we need to divide the problem into its specific components. The assemblage of elements needs to be laid out. Knolling the problem, so to speak. In neatly laying out the particular parts of the conversation, we hope to achieve a clear overview of the challenge that urban design is currently facing in the gestalt of a novel agent in design. Unpacking the pieces, unwrapping them, and cleanly positioning them on a flat surface allows for a clear overview. We will unpack the problem by closely looking into the meaning of Neural Networks and slowly and methodically working ourselves towards the aspect of the Epistemology of the object we are observing and the elements of paradigm and theory that they produce.

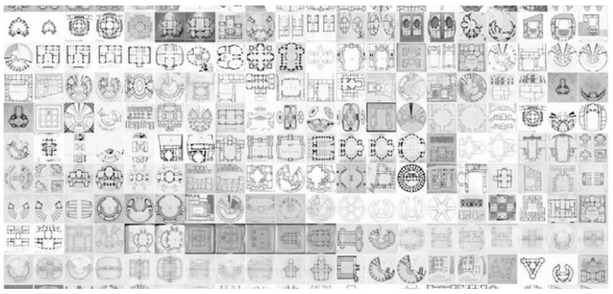

Figure 3. Matias del Campo, selection of images from the Baroque Data base, 2020 (Credit: Matias del Campo)

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Ontology

Neural Networks are abstract Objects.

As described above, NN's are prolific in recognizing relationships within a set of data. This is one of the reasons why this method is such a provocation for urban design. The traditional role of the designer is not very different. Architects, for example, are trained to recognize, understand and process a large set of correlated information to assemble them in a project. Just think of an urban design competition situation. There is a call for a competition; a group of rules in the form of programmatic, technical, social, and economic aspects is established. The specific program calls for the urban planner's knowledge, experience, and expertise to synthesize the rules in the form of a design idea. How does this *knowledge* emerge? Let us be concrete about the problem by assuming it is a specific competition; how about picking up a historical example. How about the "Park de la Villette" competition? The result of the competition can be described as a very concrete object[12]. To achieve this concrete object, a set of abstract objects have to be established first, such as plans and sections, which are based on calculations, numbers, and collections of diagrams demonstrating the spatial relationships. This produces a set of ontological dependencies, not only between concrete (material in the form of a building) and abstract (design, plans, sections) object but also between the concrete objects (such as the Follies, in the case of the Park de La Villette) and the set of data present in the architect's mind. How many parks did he/she design before, how many did he/she see, how many images of parks were absorbed? Admittedly, this is a weak ontological dependency, but a dependency regardless. With this in mind, we can interrogate these entities, these examples of parks in the architect's mind, by their properties.

Properties

What is meant by properties? Properties allow us to compare entities with each other. To stay with the example of the park: The Park de La Villette[13] (Fig.5) in Paris has a playground and a cafe. So does the Central Park in New York[14], the Fuxing Park in Shanghai[15,] and the Stadtpark in Vienna[16]. So we can assume that playgrounds and cafés are properties of a park in that they are universally present. Any number of parks can share them. To that extent, we can consider the park as an object with a bundle of properties. (It would be easy to name more properties present in parks in general, such as benches, trees, fountains, monuments, walkways, bandstands, pergolas, etc.) This might be true for every urban object that operates along with a specific program which ultimately represents a compresence-relation responsible for the bundling. Of course, it is necessary to distinguish between the categorical and dispositional properties of an urban object. When discussing definite concerns, we discuss what something *is like*, meaning its qualities. Dispositional qualities discuss the potentialities of an object (which can be tied to Manuel DeLandas' conversation on p*otentialities*[17]). The Park de la Villette has a specific shape, a definite property, while its tendency to provoke joy is a dispositional property. Concerning the discussion on AI and architecture, we are primarily interested in the categorical properties as these can be examined by Neural Networks. Shape, dimension, plan, section, umriss, pixels, etc. For this reason, we would also include color in the area of the categorical properties as Neural Networks divide color into their RGB values, into numbers, that can be interrogated for their properties, thus positioning themselves within the conversation of abstract objects.

Relations

When talking about the properties of a piece of architecture, it seems evident also to discuss the relationships of these objects to each other. Traditionally in architecture, the discussion of the relationships of buildings to their environment, whether it is urban or rural, is described as the contextualization of a building. I do not know how many hours I spent in Hans Hollein's office discussing the contextualization of a specific structure. How does this axis meet that axis? How does the sun rotate around the building? How are the proportions and scales of the buildings around the project? etc. etc. I had to build dozens of models, physical models in blue foam, with variations of how a building is contextualized in its surroundings (Fig.5). Later I applied the same method in a digital context, allowing me to increase the possible variations into the hundreds today it is databases with thousands of examples (Fig.6). This short story demonstrates the transition from the age of data scarcity to the era of data abundance and the struggle to harness the inherent information. Or as Mario Carpo put it:

"The collection, transmission, and processing of data have been laborious and expensive operations since the beginning of civilization. Writing, print, and other media technologies have made information more easily available, more reliable, and cheaper over time. Yet, until a few years ago, the culture and economics of data were strangled by a permanent, timeless, and apparently inevitable scarcity of supply: we always needed more data than we had. Today, for the first time, we seem to have more data than we need. So much so that often we do not know what to do with them, and we struggle to come to terms with our unprecedented, unexpected, and almost miraculous data opulence." [18]

Circling back to the statement about architects operating as data miners, the response to Carpo's concern about how to harness the qualitative information of big data to inform the architectural project at hand is the use of Neural Networks. Not only do NN's process enormous amounts of data, but they also need enormous amounts of data to learn anything of value, whether it is relationships (contextualization), features (properties), or behavioral patterns. To this extent, the collision of the wealth of data produced by the city and its history of urban design with processing methods borrowed from Artificial Intelligence results in Neural Urban Design.

About Features of things and how to capture them

What does this mean for the relations between these urban objects? We can find a close connection here to the aspects of properties, in that both -relationships and properties- describe

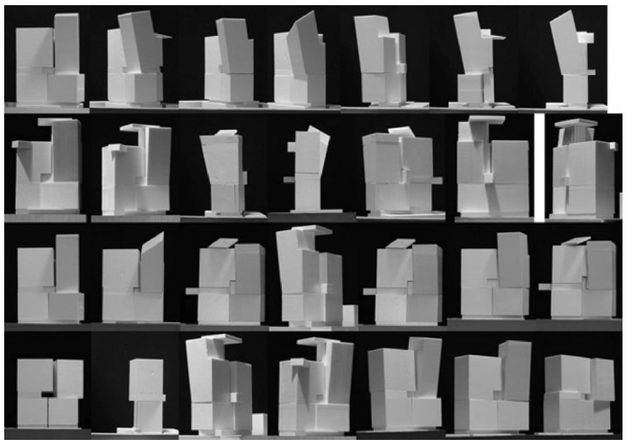

Figure 5. Hans Hollein, Series of Models for the Saturn Tower, Vienna, Austria, 2004 (credit: Sina Baniahmad)

the character of the things they are applied to. Occasionally properties are described as a special case of relations[19]. The example of the park as an urban object described in this essay allows us to differentiate between internal and external relationships. The Park de la Villette and the Stadtpark are in an internal relationship of similarity to each other as both are *parks*.

The relationship is determined by the relata of similar *Features*. As evident and almost simplistic as this insight seems to be, it is crucial for the operation and inner workings of Neural Networks. Features and the relationships to each other (for example, in an image) make it possible to train a Neural Network to recognize a park – or anything else it is trained to recognize, for that matter. Currently, this method is utilized in machine vision tasks that allow self-driving cars to recognize other vehicles, the street, signage, people, dogs, cats…– by understanding a family of internal relationships within a large number of images. In architecture, we can use this ability in an analytical sense and in a creative sense in that the flow of information can be reversed to generate a park instead of rec*ognizing* one. I would like to emphasize the impact of such a motion, as it opens up questions about agency, authorship, aesthetics, and sensibility. Apart from the consideration of internal relationships, there are also the aspects of external relationships. As briefly discussed before in architecture, this discussion would gravitate around the *contextualization* of a built object. In contrast to internal relationships, external relationships in architecture are not defined by similarities.

Things, Facts and the Ontology of Neural Networks

After defining that Neural Networks are abstract objects defined by their properties and their relationships and dabbling in abbreviated definitions of some of the terms used in this essay, one more question remains: Is Neural Urban Design a thing or a fact? Why is this relevant within the conversation laid out in this essay? It is very alluring to declare that every architecture is a thing, and thus every aspect and part of it is a thing too. But is this really so? What about plans, calculations, proportions, simulations? Are those things or facts? Well, maybe it would help first to briefly define what is meant by things and facts in this conversation. Thing ontologies discuss the possibility that the universe is made of a plurality of discrete objects[20]. To this extent, the paradigm example of a thing ontology would be atomism21 in contrast to non-thing ontologies, which consider that an object is not necessarily an assembly of objects but could also be one continuous object. For our conversation, let us stick to the idea of Neural Networks being things in that they represent an assembly of objects. These discrete objects can be the dataset of individual images or individual obj[22] models (as in the research on GraphCNN design methods[23]) or the numerical data of images (in the form of their RGB values) or the layers in the networks that fulfill different tasks such as edge recognition et al. How are these things and not facts? Or are they both? Let's take a Materialist perspective (and Materialist is interchangeable with Realist in this conversation). We can assume that Neural Networks' calculation is based on material processes: Electrically charged matter. moves, creating a set of physical phenomena resulting in an electric current which in turn is used to run computers and their respective GPU's (Graphic Processor Units), made of Silicon, Tantalum, and Palladium, that calculate the numbers laid out by a set of algorithms known as Neural Networks. All of which are things operating in discrete processes to create a result. The result can be the successful recognition of a car, a person, a dog, a sign, or a voice – or the creation of an image that we describe as art (Sofia Crespo, Mario Klingemann), music (Dadabots, YACHT, Holly Herndon) or architecture (SPAN (Fig 9), Daniel Bolojan (Fig.10), Immanuel Koh (Fig.11), etc.). What if Neural Networks are not things but facts? What is the difference? Things are, in general, put in contrast with the properties and relations they instantiate[24].

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[14]Olmsted, F.L. and Vaux, C., Central Park, New York, 1876

[15]Selleny, J., Stadtpark, Vienna, 1862

[16]Built by the French in the French Concession, Shanghai, 1905

[17]DeLanda, M. Assemblage Theory, Edinburg University Press, Edinburg UK, 2016, pp. 73

[18]Carpo, M., The Second Digital Turn, The MIT Press, Cambridge, Massachusetts, USA, pp. 9

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Figure 6. SPAN, Matias del Campo, Sandra Manninger, Urban Fiction - Vienna 2020 (credit: Matias del Campo)

In contrast to facts described as adhering to the things in combination with their properties and relations as their *constituents.* In short, facts swallow things and their properties/relations versus things in themselves, maintaining independency in a flat ontology.

What about Aesthetics, Agency, and Authorship?

There are three takeaways here for the conversation on Neural Networks and their meaning for the architectural discourse. NN's are things; they are abstract objects with properties. They maintain internal and external relationships within a flat ontology, and they constitute discrete assemblies[25.] After interrogating the ontological frame in Neural Architecture, it might be time to ask if we actually gathered any knowledge from the frame we laid out. Do we know more now that we have explored questions such as objects, properties, and relations between elements at play in Neural Architecture? Most importantly, the previous interrogation already hinted towards some of the epistemological questions that arise out of the work with Neural Networks. Such as the Aesthetics, Agency, and Authorship of the resulting project. Relevant for the frame of conversation in this essay are the positions of Roland Barthes and Michel Foucault concerning the nature of Authorship and Author at large. These critics interrogated the role and relevance of authorship about the interpretation or meaning of text - this can be expanded to all areas of artistic production, such as architecture, in the present text of this essay. Barthes, for instance, attributed meaning to the language and not the author of the text. Instead of relying on the legal authority to exude authorship[26], Barthes assigns authority to the words and language itself. Foucault's critical position vs. the author can be found in the argument he presents in his essay *What is an Author*[27]. Foucault argues that all authors are writers, but not all writers are authors - echoing a broadly discussed sentiment in architecture: ***not every architecture is a building, and not every building is architecture.***

Sensibility of Neural Architecture:

When I talk about the term sensibility, it is specifically geared towards aspects of artistic sensibility. This assertion discusses the arts of the past as much as the arts of the present, recognizing the aesthetic value as a specific feature of all experience. Or, as Arnold Berleant put it: *Such a generalized aesthetic enables us to acknowledge the presence of a pervasive aesthetic aspect in every occasion, whether uplifting or demeaning, exalting or brutal. It makes the constant expansion of the range of architectural and aesthetic experience both plausible and comprehensible*[28]. How is it possible to scrutinize the term Sensibility when discussing aspects of urban design and architecture? What I mean by sensibility is the perceptual awareness developed and guided through training and exercise. To this extent, it is certainly more than simple sensual perception and closer to something like a trained or *educated* sensation. Education has to be continuously fostered, polished, and extended through encounters and activities to maintain the ability to execute tasks with an *aesthetic sensibility.* This ability is attributed in the Western traditions primarily to the arts -to painting, sculpture, music, literature, and so on - with architecture being this strange animal living somewhere between engineering and the arts. We can interrogate these territories of human production concerning their fashions, styles, etiquettes, and changing behavioral patterns resulting from transforming sensibilities. Giving rise to novel movements and entire epochs in the arts in general and architecture in particular.

Neural Architecture is a New Paradigm

New paradigms have the habit of emerging when the existing paradigm has run its course – but what is the current paradigm? That question alone can fill tomes, so we will leave that question open for now instead of focusing on what Neural Architecture brings to the table regarding a substantial Innovation in the Architecture discipline. For one, it critically interrogates the role of the architect in the creative process of architecture design. Neural Architecture embraces the possibility of a design method that is deeply informed by exiting information in the form of databases and understands that the artificial modeling of neural processes can aid in harnessing the information in Big Data. Interestingly the results do not resemble historical examples, and thus the methodology is not a repetition of Postmodern tropes, such as collage, quote, and ironic assemblies. The results instead construct a frame around aspects of ***defamiliarization and estrangement,*** in that we can recognize certain features without it being a copy. We are still at the beginning of this new paradigm of architectural production; the first built examples are currently emerging[28].

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AItect : Can AI make designs ?
Architectural Intelligence/Artificial Intelligence

MAKOTO SEI WATANABE
Makotot sei Watanabe/Architect's Office

Has there ever been a Science in Architecture?
The concept of Architectural Intelligence

The purpose of architecture (design) is to create. To make things better. The purpose of science is to know. The aim of science is to know, more widely and more deeply, how all things work. The area between knowing and making is called engineering. Design tells us what to make, engineering tells us how to make it, and science guarantees the basis for judging how to make it. Since architecture is the work of creating physical entities, it is inevitable that it involves engineering. Stone is strong enough to be stacked vertically, but it is prone to splitting when it is passed horizontally to form a beam. Wood, on the other hand, cannot be stacked like stone, but it can be laid horizontally to form a long span beam. Such knowledge and ingenuity are the engineering that has been used since humans first came out of the caves and started building their homes. Engineering is different from science. Engineering uses science as a basis for its decisions, but it does not necessarily require a logical explanation of why its criteria are appropriate. If you were to ask an ancient carpenter why he judged that a timber of this cross-section was appropriate for a span of this size, all you would get would be, "That's just the way it is". And the architecture made with that answer will live up to expectations. For engineering, if it fulfils the required function, that is enough. Intuition and experience are also engineering. Of course, it would be even better if the logic behind the empirical values could be discovered using scientific methods, but this is not a necessary condition for engineering to work.

However, this distinction also becomes ambiguous if we continue to ask why and how. The engineering reference value for how much load steel can withstand is not a theoretical one, but an experimental one. It is not clear why this value is used. The acceleration values in the seismic standards are arbitrary and can change according to country and time. So, if we say that science derives everything from theory, then even in that science, the fact that water boils at 100 °C is not a theoretical value, but a measured one. In the realm of the so-called social sciences, theories are obtained from the statistical treatment of observations. On the other hand, the definitions by humans, such as 1X1=1, the chains of symbolic logic derived from these definitions, and mathematics, are not based on experiments or observations. Some areas of science have logical foundations that cannot be broken down further. In some domains, science and engineering are clearly distinct, while in others they are difficult to distinguish. The relationship between why and how is something that comes and goes. Structural mechanics and environmental engineer ing run side by side by side in today's architectural design. In structural de

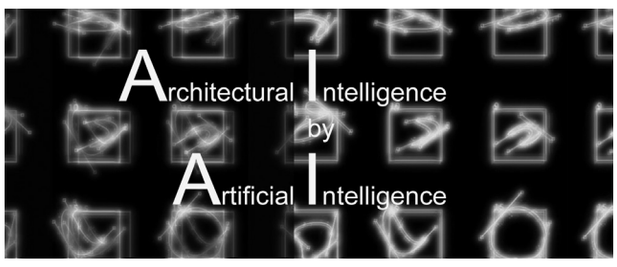

Figure 1. AI by AI

-sign, the required conditions and physical data lead to a logical solution. The same applies to heat loads, airflow models, etc. Patterns of elevator use and evacuation simulations provide rational planning. Such engineering design assistance can be reproduced and verified as long as the same programs and settings are used. However, in the narrower sense of the design field, not including structural design, equipment design, etc., such engineering assistance is less common, although the use of programs is increasing. As ever, the old methods of design are still the norm. There have been research areas in architectural planning for a long time, but most of them are (or seem to be) concerned with guidelines for the quantity and layout of necessary facilities and functions. In the end, architects (including me) still make and destroy a lot of sketches, models and computer graphics, trying to find the ideal solution that must exist somewhere. Eventually, deadlines loom, and around this point, it is time to give up and make a design decision. Hopefully, before then, the solution will appear in front of him/her. It is a blissful moment of descent. In anticipation of this almost miraculous encounter, the architect continues to try and hesitate until the very last minute. Along the way he uses various simulations, calculations and sometimes genetic algorithms, but in the final moment neither science nor engineering can intervene. There is no logic in the coming of the light. It is the same as the absence of the question of why in faith. What there is the inspiration of a talent that calls it forth.

Apart from "inspiration", which cannot be measured or predicted, the engineering/scientific activities related to architecture (which can be calculated), such as structural mechanics, environmental engineering, architectural planning research and various simulations, have been separated into each field and have not been treated in a comprehensive manner. These methods, especially the recent ones using computer programs, have a higher affinity with the IT field than with the traditional " studies " of architecture. In biology, for example, the mainstream method of classifying and systematizing fossil evidence has been replaced by the phylogenetic analysis of DNA, which has led to the discovery of different evolutionary lineages using the same fossil material. In contrast to the established theory of evolutionary phylogeny, by reconnecting the same material with the DNA perspective and method, a different sequence emerged and a new evolutionary path was proposed. The main difference between this hypothesis and the old one is that it can be experimented with and verified.

Rather than competing over whether method A or B is better, a concept and attitude that can deal with different methods and different paradigms from a bird's eye view would be required. Thus, the "totality" of the "multifaceted intellectual endeavors to improve architecture using science as a reference base" is called Architectural Intelligence - AI (AQS International Symposium 2015). "Architectural Intelligence" is a way of looking at all of the methods and research involved in architectural design in terms of "intelligent actions that use logic, algorithms and programs as effective tools". The hope is that by changing the way we look at things, a new system will emerge from the same set of materials. In modern times, science, engineering and design have become increasingly specialized and fragmented. (Incidentally, the world's first engineering faculty in a university was established in Japan in 1877. In the pre-modern Renaissance, they were not as fragmented as they are today. Leonardo da Vinci, the all-round genius, was an artist/architect, a military and civil engineer, a researcher of optics, fluid mechanics and anatomy. The world of design/engineering/science, which has diverged like an evolutionary phylogenetic tree, may be gaining a different form of integration with the new tools of technology. The following are some examples of what I have done so far in this area of Architectural Intelligence, and where I see it going in the future.

Figure 2."Architecture comes closer to a soft/flex science"/(Kentiku wa yawarakai kagaku ni tikazuku) published 2002

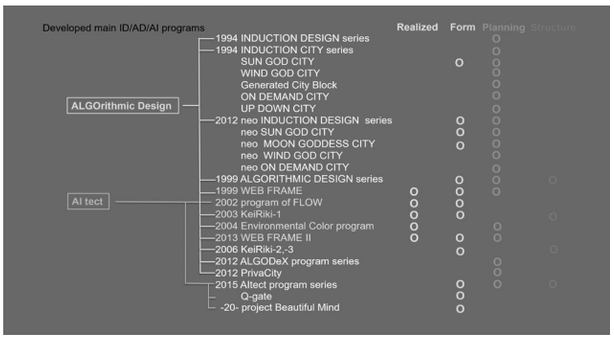

Figure 3. List of major programs researched/developed to date. Sections marked "Realized" in blue = used to design and complete the actual architecture.

ID 1994 – Instead of design, generation

Can architecture and cities be generated according to required conditions instead of designed with traditional methods? In 1994, struck by that concept, I created the first programs to enable it – the series of programs called INDUCTION DESIGN (ID). Here, "conditions" means the various elements of the plans that make good cities and architecture possible. To begin, I selected sufficient light, pleasant breezes, and efficiency, together with streets that are a pleasure to walk on, an appropriately rising and falling topography, and various functions laid out in optimum relationships. Then I began working on computer programs to generate cities that would better fulfill these

conditions. Rather than specifying forms and layouts through direct operations, these programs obtained their results by operating on the conditions. This resembles the electromagnetic induction of physics, so I called the series Induction Design. A key point is the diference between ID and using the computer to create forms and plans. The aim of ID is to obtain the plan, environment, and structure required of architecture by obtaining a configuration, layout, and form that solve the project's various conditions. Rather than human

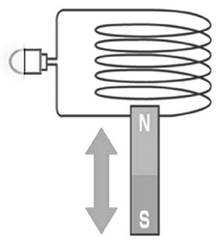

Figure 4. Electro Magnetic Induction

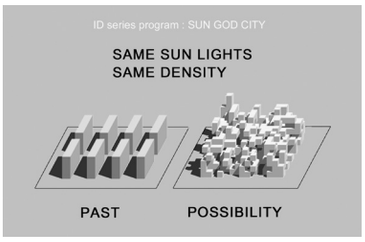

Figure 5. Sun God City < INDUCTION DESIGN (ID) 1994

creations, these are solutions that best meet the conditions. They are "better" solutions. Therefore, although creating variations by adjusting parameters is important, the variations are not the objective. ID seeks correct solutions, not a large number of candidates. In 2001, WEB FRAME (Subway Station IIDABASHI on the Oedo line) became the first work of architecture in the world to be generated with this method–

Figure 6. AI by AI WEB FRAME (Subway Station IIDABASHI) 2000

solving required conditions by program–and actually built. This was followed by the KeiRiki series, which took structural mechanical conditions and, while maintaining the architect's intended form, generated the light est structure. In 2004, the KeiRiki-1 program was used to complete the Shin Minamata MON project 2005. Nowadays, similar functions of the KeiRiki series, called generative design, etc., are becoming standard equipment in commercial CAD software. The KeiRiki series is a much earlier pioneer of such "structural aptimization" software. (The term "optimal" is inappropriate here as there is more than one solution. The answer obtained is a solution that fits the specific parameters of the task to a "high degree", and it may not be the only "best" solution to the task) These series of attempts, including other instances, are called "ALGOrithmic Design (AD)"

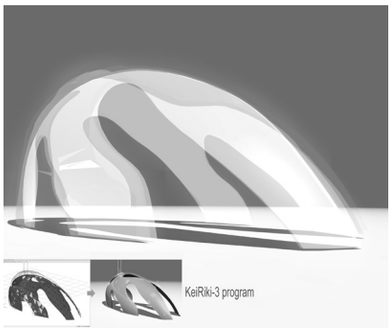

Figure 7. Shin Minamata MON by KeiRiki-2 2005

Figure 8. KeiRiki-3 for Shell structure

AD 2001 – Externalize what occurs in the architect's mind

Both ID and AD take judgments that are made in the architect's mind, externalize them, and write them down. Architects are normally not conscious of the mental processes they use to arrive at judgments and selections. After conducting various studies, they make these decisions intuitively. However, there are some challenges that the head, or human brain, cannot solve. When there are interrelationships between elements, it is difficult to picture in our minds the best relationship between them.

ID and AD are attempts to write down the judgment and selection processes as algorithms. If these processes can be written as algorithms, they can be translated into computer programs. And if programs can be written, they can be used to generate architecture. Therefore, the core of this method is externalization of algorithms.

To externalize algorithms, standards of judgment need to be set. It is necessary to define what is good and what is bad. It is essential to decide what makes a good street, what makes a good disposition of functions, what makes a goodXXX. It is not hard to define "good" for physical phenom ena like temperature or the amount of sunlight or wind. It is also possible to determine good and bad for function dispositions and volumes. But conditions related to humanfeelings and preferences are difficult to define in this way. Good and bad can be defined when an underlying framework is accepted. But preferences cannot be defined. Everyone is different from others, and different from themselves from day to day. Even if expressions were read and brain waves me sured with a Brain-Machine Interface, tomorrow might bring a dif-

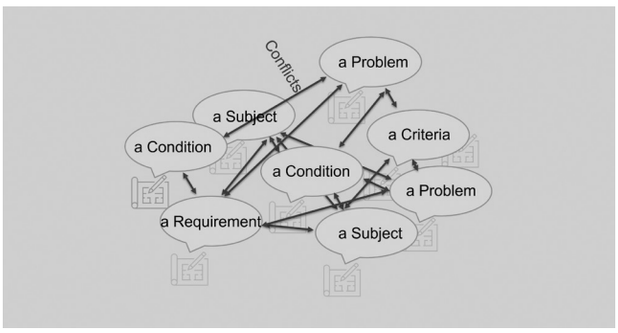

Figure 9. Multiple, interacting requirements - cannot be solved by the human brain

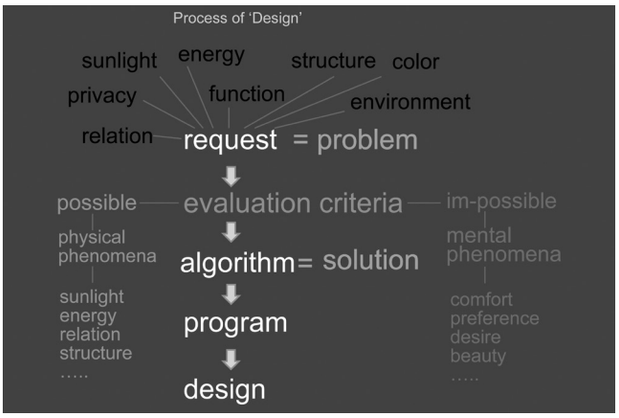

Figure 10. Process of making design

ferent result. Standard values cannot be defined in the realm of preferences. Algorithms cannot be obtained without defined values, and programs cannot be written without algorithms AD becomes impossible. So what should be done?

AIdesign 2001 – Algorithms of preferences

This challenge was taken up in 2001 by the Program of Flow. This was developed to allow forms thought to be good by the architect to be obtained without writing down algorithms. Architect aims are achieved through a dialogue with the program. The architect makes multiple sketches, scores them, and passes them to the program. The program reads the drawings and produces what it thinks is a good form. This is scored by the architect and returned to the program. The idea is that the architect's desired form will be display after a certain number of repetitions of this process. It might be said, correctly, that this could be done by hand. Every architect worthy of the name can draw good forms by hand. It might also be said that the form of architecture is decided by making overall judgments of various requirements, and not by drawing good lines. That is also true. Before deciding on a form, studies are needed of functions, the environment, structure, and history. But while conceding all of that, "good form" was still selected as a theme, because I think that this is the realm least suited to computer programs. If it is the most difficult, then there is value in taking up the challenge. Let's try it. Another reason for isolating the work of drawing forms from the integrated work of design is that this would allow other conditions to be incorporated. This is because values can be defined for many other conditions. If a value can be decided, then an algorithm to achieve it can be created, meaning that it can be programmed. The idea is that if it were possible to develop algorithms for this impossible theme – good forms – then it should be possible to develop them for other conditions.

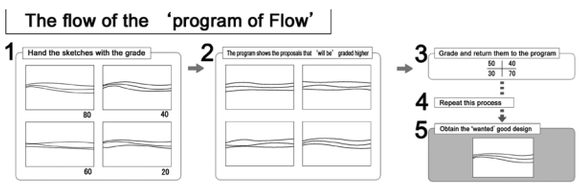

Figure 11. Program of FLOW - Application procedure

Here, "good forms" has a number of different meanings. To one architect, it may mean simply beautiful forms. Another architect may require that designs be astonishing, or even disturbing. In the same way that bad scents need to be mixed into certain good scents. "Good" means different things to different architects. There is no such thing as an absolutely good form. There are as many good forms as there are architects and users. What kind of method could generate such individually different "good forms" without algorithms? The 2001 Program of Flow was an attempt to realize such a method. Combining a neural network with genetic algorithms, it could be called AI.

In 2004, this program was used to complete the Tsukuba Express Kashiwanoha Campus Station, which is configured from 3D curved-surface unit panels. It can be called the first work of architecture in the world to have used AI to generate architecture by solving required conditions.

AItect 2015 – 2021-Will a super architect emerge? / pBM – project Beautiful Mind

The Tsukuba Express Kashiwanoha-Campus Station was completed as the world's first AI-generated architecture. But the performance of the Program of Flow that was developed for this project did not reach the expected level. In the actual design, the program's results were finally adjusted manually. In the end, the AI program was no match for human hands. Then,

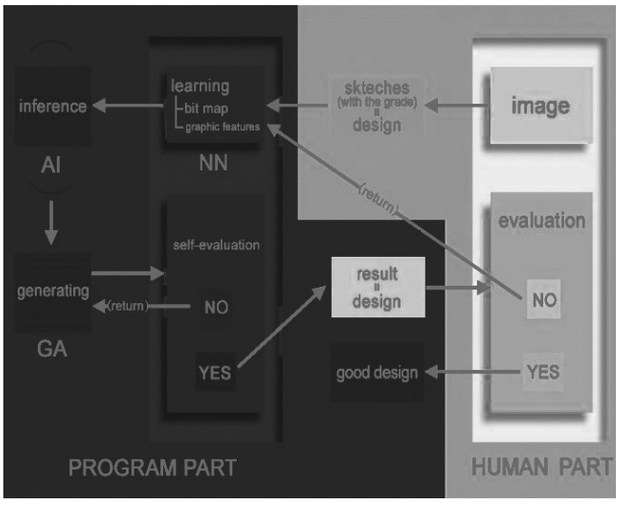

Figure 12. Multiple, interacting requirements - cannot be solved by the human brain

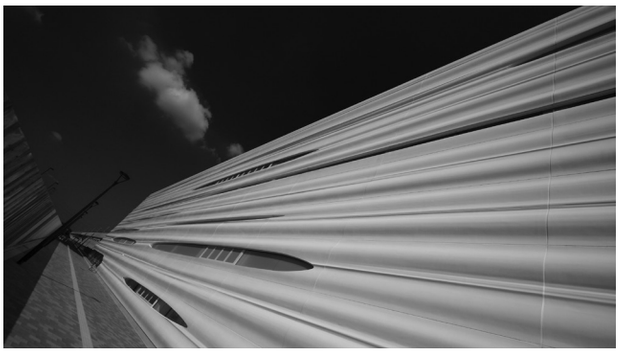

Figure 13. Kashiwanoha Campus Station 2004

in 2015, a new project was begun to inherit this concept – pBM: project Beautiful Mind.pBM aims at the emergence of the architect through AI, or in other words AI architect → AItect. pBM can also be called a project of collaboration between intuition and AI. This series of conceptual perspectives – ID, AD, AItect – is an intellectual experiment in the realm of architecture. It could be called AI, for Architectural Intelligence. The word AItect encompasses two meanings: Architectural Intelligence and Artificial Intelligence.

Objectives and targets

The pBM is an ongoing project as of 2020.

The pBM as of this section provides effective solutions to some extent, but it is not yet sufficiently satisfactory. We are working on trials and improvements (and in some cases innovations) in the following areas: development of the original AI, improvement of the UI, and a system for linking with CG software.

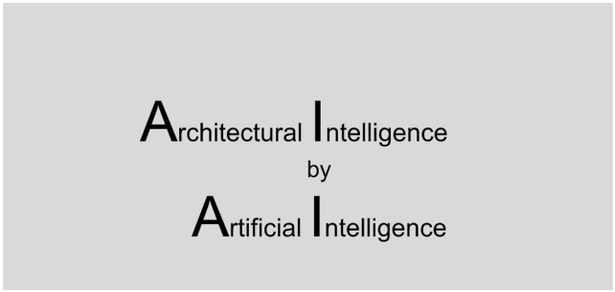

Figure 14. Double meaning

The goal of pBM is for the program to present the form (potentially) desired by the designer (i.e., beautiful form) in three-dimensional geometry. Of course, there are many other conditions in architectural design besides the form. The objective at this stage is to prove that the desired answer can be obtained when only the condition of form is selected from among the various conditions. The reason why only one condition is selected among the various conditions is because the program cannot satisfy multiple conditions if it cannot meet even a single requirement. If the program can solve the single condition called "morphology", then it can be expanded to deal with many different conditions. “To achieve many things, start from one thing”

Features pBM_AI has the following features:

- Does not require teacher data.
- Proceeding in an interactive way with humans.
- Gradually (to some extent) grow.

Many AIs require a huge amount of teacher data.

However, when trying to do a specific design, it is not practical to prepare a large number of teacher data in advance. Even if the images and data of all the works of that designer are read and used as teacher data, the amount of teacher data will not be sufficient. Besides, it is impossible to create new designs if they are pulled by past trends. An AI that does not use teacher data is required. In moreover, since the user does not know himself/herself what he/she is seeking, the process of operation must be a dialogue between the user and the AI. Therefore, the operation process has to be interactive. And because we start without any teacher data, it is essential to have a system that enables the AI to gradually learn and increase its effectiveness.

There is another feature:

No evaluation criteria are defined

This is a big difference from the ALGOrithmic Design. In ALGOrithmic Design, the evaluation criteria need to be determined in advance. Otherwise, the algorithm cannot be composed. We need to determine what is good and where the boundaries are. Even for an AI to distinguish between, say, a human face and a stain on a wall, it would need a consistent criterion that could distinguish between the two. It may be a criterion that humans can understand, such as the ratio of eyes/nose/mouth, or may be a criterion that the AI has learned on its own and is not recognizable to humans. But with pBM, we do not decide if it's good or bad. It is the users themselves who decide/choose it. The user determines the value each time. In the process of interacting with the user, the AI "learns" what is good or bad. ("Learning" in this context is a figurative term) It is you, on every trial, who decides whether it is good or bad. The criteria for judging is different for each person, and the same person often changes his/her mind. The beauty for you may change from yesterday to today. Even under such circumstances, pBM should be able to provide answers. And trying to do exactly that is what makes the development of pBM not an easy thing to do.

Difficulties in AD/AItect Monkey jump effect

If the design conditions can be written down, the process of solving the problem can be made into an algorithm, so " ALGOrithmic Design" is possible. If the conditions cannot be written down, algorithms are not available, so "ALGOrithmic Design" is not possible. This is where AItect comes in, as it uses AI that is (poten-

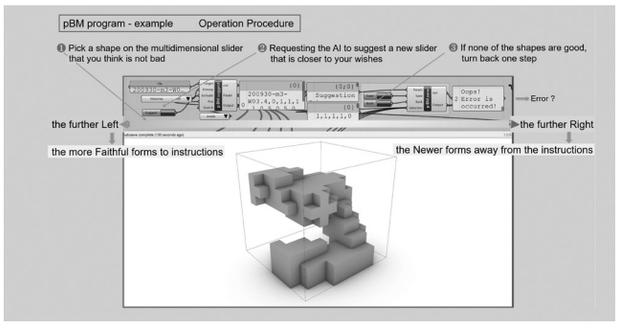

Figure 15. Current pBM - Execution process

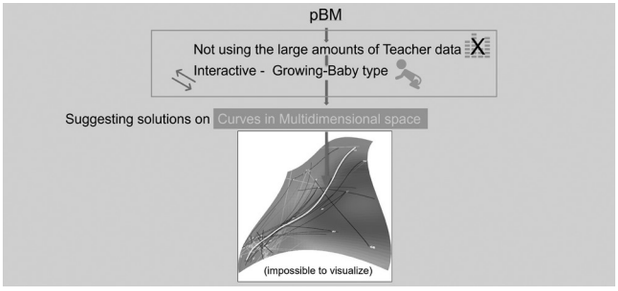

Figure 16. The AI presents a different slider (=a multidimensional curve in a multidimensional space) each time.

tially) capable of solving problems without writing them down. Even that AItect also has its difficulties. To solve a task that cannot be written down, it still needs to be evaluated. Even if the evaluation criteria cannot be written down, the evaluation itself can be done. Although we cannot explain what "like" means, we can tell whether we like it or not. Using this mechanism, the AI can operate. However, there must be a consistency in liking/disliking. If every time it continues to dislike something previously liked, AI will not know what to make a decision on. That AI becomes dysfunctional (...possibly like that HAL). And this is what often happens. The human mind is fickle. Love is transposable. This is an obstacle for AI.

It is OK if inning/losing or the degree of conformity is consistent, such as achieving victory in a game or reproducing the touch of a Van Gogh painting. But when the subject is dependent on human emotions and moods, such as likes and dislikes, there is a great deal of fluctuation in evaluation. And design is just that area. Even if you reach the end of the branch, the top of the decision tree, the branch from which you are advancing through a series of yes/no bifurcations, your "favorite" can suddenly jump in a flash to the next non-contiguous branch. A leap that jumps over the path of logic, a leap that cannot be followed by logic. Action without context. I call this" Monkey jump effect".

The Monkey jump effect buries the accumulated efforts of decisions at each juncture in an instant. It turns the decision tree into a useless dead tree. Monkey jump effect is the first of the many difficulties of design AI. AItect's difficulties do not stop there. It is not the same as chess, shogi, or video games where the only answer=a winner exists. Unlike distinguishing human faces, animals, and cars, there is no clear typology of forms to classify, either. Nor are there any common rules or language, like musical notation or chords. In this vague universe of design, where there are few clues and where anything is possible, it is necessary to find what is "good". Will we ever be able to catch the monkeys flitting from branch to branch ?

Science + Art Paths in the opposite direction actually lead to the same place

ID and AD tried to obtain better architecture by bringing architecture closer to science. They could be called white boxes, because they tried to answer "why" questions with rigorous logic. The brain of the architect and AItect are the

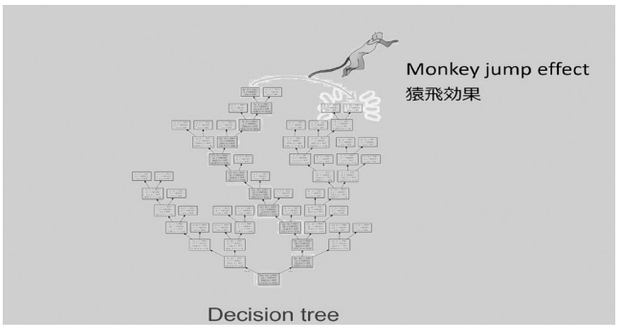

Figure 17. Monkey jump effect

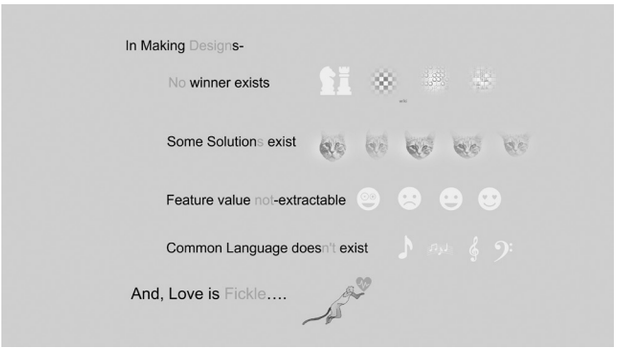

Figure 18. Difficulties in AD/AItect

Figure 19. pBM_credit

rigorous logic. The brain of the architect and AItect are the exact opposite. They are black boxes. Instead of answering "why" questions, they suddenly produce excellent architecture (assuming that they are good at what they do).

The attempt to obtain better architecture by bringing chitecture closer to science. They could be called white boxes, because they tried to answer "why" questions with rigorous logic. The brain of the architect and AItect are the exact opposite. They are black boxes. Instead of answering "why" questions, they suddenly produce excellent architecture (assuming that they are good at what they do).

The attempt to obtain better architecture by bringing architecture closer to science involved the pursuit white boxes. It is interesting to see how this attempt ended up with black boxes. Further, although science, with its principles of verification, and art, which is produced through intuition, appear to be going in opposite directions, in fact they may be describing a loop, so that they are connected at their destinations. That is also interesting. The challenge of ID, AD, and AItect will probably help clarify this uncharted trajectory.

It is not necessarily true that AI will remain a black box forever. With the advent of Explainable AI (XAI), which is capable of providing a rationale for its decisions, AI may once again be transformed into a white box.

AD + AItect When machines have dreams, what will humans see?

As a result of pursuing (soft) science in the realm of design, arriving not at science but art. As a result of seeking to acquire the

logic (algorithms) required by science from the act of design, which depends on experience and intuition, arriving at AI without algorithms (at least not algorithms that can be understood).

While pursuing the extraction of white box algorithms from the black box of intuition, arriving at AI, a new black box. This is a paradox. A strange but interesting paradox. Is collaboration possible between the primordial black box (brain: intuition) and the new black box (AI: learning type)? During lectures on algorithmic design, there is a FAQ that comes up often: if programs generate architecture, what will architects do? I always answer as follows. Machines are better than people at solving complex problems with many intertwined conditions. In that realm, people are no match for machines. But people are the only ones who can create an image that does not yet exist. Machines do not have dreams. Will this answer always be true? Will the day come when machines have dreams? Getting ready for that day will involve exploring that path of fortunate cooperation between the brain and machines.

This will require work in both areas: that of white boxes = the scientific approach = ALGOrithmic design, and that of the two black boxes, toward collaborative methodologies = +AItect. In the same way that our left brains and right brains handle different functions and collaborate to deliver outstanding performance.

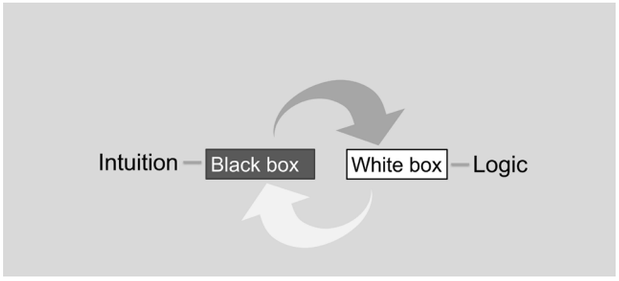

Figure 20. Color of the box

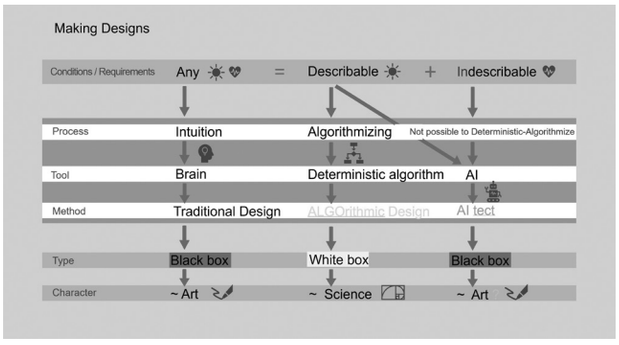

Figure 21. Process of making design

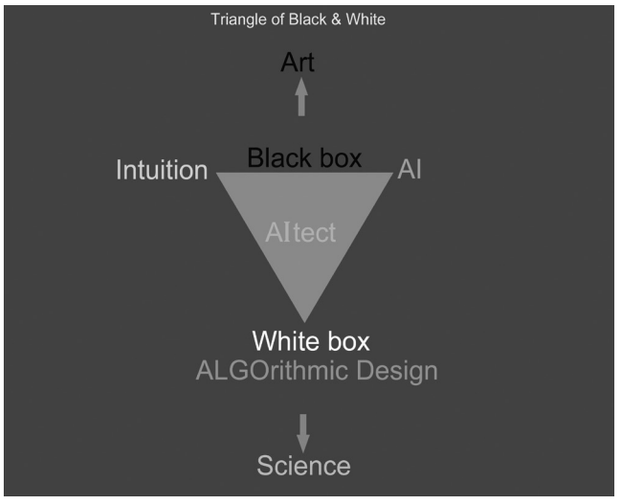

Figure 22. What color is the box?

The [dis]position of Albanian Adobe Constructions. The potential of earth as a traditional building material in the future.

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Abstract
In traditional societies, building construction was related with local materials available in situ. In Albania, traditional architecture is especially built with adobe in the lowest areas, especially near the coast and with stone especially in the mountains. The scarce resources of stone near the coast and the facility to build with mud bricks, has made possible its implementation both in urban and rural dwellings. The greatest number of adobe constructions belongs to the Ottoman period and lasted until the first decades of nineties. This paper focuses in analyzing the design principles and the constructional elements of the traditional earthen architecture in Albania. Through the documentation and study of the local traditional adobe construction systems, it would be more interesting to understand its potential use today.
This paper's analyses are based on large-scale in-situ research made with students in the framework of the restorations course at Polis university, which includes field survey, archival research, detailed photographic recording of the remaining traditional buildings mainly in central Albania and literature review of the main causes of deterioration of adobe structures. Analysis of spatial distribution of housing typologies, basic structural elements, and different construction systems influenced by the geographical position highlight specific earth architecture techniques used in different traditional building typology. Based on the collected data and critical analyses, this paper will provide some useful suggestions concerning the typology, form, and the construction techniques of traditional earth buildings, and it will guide us in finding some techniques currently used for the restoration and preservation of traditional adobe buildings and the use of new earth buildings construction in particular locations.

Keywords
Adobe architecture, traditional buildings, earthen material, contemporary use, revitalisation, preservation

Introduction

The adobe construction technique is one of the oldest methods of construction known to humans. The adobe consists of sand, soil or clay, water, and a fibrous or organic material such as straw or manure. Its preparation with sun-dried bricks is simple low-cost. The term "qerpiç", known as adobe in English, or altube from Arabic, or thobe in Egyptian, corresponds to a building material made of earth and other organic materials. According to H. Raulin[1] (1990), worldwide, there are three main techniques mainly used for the construction of adobe walls, which are: *adobe walls mixed with fiber from woody plant materials such as ground straw, hay, cattle waste, etc; pure clay without the presence of a mixture of vegetable matter,* with the use of lime between each paving and the last one is earthen bricks dried in the sun. The first methodology is applied in different countries in Europe, and it was still applied at the end of the nineteenth century in the west of France. The second one, which is also known with the term Pisé, is realized by compacting the clay with a kind of earthenware pressing between two wooden walls connected to each other by beams. The use of lime between each paving and the regularity of the walls distinguishes this technique from the first one. In the third technique, sun-dried bricks are connected to each other with clay mortar. This first and the third techniques are also used in Albania, differently from the second technique, which is not known in this area.

In Albania, adobe constructions belong mainly to the Ottoman period. The scarce resources of stone in some areas in Albania have pushed the people to define new ways of using local materials in constructions. The ease of using earth as a building material in particular regions of Albania, because of the geology formation of the terrain, especially in the central and western parts, has made possible the implementation of both urban and rural earthen dwellings with a distinct architectural identity. Nowadays, the earthen urban typology is under risk due to the abandonment, non-maintenance, and the decay of these houses. Restoration techniques for both urban and rural dwellings are missing. In this research, the aim is not only to document different typologies of earthen building according to their space distribution, volume form, construction techniques and materials combinations, but also to find out some design principles, which can be useful for the restauration, preservation and construction of new earthen buildings especially in rural areas.

Geographical location of earthen architecture in Albania

Traditional houses in Albania are mostly constructed with stone in combination with wood. In some areas, the stone was not easily found and the cost for its provision was high. For this reason, people used earth as a local material in construction, which was peculiar especially in the lowland of Albania, even though it was also used in some regions near the mountains. We can classify three different techniques of adobe constructions used in Albanian traditional buildings that are closely related to geographical areas.

The first area, and the main one for the concentration of adobe buildings, is the lowland of western and central of Albania. According to Muka (2001), earth, wood and reed were the main materials used to build walls in the wetlands of Myzeqe in the upper region of the city of Vlora. It was also, widely used in Tirana, Elbasan, Durres, Kavaje, Peqin, Rrogozhinë, and Lushnjë villages, all parts of the lowlands of Western Albania. A similar use of adobe constructions can also be observed in villages surrounding the city of Korça, which although is quite a separate area, it has similar geological conditions to provide earth as a building material (Fig. 1, 3). In the lowland area, adobe was used for one or two floor residential buildings but also, for service and low-cost building and courtyard walls. In Central Albania the main typology of residential building was the fire house with one or two floor plans. Adobe was used for masonry walls and internal partition walls and was combined with other materials such as stone and wood. To protect the buildings from humidity, the foundations were built with river stone with a height of 15-20 cm from the ground level. The wood was used as horizontal timber beams in the walls, to reinforce the walls in better resisting earthquake. Timber beams were placed mainly every 0.7-1 meter-high, one in the internal part of the wall and the other on the outside for walls up to 70 cm wide, and another one was added for wider walls that went up to 1 meter of thickness.

Adobe walls, built with clay mortar, straw, and wooden beams, range from 40 - 60 cm, up to 90 - 110 cm (Muka 2007). According to Muka (2001) there were used two types of adobe: "thin" and "large" adobe walls. The thin adobe walls were usually constructed with bricks 20 – 30 cm wide, mostly belonging to

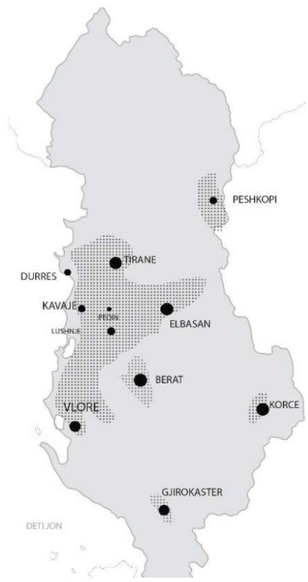

Figure 1. Adobe vilas distribution in the Albanian territory

[1]*Henri Raulin, (1990). Konservimi dhe vendi qe ze ne kuadrin europian arkitektura shqiptare, kryesisht banesa qytetare dhe ajo e ndertuar me qerpiç, ne Monumentet 2, Tirane, f.65*

modern techniques, while the large walls were from 40 to 100 cm, representing mostly the traditional techniques

In some cases, the stone was used only for foundations and the rest of the wall was in adobe, in other cases it includes the basement up to the first timber beam, but there are also examples of stone walls that can reach the second last beam and only a small part is built in adobe. In two storage buildings, for example, the first floor is usually made of stone and the upper part is in adobe. There are cases in which the side wall, exposed to the rain humidity is made of stone and the rest of the building is in adobe, or the outside walls were built in stone and the inside in adobe. In rainy areas, most of the walls were made of stone and adobe was used between the last two horizontal timber beams. In these dwellings, the roof of the house was wide to protect this part of the wall from the rain as adobe is vulnerable to humidity. According to (Muka, 2007) the ratio between stone and adobe in the tradition buildings in Albania is from 1: 4 to 1: 1. Typical for this area is also the use of the technique with *furka* to build walls. (timber frame infilled with mud or mud bricks). Most of adobe walls, especially in urban areas, were plaster with clay mortar and then smeared with lime. In Myzeqe area, it was mainly used with red earth. In this area we can sum up 5 variants of adobe walls based on the ratio between the stone and adobe, their position and the use of timber beams.

- The stone is used only for continuous foundations and reaches up to 15-20 cm from the ground level.
- The stone is used for foundations and reaches up to the first timber beam, in order to protect the adobe part from the water coming down from the roof to the ground and hitting the wall.
- In rainy areas, most of the wall is made of stone, and adobe was used between the last two horizontal timber beams. In these areas, the roof was wider to protect the walls from the rainwater.
- In rainy areas, where the stone is missing, the wall of the first floor is built in stone and that of the upper floor is built in adobe. The upper floor is less exposed to the rainwater.
- In rainy areas, sometime the outside walls were built in stone and the inside walls in adobe. (fig.2)

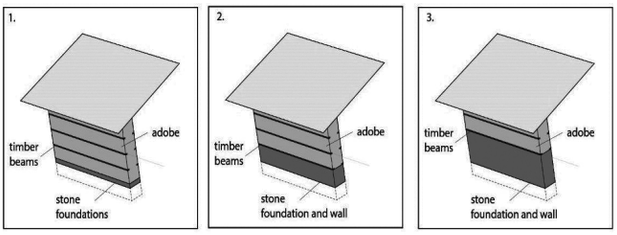

Figure 2. Adobe wall variants

The second area of use of the Adobe walls, is in mountainous area in north-eastern part of Albania such as Peshkopi and Diber, especially in a few villages in the lowlands of the Drini i Zi river such as Kastriot, Sopot, Maqellarë, etc. Adobe techniques in this area are similar to those in the western and central part of Albania, but there are also other techniques used. The use of adobe walls built in timber frame with mud brick infills can be found in these areas, a rare technique with the use of diagonals in wood timbers in order to better resist better the horizontal forces. (Fig. 4) The third area of use of the earth as a building material is Gjirokastra and Berat. The technique in these areas is very different with the first two mentioned before. The traditional houses in these cities are made of stone, and mud is used as infill material in the upper floor. The walls in the last floor are constructed by wood construction, and adobe is used as a filling material and as a plaster layer in both external and internal part of the wall, or as a light ceiling. This technique was called *"çatmá"* which means a thin wall, with wood planks or twigs and painted with mud or plaster. This technique was used also for the ceiling not only in traditional houses but also in houses of the beginning of the XIX century. In Berat and Gjirokastra, there are some examples of çatmá made of wood and reeds and used for the upper part of the buildings, which was then white plastered with clay. (Fig. 5). Similar examples can be observed also in Myzeqe and Korça villages.

Figure 3 a,b,c. The use of adobe in the lowlands of central western Albania. View of the ground floor raised above the ground level. View of the inside house with perimeter walls in stone until 2m high and then the continuation is in adobe wall.

Analyses of Albanian key study with adobe walls

The widespread use of adobe as a building material in our country makes it an element of tradition, culture, and an added value of architectural evolution. Nowadays, cities like Tirana are losing their identity, the memory of their origin because of the demolition and non-preservation of traditional dwellings. In the authentic neighbourhoods of Tirana are still found earthen traditional villas, which are threatened by the large urban development of multifamily houses. Part of this heritage is ruined, due to their abandonment by the inhabitants, lack of maintenance by the authorities of heritage preservation, and the subsequent speculations of a multi-storey buildings. No initiative has been taken to restore, maintain them, or adapt them for another useful function. In Tirana, the main adobe villas are located in the old parts of the city, mainly along Dibër Street, Kavaja and Dur-

Figure 4. The use of adobe in Dibra area

Figure 5. The use of adobe for the çatma technique in Berat e Gjirokastra

rës Street and their transversal roads, or the eastern part along Elbasan road.

Raising the awareness of the younger generations about preservation and the reuse of these buildings for various purposes, such as social, culture and economic activities, seems to remain the only hope for the future.The urban houses in Albania from XV to XIX century, according to E. Riza (2009), can be classified into six typologies based on their compositional character:

- The Fire House, especially developed on two floors, around of which are distributed the other living and auxiliary spaces
- The Porch House (Hajat) has next to the living rooms, in front of the house, an open space with wooden pillars which is called the porch. This is a tampon space between the house and the courtyard. This house typology is most ly located in the central of Albania, in the lowlands.
- The Çardak House (loggia), is usually constructed in two-floor buildings. The Çardak element is built mainly on the main facade of the house, and in its original stage it was open. This space was greatly used by the residents during the warm season, because of the big windows in it and the pres ence of the natural light. The çardak or loggia, in Albanian houses is used in different typologies, all over the front fa çade, positioned only in one side or in the central part.
- The Fortified house, also known as Gjirokastra house be cause of its extended use in this city, is distinguished for its outstanding development height and its protective features.
- The Tower typology is mainly the tradition of the mountain ous areas and is mainly built in stone walls.
- The Corner House (Qoshk), is mostly used in Korça, and in some cities in Kosovo, such as Gjakova, Prishtina, Vushtri, etc.

In the adobe villas taken as a case study in this paper, because of their different spatial distribution, they will be characterized according to the six typologies explained above.

- The first case study is a private villa, situated in Thanas Ziko road, but does not overlook the main road. It is only one floor and is a porch house, in which the porch is the central element of the house that provides a distribution space for the ground floor. In the main façade there is the entrance to the porch which guides one to the other two spaces of the private room and the storehouse with a reduced height. In the main façade, there are also lateral stairs which bring one to the other room, situated over the storehouse.
- The second case study villa is composed in one floor. It has a U shape and creates an inner garden which serves as spatial distribution for two houses. The original shape of the Adobe wall construction has been modified along the years by add ing new living spaces and creating two detached houses for two brothers and their respective families. The new created spaces are made by ceramic brick walls by changing the original L shape of the house. This house is not a listed building.
- These two villas (the third case study), situated in Bargjini Street, are two vernacular houses located in the same court yard and planned for two growing families. The first villa has a rectangular shape with a central main entrance which takes one to the central space distribution. The second vil la has a quadratic shape with a lateral entrance. Both hous es, which were originally designed with a space of 1 + 1, have undergone later modifications in time adding other ad ditional spaces for the family.
- The fourth case study villa is composed in one floor. It is accessible from the garden. It has a quadratic shape creating a symmetrical imprint. The internal central corridor makes the distribution to the lateral rooms. The ground floor is elevated from the ground level and is realized in wood construction. This house is still in use and has been modified during the years according to the daily needs. The internal spaces that face directly onto the courtyard are the spaces used mainly during the day, and for this reason there are more than one big opening for each space. Night spaces are placed on the back of the house and have less openings. This house is not a listed building.
- The fifth case study is the Begeja House located in Dibra Street, in the old neighborhood near the bazaar of Tirana. It is a two-floor building. It has a specific architecture and con struction in comparison with the other villas taken as a key study in Tirana. The perimeter walls of the house are made in

Figure 6. Adobe construction distribution in Tirana City

stone for the entire height of the ground floor and in adobe only for the height of the first floor. The interior walls are made with adobe material, for the whole height of both the first and second floor. All the walls are structural walls. The house plan is a merging of the two houses of the two broth ers. It has a direct view of the road, but the main entrance is from the back façade, which faces the internal courtyard.

- The sixth case study villa directly faces the main Dibra Street and is composed of two floors. It is accessible from the back façade, from the garden. It has quite a rectangular shape and is symmetrical. The central corridor enables the distribu tion to the lateral rooms and hosts the stairs for the second floor. On the ground floor are located the rooms for daily ac tivity, while on the first floor are located bedrooms, the cen tral corridor lit with natural light and the loggia. The whole structure of this house is constructed with adobe structural walls and wood roof. This house is still in use and because of family needs it has been modified inside by adding a new bedroom in the central corridor, creating a shop in the ground floor accessible from the main road and closing the loggia to create a private space. This house is not a listed building, but it is one of the few vernaculars remaining.
- The seventh case study is an adobe house in Kavaja, which today functions as an Ethnographic Museum. Originally the villa had been used as "an adjoining housing for two fami lies." It is a listed building and is under protection by the Ministry of Education and Culture as a first category monu ment. It is used as the Ethnographic Museum of the city and it's a tourist attraction. The spatial composition of the house is derives from two houses with 3 living spaces for each of them. This house typology is known as the hajat house be cause of the lobby in front part of the house. In the center of the house there are placed two (separated) fire spaces. On their sides there are two rooms and in front along the four rooms there is the porch (veranda). Sofa are the rooms that extend from the veranda creating two wings in the front fa çade and with a higher level of the ground floor (1.2 m high er than the veranda level), accessible through the stairs. These spaces are more airy and have a natural ventilation system, creating cooler spaces for the summer.Consequent ly, these spaces are used more in the summertime,because of the higher temperatures. The roof of the house in the main rooms is decorated with wood ele ments. The windows have wood grids and wooden shutters.
- The ninth case study house, is situated in Abdi Toptani Street (former Alqi Kondi street), composed in two floors. This house, with an axial symmetry, is made with adobe construc tion walls for the whole height of two floors. The only excep tion is the construction of the second floor of the summer space of the rooms overlooking in the main façade, which have wood construction. The center of the house is the fire space creating an open atrium.

Even in the two-story buildings, the fire room was the gathering place for the whole family. In these houses the fire room reached the height of two floors, and it communicated directly with the other premises through an internal staircase. In front of the fire room is the porch, which served more during the summer period.

Some features of the traditional house with adobe construction

From the analysis of these houses asd case studies, we can see that after 1920, some of the traditional Tirana villas built with earthen walls underwent changes on their facade, importing elements and decorations from the Italian style. Both outside and inside the houses were finished with lime. Most of the houses were originally one-story, but later two-story houses were built, with wooden stairs positioned in the interior space. The ceilings and floors were made of planks. Only the fire room was without a ceiling to allow the smoke to escape through the roof. Bathrooms were built adjacent to the bedrooms. The bathroom floor was paved with cement with a hole in the middle, which served to remove water. The protruding roof creates a shelter quite often more than 50 cm out of the plane of the wall. This element, which may seem as purely aesthetic, actually had a very important function, as it protected the wall from rain. The floor was designed in two ways. It was raised from the ground level, and it was constructed with wood, thus creating a detached floor from the ground, or it was constructed with rammed earth directly adjacent to the soil layer. The foundations were always constructed with stones and were always higher than the ground level in order to create a layer of stone, to protect earthen walls from the rainwater. Windows had wood shutters to offer protection from the sun, especially in the South facades.

Houses were mostly detached from the road through an intermediate space that was the courtyard. In the cases when the house was built along roadsides, the main entrance was not from the road but from the back facade that was facing from the courtyard. The courtyard was in front of the house, paved with cobblestones and had a smaller area compared to the garden. The water well was a central element of the courtyard. After 1944, garden spaces were expropriated by the communist regime for the construction of new social multifamily housings, streets, schools, etc. Since 1990s, these traditional dwellings have always been under the pressure of demolition because of the increased demand for urbanization. A large part of traditional buildings, listed as monuments or not, have been damaged or are in danger of falling due to lack of restoration.

Restoration, Reconstruction and Reusing of earth architecture.

Adobe buildings are very much used in traditional societies as a natural and local material. They are also widely used today in the context of green building. Earth is a natural and biocompatible material. Its environmental impact is minimal since it is an abundant resource, and it is not mixed with chemicals or subject to processes that produce polluting waste. At the end of its life cycle it can be returned to nature without special treatments. In addition to being sustainable, earthen buildings have considerable mass and, consequently, a high thermal inertia. Earthen walls more than 50 cm thick, have excellent heat storage capac-

ity and can retain heat and the humidity present in the air. Both heat and humidity are released into the environment only when necessary. The sound proofing properties are also good, also

Figure 7 a,b,c. Protruding roof/Wood beams in the external walls/Porch space in front of the house

thanks to the porosity of the adobe. Adobe walls have good performance of fire resistance. Adobe walls have good structural resistance and excellent structural capabilities. Earth buildings have demonstrated that they can last for hundreds of years and remain structurally sustainable. Adobe is an elastic and ductile material that makes it suitable for buildings of different shapes and sizes. Using less energy than fired materials and requiring less operational energy during their lifetime to create comfortable, healthy indoor environments, these buildings create sustainable society and local economy.

One the weaknesses these structures present is their sensitivity to water, which could compromise its performance and resistance. For this reason, it is always necessary to evaluate some very important architectural solutions related to the building body. First creating an elevated basement from the ground level. The air layer between the pavement and the ground layers will create the possibility of creating an interspace layer which protects the floor from water and keeps it warm in the winter and fresh in summer. To stop rising the humidity, it is necessary to set up horizontal barriers between the wall and the foundations. The foundations can be designed with a water-resistant layer to protect the wall from the capillary water and the pavement. The creation of an external drainage system near the basement can also help to keep the foundation and the walls dry from the water.

The use of ventilated roof is the best solution in creating insulated and cool roofs. An adequate coating, to protect adobe walls from atmospheric agents or increase its thermal characteristics, can be designed with different solutions. Another external fire bricks or wood layer in both exterior and interior, can be designed to protect the adobe wall. Insulation materials can also come in three variations. On the exterior side of the wall, on the interior side, or in the cavity between two layers. Insulation materials can be of different materials, as glass fiber, rock wool or fibrous materials such as cellulose insulation or glass wool, or solid fill as polyurethane or polystyrene, mineral wool fiber, polystyrene beads, or insulation foams. When the insulation is located on the outside of a building's load-bearing wall, the structural components are better protected from extreme temperature variations and condensation risk. This reduces the possibility of damage due to thermal stress and water vapor saturation (Krus et al., 2005). External insulation can change the building's appearance and sometimes may not be favorable when we must intervene in a listed building. It can also change the footprint of the building by increasing its total surface.

Internal insulation is relatively easy to apply, does not require additional elements outside, and is often the most viable in terms of costs and permissions. However, the biggest technical problems one will face with internal insulation are related to the occurrence of thermal bridges, in the architectonic nodes of the building. Cavity wall insulation refers to insulation that is placed between the outer and the inner layer of an external wall. A cavity wall presents advantages and disadvantages that are similar to externally insulated structures that often benefit from reduced overheating hours in summer due to the retention of thermal mass in the inner side. Adobe walls can be used also in new contemporary architectures as a passive wall heating system by contributing in the green building performance.

Revitalization and reassessment of traditional architecture and materials in developed European countries

Museumsdorf Niedersulz is an open-air museum, built in 1979

Figure 8. External Adobe walls of a traditional house in Kavaja, coated with an external brick layers

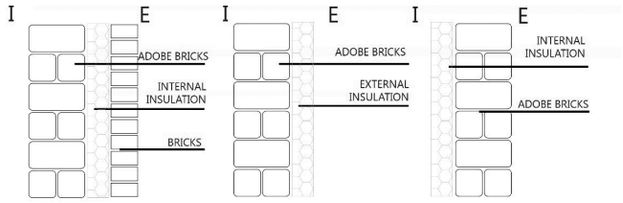

Figure 9. Different solutions of insulation of the external layer of earth wall

in the village of Sulz in Weinviertel, Austria. This museum, within approximately 45 km from Vienna, is a collection of about 80 important traditional buildings, characteristic and representative for the architecture of Weinviertel's area. These buildings have been transported from their areas of origin from the entire region, to be housed in this open-air museum, to enable their preservation, constant surveillance, maintenance, and also give the opportunity to the tourists and academics to have access in traditional techniques and design. The structure of these buildings is made of retaining adobe walls. These 'monuments' are mainly residential buildings, but they are also buildings with social or service functions. The placement of these monuments, have the form of a linear village, according to the traditional settlement of 1000 years p.e.s along a stream.

Inside this complex, immediately after the entrance, there is a hut, left for the academic activities of the TU Vienna students, experimenting on the adobe material. The idea of the workshop

and the whole open museum is to study the adobe material, to build with traditional methods of this material and to study its problems or its different behaviors in cases of being interweaved and combined with other materials. The adobe material in this area was mainly used as a mixture of several elements, such as soil, sand, straw, and lime (fig. 14). The mass of these elements, and their variation, constituted a change in the characteristics of the final material. During the workshop with the students, the adobe was experimented as a building material in several ways and part of the building, as follows:

Casting Adobe walls / 2. Wall with wooden structure and Adobe used as a connecting material in between

Adobe brick wall / 4. The adobe as a structural wall element with large dimensions without the need for a connecting element between them / 5. The adobe as a ceiling material (architectural element dividing between the roof and the living environment)

Case 1 / Casting Adobe walls In this case adobe wall is not created on the basis of a certain shape. After preparing the earth material at the

right viscous mass, the material was built by filling, creating a vertical wall. After reaching a certain height, the adobe material that protruded on both perimeter sides of the wall was cut with a knife to give to the wall regularity and vertical finesse. After this process, the wall was plastered on the inside with adobe material, but with a finer composition of soil and straw. The outer side of the wall which was in contact with the external environment could be plastered or not. From the tests performance of the use of paint on the inner plastering layer, the adobe material got the color very well.

Case 2 / Wall with wooden structure and Adobe used as a connecting material in between. The second case with wooden wall and the use of adobe as a filler and as a plastering material is quite frequent in Austria. In this case, the wall is made by horizontal wooden beams and between them is placed the material of the adobe with the same thickness as that of the wood. Two types of plastering have been experimented in this. On the outside surface, a three-centimeter-thick plaster was used. On the inside part, the plastering is done with roofs (small wooden shutters), a thin layer of adobe mixed with the binder, straw, and a layer of straw as the connecting element.

Case 3 / Adobe brick wall. The third case is the realization of the adobe bricks according to the process explained above and the realization of a vertical wall with adobe bricks using the adobe as a connecting element again. This wall is very similar to the adobe wall that is also found in our country. On top of the adobe wall is placed a plaster layer approximately two cm thick, and a thinner layer of adobe without the straw material about 0.5 cm, to give a uniform finish to the wall.

Case 4 / The adobe as a supporting wall element with large dimensions without the need for a connecting element between them. In this case, wide pipes of adobe are used to create walls. Once the processed adobe reaches the right viscous mass, it is laid on a certain square surface, and then assembled into the shape of a "pie" to create a so-called "brick" which has a considerable width, over a meter, and a diameter of approximately 10-15 centimeters. They are placed on top of each other without being dried and without the need of a foundation under it. Because of their gravity they don't need the presence of a connecting layer between as well.

Case 5 / The adobe as a ceiling material (architectural element dividing between the roof and the living environment) The last case, similar with the fourth one is created as a horizontal architectural element for the ceiling, as a layer in between the living room and the roof, creating the possibility of a room under the roof for the placement of animal feed. This ceiling is

Figure 10. The table where the adobe material was placed and the mold made with wood, useful for the brick shape. In the right there are different shapes of adobe bricks

Figure 11. The different amount of straw inside the brick and its size, change the binding properties of the material and its finesse in appearance.

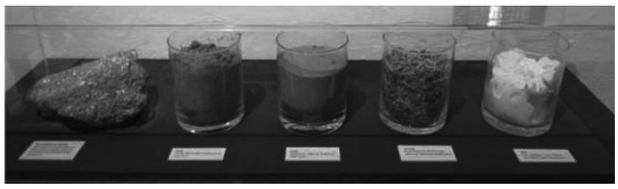

Figure 12. Limestone as a mixture of several elements, such as soil, sand, straw, and lime

reinforced by a strong stick in the center of the assembled adobe layer, which also helps in the stability of the horizontal structure

Conclusions

Adobe is a material that is widely used in many places around the world and is one of the most widely used building materials. A big number of world's population lives in adobe buildings today. The widespread use of earth buildings in our country makes it an element of tradition, culture, and architectural values. Nowadays, Albanian cities are losing their identity because of the demolition and non-preservation of traditional dwellings.

In the authentic neighborhoods of Tirana there are still villas with earth materials. Most of them are ruined, abandoned and forgotten. A lot of research and many studies about earth materials are returning the attention to this construction material because of its good thermophysical properties, its low cost, good resistance to earthquake vibrations for one- or two-story buildings, low impact in the environment and the adequate microclimate in the interior. It keeps the environment fresh in summer when external temperatures are high and creates warm environments in winter. These properties make this material stable and of interest to be used, on the outskirts of the city or in suburban areas, where the demand for private villas is high. The results of this article show that different techniques can be applied for the restoration or strengthening of existing earth retaining walls, which lead to the preservation of local identity by contributing to sustainable development. Sustainable development with earth construction is related to several factors that contribute to the preservation of traditional architecture and memory, to minimal impact on the environment, low construction costs and low energy requirements of these dwellings which from the beginning can be designed with high energy efficiency requirements. New adobe constructions can use traditional local techniques, and through laboratory analysis of the material can be intervened to increase the thermophysical properties of the natural material thus contributing to a better energy performance. New techniques can also be introduced which are used today in other countries with climates like ours, in order to make this material more usable and more competitive in the construction industry, so that the time of realization can be faster. In preserving the traditional material and its use in construction building, raising awareness is also worthwhile as in the case of the Open-Air Museum in Lower Austria, Museumsdorf Niedersulz, in the village of Sulz in Weinviertel.This material can be turned into a useful material for new houses in case of emergencies, providing speed in construction, low economic costs, and good living conditions for families in need.

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Urban Architecture: Eyes from the city
A Mobile Eye-Tracking Study of Urban Villages

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Abstract
This feasibility study assesses the strength and weaknesses of a novel methodology applied to the design of urban architecture to enrich the process of urban planning to satisfy the needs of a city's inhabitants. Specifically, a visual preference survey was conducted using eye-tracking technology to observe the influence of urban differing scales on the human visual experience. Using an observational design, two architectural conditions were introduced to section an urban village into a few predetermined areas and walking lines. The visual experience of ten participants was then collected using a mobile eye-tracking device. Results showed that people indeed have different visual perceptions when interacting with urban fabric, and that such perceptions change from a formal to a traditional scale design

Keywords
city, mobile eye-tracking, urbanscape, change of scale, edges, walking lines, visual perception

Introduction

In today society's rapid technological innovation, planners, architects, and scientists have been tasked with supporting businesses and policymakers in creating 'intelligent' cities that can balance contemporary human behavior with the capacity of the environment.

This paper proposes a framework for data collection methods to capture human responses elicited from the urban fabric. The purpose of this method is to benefit planners in innovating and regenerating the urban landscape. This position will be supported by a feasibility project, 'Living Shenzhen'[1] , conducted by the authors, with the aim to introduce citizens' desires and needs into the urban planning process.

The broad objective of the study underlying the project 'Living Shenzhen' was to explore the relationship between humans and the urban environment. More specifically, the aim was to understand people's responses to the developing integration between modern and traditional areas of the city. Using eye-tracking technology to capture the human visual experience, ten participants were monitored in the following urban fabric conditions: i) five different sectioned areas of the city district ii) predetermined walking lines. More recently, this work was reinterpreted to address the theoretical and empirical issues that emerged from the project in the exhibition 'Presenting Living Shenzhen'[2].

This paper will first present an overview of the background literature; it will then move on to discussing existing eye-tracking studies in urban architecture (Hollander et al., 2019; Sussman & Hollander, 2015) and the landscape (Junker & Nollen, 2019). Next, the urban fabric conditions implemented in the project 'Living Shenzhen' (sectioned areas, sectioned walking lines) will be evaluated within a selection of the relevant literature. Finally, potential ethical issues will also be addressed before suggesting future applications and research directions.

Background: City of Augmented Differences

This section will explore the argument for conducting the eye-tracking study in the city of Shenzhen. The word 'augmented,' included in the heading above, intends to express the magnitude of differences explored within urban architecture. Together with a historical and regulatory background, the existing contrast of the city will be analyzed in terms of scale between the spontaneous formation of the urban villages and the formal fabric of the planned city. Accordingly, a new paradigm named: The CITY OF EXACERBATED DIFFERENCE© (COED©) was introduced by Chuihuia, Inaba, and Koolhaas (2001) to capture the differences in the city as an architectural concept. Their view cannot be better described than in their own words:

"The traditional city strives for a condition of balance, harmony, and a degree of homogeneity. The CITY OF EXACERBATED DIFFERENCE© (COED©), on the contrary, is based on the greatest possible difference between its parts – complementary or competitive. In a climate of permanent strategic panic, what counts in the COED© is not the methodical creation of the ideal, but the opportunistic exploitation of flukes, accidents and imperfections. Although the model of the COED© appears brutal […] the paradox is that it is, in fact, delicate and sensitive. The slightest modification of any detail requires adjustment of the whole to reassert the equilibrium of complementary extremes" p. 29)).

Never before has a place gone through such a relentless building process as China has over the past thirty years, and no other city has matched Shenzhen's rapid growth in population and urbanization, being transformed within a very short time from a group of small villages of some thirty-thousand people into a city that, with its 14 million inhabitants, exceeds the biggest metropolis in the world (Huang, 2017, p. 65). Founded in 1979 in Baoan County, with the approval of the Chinese State Council, Shenzhen was officially declared the First Special Economic Zone (SEZ) of China in 1980 and rapidly urbanized from then on (Vogel, 2017, VII). In a few decades, this unique process led to a singular urban entity. The original agricultural and fishing villages within the Pearl River Delta area have been gradually surrounded by the rapidly urbanizing landscape, giving birth to the phenomenon of the so-called 'urban villages', or chengzhongcun 城中 (Bach, 2017b, 138). Urban villages are now a nationwide communal formation in China, and Shenzhen is one of the places where they first emerged, making the region a dazzling landmark for locals and foreigners alike while remaining a special space of negotiation and contestation.

Urban villages have become a key resource for researchers hoping to understand the process and effects of rapid urbanization in the Republic over recent years. The uncommon dynamics behind their development stem partially from their ambiguity concerning land rights. According to the Chinese Land Administration Law, all urban land belongs to the Chinese government while all agricultural land in rural areas belongs to the village collective. However, the so-called ownership of property within urban areas by citizen or non-government organizations is actually a long-term renewable lease. That is to say that the villages remain in control of their land even after the urbanization process, maintaining special collective property rights. In this regard, one often-unspoken conflict of interest arises when the city government develops new plans for public infrastructure around or inside the village, which constitutes a direct assault on villagers' collective landholding rights. In Shenzhen, the city municipal government has for a long time been cautious to impose a forceful authority against large collectives. On the other hand, throughout the years, villagers have proved themselves to be amazingly flexible and adaptable to the gradual changes in conditions and environment. First, they simply leased village land to small investors, then, they became builders of self-constructed housing on personal lots or even major landlords who set up small factories with particular specializations.

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[1] Bi-City Biennale of Urbanism/Architecture (UABB) of Shenzhen-Hong Kong 2019-2020 curated by Carlo Ratti.

[2] "72-hours Short-circuit" event in Rome of Open City, CHANGE: Architecture. Cities. Life

However, the real business opportunity came later when Shenzhen's population expanded. Villagers were able to establish large-scale accommodation leasing operations. Since the late 1980s, China's economic reform policy and Shenzhen's status as a SEZ made the region a destination for migrants from all over China, who were attracted to urban villages for their cheap rent and loose residential registration. Throughout the 1990s, some of the original villagers took advantage of the migrant population boom and began to cooperate with the newly emerging class of Chinese real estate developers. Better quality apartment complexes began to emerge around the villages, and these improvements attracted a new generation of white-collar migrants. In the early 2000s, this phenomenon has become so widespread that real estate developers began to favor urban villages for urban renewal projects, a phenomenon that slowly transformed Shenzhen's cityscape (O'Donnel 2017a; 2017b; 2017c. Bach 2017a; 2017b).

Under the influence of these counterposed forces, the urban village emerged because of the collision between the rapid urbanization under the current law of the market and the urban-rural dual structure inherited from the planned economy period. The result of these complex forces is today's infamous urban village landscape, full of densely constructed apartments (so narrow is the distance between the buildings that the locals call them the *'kissing buildings', qinwenlou* (亲吻楼), encircled by massive headquarters and a forest of 'hyperbuildings', as Koolhaas defines them (Chuihua, Inaba, & Koolhaas, 2001).

The locals seem to have little awareness of the richness that urban villages impart in terms of vernacular architecture, cultural, and social heritage. On the contrary Chinese people look at these places, at their best, as something to be soon replaced. Hints of change have been coming for a few years, some from the city itself, where gentrification in villages like Shuiwei reinterprets these fragments of the city according to a new vision, though not necessarily a better one.

One of the first official attempts to overturn this tendency towards urban villages came from the Biennale 2017. The curators, the local architectural firm Urbanus, decided to indicate the urban village as a paradigm for an alternative model of the contemporary city for their *City, Grow in difference* project. Forming spontaneously and evolving continuously, the urban village "[…] is the last frontier of Shenzhen Urban renewal campaign, and also the bottom line of a balanced urban development" (Hanru, Xiaodu & Yan, 2017, p. 49). To emphasize this theory, Urbanus chose to set up the main venue in Nantou, one of the most ancient villages in Shenzhen. The move perfectly matched with Rem Koolhaas's aforementioned description. The firm's curatorial statement posits that "Cities, Grow in difference" signifies a recognition and inclusion of things of different origins, status and values at social, cultural and spatial levels. It is a revolt against the mainstream culture ruled by 'centralism'. […] On one hand, the balance of contradiction and hybridity in the city shouldn't be broken arbitrarily. On the other hand, respecting otherness is a test of degree of tolerance of a city (Du, 2017, p. 49).

According to chief curators Hou Hanru, Liu Xiaodu, and Meng Yan, Shenzhen is currently experiencing a 'Post-Urban Village Era' and going through a second urbanization that threatens the survival of urban villages. Several questions concerning their management remain open. The urbanization of a city is driven by both top-down urban planning and bottom-up growth.

Residing in between past and present, order and chaos, legal and illegal status, and outside of the all-or-none system of value judgment, the urban village preserves the bottom-up spontaneous potential.

Pushing the limits of reforms, laws, institutions, and administrations, Shenzhen generated a transitional territory where conflicts and challenges are still cultivating an active mentality, an ability to reshape the national political vision to better fit in a specific local condition.

FTZ/SEZ: is the Zone a Modern Urban Space?

In this section, economic and socio-demographic factors are introduced as key components to understanding the urban dynamics of a case study. Recent empirical research has also shown the importance of economic structure and socio-demographic local contexts on urban complexity (Salvati & Carlucci, 2020). However, in the context of the present research, there is an emphasis on the relations between the economic aspects of the Free Trade Zones in Shenzhen — also called Special Economic Zones — and their urban development and architectural character. The remarkable view of Jonathan Bach (2017a, p. 30-32) is presented in his own words.

As Shenzhen grew, it had to find its place within two parallel processes: a global shift from labor-intensive manufacturing to knowledge-based economies, and increased competition from the ever-growing array of zones within China vying for both domestic and foreign attention. The diffusion of Shenzhen's market model across China means that the city can no longer lay unique claims to the sectors that once made it a destination for workers and investors alike. It faces serious domestic competition from Shanghai, Tianjin, Chongqing, and many other cities and regions, and increased international competitions from both low-wage countries like Vietnam and Bangladesh and high-end centers such Seoul, Singapore, and from its neighbor, Hong Kong. For Shenzhen to continue to produce, economic value required continuous adaptation of what Shenzhen was able to offer. As labor costs increased, it became less profitable to maintain small-scale factories. Already by 1985, low-skill manufacturing began to give way to more highly skilled demands from the emerging high-tech sector. High tech came to dominate Shenzhen, with flagship Chinese companies such as Huawei (telecommunications) and Tencent (Internet) and with globally famous (or notorious) branches of companies such as Foxconn making components for Dell, Hewlett Packard, and Apple. High tech is still the mainstay of Shenzhen, accounting for about 60 percent of its total industrial output, but is itself being retooled to focus on the 'new' industries of the twenty-first century, key among them e-commerce, non-

carbon-based energy sources (e.g., solar, wind), and the biomedical sector, including stem cells and biomedical equipment. Similarly, Shenzhen's vast infrastructure for transport and storage — key to the institutionalization of zones as nodes in the global economy — augmented its size as the world's fourth-largest container port with a new focus on services and back-office work. Financial services (especially fund and venture capital) and creative industries (especially design) round out Shenzhen's economic profile on the world stage.

Its ultimate value, however, is not measured in GDP (a respectable US$ 25,038 per capita in 2014), exports (more than US$ 245 billion in 2015), or the fifty-three top Chinese companies headquartered in the city alone. Rather, it is in the perception of Shenzhen within China as a world-class city with a mixture of spectacular architecture, 'civilized' citizens, clean streets, and an entrepreneurial spirit in line with the city slogan: "Dare to Become the World's First". In short, Shenzhen wishes to be at the pinnacle of modernity. The modernist dream of the city as the ultimately rational, civilizing force in human development is the other legacy of the zone, one as important as its origins in the postwar export economy. This modernist fantasy comes from a long tradition in (mostly Western) philosophy that Stephen Toulmin characterizes as the dream of Cosmopolis: a rationally ordered society where nature and society fit into precise categories and interact productively according to an unerring logic. The modernist-planned city was thought to give rise to this ordered society and has a long history of seeing the fresh start as its essential ingredient, from American utopian communes in the nineteenth century to the Soviet total planning cities in the twentieth century to contemporary gated communities today.

This is the fantasy of the ideal modernist city as a clean slate, a tabula rasa. The fantasy of the perfect city as a tabula rasa sits deep within Shenzhen, which seems to take to heart the playwright and poet Bertolt Brecht's exhortation in his 1926 *Handbook for City Dwellers* to "erase the traces!". Invariably, Shenzhen is presented in media, promotional materials, and conversation as a city with no history, arising from a proverbial small fishing village or, somewhat more accurately, a small border town. Its historical predecessors, Xin'an (which encompassed both present-day Hong Kong and Shenzhen) and Bao'an counties, become mythologized and temporalized. Its former villages, still physically and psychologically present as traces of a rural past turned urban anomaly, disappear in official representations of the city.

This elision of the past is, in part, what enables Shenzhen to present itself as a unique space that can redeem the past precisely because it is unencumbered by it. Redemption occurs through a focus on the present where, in the words of the city's popular slogans, "practical work brings prosperity" and "time is money, efficiency is life". This emphasis on the pragmatic application of grit and entrepreneurial spirit not only redeems the 'lost' decades of the Cultural Revolution but also helps settle the larger score of being subjected to colonialism. During the city's thirtieth anniversary, for example, a common catchphrase touted how Shenzhen accomplished in thirty years what it took Western society three hundred years to achieve. This is the heroic, even miraculous Shenzhen, which former Chinese President Hu Jintao referred to as "a miracle in the world's history of industrialization, urbanization and modernization".

For those who are familiar with the more rhetorical aspects of the book *Delirious New York,* it will not be difficult to conflate the conditions described by Koolhaas about the genesis of New York with the recent steps by Shenzhen accurately described by Bach above (2017a). For the same reason, it is crucial to grasp the complex and contradictory nature of this scenario in order to understand why Shenzhen is an ideal city to inspire today's dialogue surrounding the relationship between habitants and context. We could say that Shenzhen will be for the twenty-first century what New York represented for the previous one (Figure 1).

Perspectives from Urban Architecture

According to Pérez-Gómez (2016), for many years the (European) city was designed to include a variety of complex atmospheres within its urban fabric, accommodating all human senses as well as targeting the use of diverse public actions. These moods were created to either be apparent to the city's inhabitants or to fade within the backdrop of its activities. From the eighteenth century onwards, the search for increased hygiene within the cities' fabrics led to several changes that oc curred at various speeds and that created the urban context that we currently experience today. These changes occurred alongside the end of the *Ancien Régime* and the creation of the modern nation-states and led to a lack of fundamental qualitative nation-states and led to a lack of fundamental qualitative elements within the urban context. These omissions provided a perception of the city that by comparison was similar to the one perceived from the geometric emptiness that derives from Cartesian coordinates. In the words of Pérez-Gómez Pierre Patte was perhaps the first late-eighteenth century French writer to conceptualize the city in terms of circulation, a metaphor that soon became dominant among planners and that remains

Figure 1. Comparison between Manhattan and SEZ (1); SEZ traffic plan redefined with INFRAREDO© (2) to emphasize the 'city as infrastructure' (Beijing China Academy of Planning, 1985).Adapted from Chuihua, Inaba, and Koolhaas. Great Leap Forward (2001).

unquestioned even today as we think of the metropolis in terms of flux and networks, linking institutional, commercial, and private spaces. While the city had been understood up until this point as a hierarchical assemblage of places for focal action — traditionally, political and religious activities and rituals, and, in the eighteenth century, social and theatrical public functions — Patte believe that better cities called for different priorities, namely and efficient infrastructure for the circulation of goods, vehicles, people, air, and water. […]

Nowadays, even more enlightened planners who argue on behalf of pedestrian cities and struggle to eliminate cars from public spaces tend to use purely quantitative methods and data to further their cause. Such objectives certainly improve the quality of life in places like Copenhagen or Manhattan, for example, but they leave the premises themselves unaltered (2016, p.13-15).

In the past years, new approaches to urban planning have emerged. These are typically tied to the concept of the 'smart city' and 'smart mobility'. Despite contributing to the "Great Leap Forward" (Chuihua et al., 2001) of many metropolises all around the world, these approaches are often accused of producing anonymous and impersonal *urbanscapes.* Efficiency and performance seem to be the only values of the smart approach, which tends to neglect the sociological and psychological aspects of the urban environment. This is mainly because, in order to be processed and become part of smart architecture and design, quantifiable information is needed to capture the underlying effects.

Simultaneously, a humanist and subjective vision of the modern urban arrangement process has been carried out since the second half of the twentieth century. *The Image of the City* (1960) written by Kevin Lynch is a systematic investigation of a metropolis intended for the first time as a personal mental representation; a visual city that beyond its many functions, is seen, remembered, and transformed into a meaningful imaginary.

Environmental images are the result of a two-way process between the environment, which suggests distinctions and relations, and the observer, who, with great adaptability and in the light of this own purposes, selects, organizes, and endows with meaning what he sees (Lynch, 1960, p. 6).

Lynch's view was accepted by Sartogo in *Roma Interrotta* (2014), when a group of twelve well-known — mainly post-modern — architects were asked to draw their own map by reinterpreting a quadrant of the Nolli plan. Among the guests, Aldo Rossi had been developing his theory of a biographical interdependence between city and personal or collective symbolism for years. This is explored, for example, in *Architettura della Città* (1966) and *Città Analoga* (1976). The uniting thread among the aforementioned projects is a common attempt to scientifically examine what has been empirically foreseen for a long time.

Moreover, technology and big data analysis have helped address the aforementioned dichotomy in the field of architecture. Decades of transdisciplinary studies, which involved environmental psychology, human geography, philosophy, cognitive studies, neuroscience, aesthetics —just to name a few— have increased awareness of the importance of introducing the subject's experience of space into the design process (Gregory, 2018).

Eye-tracking in Architecture and Urban research

The adoption of technological instruments, such as eye-tracking devices (i.e. capturing the movement of the eye) to measure human responses to architecture is not new. However, the number of architectural studies that adopted eye-tracking to capture the human gaze and fixation of the built environment is limited compared to the impact this technology has had on usability and reading studies (Poole & Ball, 2006; Duchowski, 2009; Holmqvist et al., 2011). Importantly, despite being a recent and growing area of research, the suitability of eye-tracking to studying the visual perception of the built environment and landscape has been established (Dupont et al., 2013; Hollander et al. 2019; Junker & Nollen, 2019; Sussman & Hollander, 2015). Before introducing the landmark studies that provided evidence of the suitability of eye-tracking in landscape, architecture, and design, a brief account of the foundations and advancement of eye-tracking from psychology to other domains is provided. The foundation of eye-tracking research in early psychological studies is based on eye movement. Importantly, as eye movement was related to visual perception and attentional processes, it could be used as an objective assessment of people's observation of scenes and objects (Bojko, 2013; Horsley et al., 2013; Nielsen & Pemice, 2010).

Subsequently, as researchers settled on eye-movement measures (gaze, fixation, and saccade), eye-tracking approaches expanded to other domains of interest (for a review see Holmqvist et al., 2011; Richardson, 2004).

Eye-tracking studies in architecture can be differentiated based on the area of its application in landscape, design, and architecture, as well as on the use of technological instruments. For example, static or mobile applications of eye-tracking or in conjunction with other apparatuses (e.g. EEG). Lisinka-Kusnierz (2020) reports a series of studies that use static eye-tracking to understand the history of architecture and historical buildings. Results from these studies have shown planners the benefits of heritage protection based on eye-tracking in static settings within historical buildings (Linsaka-Kusnierz & Krupa, 2018).

Interestingly, the eye-movement responses collected among these studies reveal the potential of eye-tracking technology for capturing the different aspects of human visual perception. In Rusnak et al. (2018) for example, depth of perception was assessed from the interiors of a Gothic church by focusing on people's change in interest as a function of the depth and height of the interior. Further areas of application for static eye-tracking have developed since then in both landscape and urban design. Static eye-tracking technology is typically applied in laboratory settings as testing occurs in controlled conditions, which improves the validity of the construct. However, this comes at

the expense of ecological validity. For example, measures of fixation have been proven to correlate with subject preferential parts of photographs, suggesting that information processing occurs as a function of the eye's 'fixation time' (Noland et al., 2017; Birmingham & Kingstone, 2009; Glaholt et al., 2009). Particularly important for architecture in general and landscape architecture in particular is the ability to map the spatial-visual properties of a landscape. A recent account, however, emphasized that there is yet little awareness of the methods available for mapping landscape spaces (Liu & Nijhuis, 2020). For example, one of the only studies that used eye-tracking to assess landscape design (Liu & Nijhuis, 2020) was conducted in Vondelpark (a known park in the Netherlands).

Another example is Traditional Neighborhood Design (TND), adopted as an objective principle of design. By using eye-tracking, visual preference surveys were conducted to elicit positive or negative human responses to urban characteristics. To assess the impact of urban design characteristics, for example, Hollander et al. (2020) report results from Noland et al.'s (2017) study of human responses, which revealed that TNDs have a significant quantitative effect on positive responses. A further body of knowledge drawn from psychological research investigated the influence that spatial cognition has on the experience of places (Robinson & Pallasmaa, 2015; Zeisel et al., 2003; Wells et al., 2007; see Sussman & Hollander, 2015 for an effect of the built environment on human anxiety). Recently, Hollander et al. (2020) emphasized the gap between understanding eye moment in relation to the built environment. Therefore, the influence of a place's urban characteristics on attention and meditation (original italics) was investigated with regard to the pedestrian experience (Hollander et al., 2020).

For the purpose of the present research, it is important to note that despite the growing interest in mobile eye-tracking to assess architectural work, this area of study is less developed within the field of urban architecture. A number of studies have proven the suitability of eye-tracking using mobile devices to assess the impact of urban design. Importantly, positive reactions to the urban environment were collected (Hollander et al., 2019; Zou & Ergan, 2018). Moreover, only one study to date used a long-term experiment in an open urban environment and collected behavioral responses using eye-tracking, showing the implications for life improvement (Ehmke & Wilson, 2007). Therefore, only a limited group of studies previously pursued the investigation of the relationship between urban architecture and eye movements together with focus measures.

With the advancement of eye-tracking technology (e.g. lightweight eye-tracking glasses) it is possible to make up for the lack of studies using outdoor eye-tracking (Uttley, Simpson & Qasem, 2018). Conducting studies in real-world everyday scenarios enhances the representativity of the stimuli environment by placing participants in actual urban settings. For example, as noted in one of the few eye-tracking studies carried out in outdoor urban settings, Simpson et al. (2019) found that gaze patterns are likely to differ between laboratory conditions and natural environments (Foulsham et al., 2011).

Framework: Mobile Eye-Tracking and Urban Villages

The proposed framework is an attempt to address the gap between urban planning and people's needs and expectation from the urban environment.

Although the concept has been explored before (Lynch, 1960; Rossi 1976; Sartogo, 1978), thanks to new technology, architects and planners will be able to develop a more accurate map by empirically quantifying and categorizing architectural elements in association with abstract values like 'appreciation' and 'interest'. Buildings, intersections, parks, and streets will be enriched with layers regarding their usage and information processing data. However, while architects' data collection methods are usually based on documenting, interviewing, historical studies, and cultural references, this study introduces eye-tracking as a new technological instrument (although already established in psychological sciences, neuroscience, and design) for tailored 'open' urban-scale projects. Moreover, future developments of this framework propose to apply eye-tracking to process people's behavior in the cityscape — delivering an authentic perspective in terms of levels of interest and attention — to better understand their needs and enhance architects' ability to respond to it.

By collecting data regarding people's visual perception and their behavior in the urban environment, the goal is to overlay the urban identity of a place on the traditional urban planning layers. Furthermore, introducing numerous everyday people into the urban design process is now possible thanks to the use of technology and the conversion of data into a readable, quantifiable visual outcome.

Feasibility study

Our research began with the following question: how can the urban environment affect pedestrians' visual perceptions, behaviors, and attitudes to further improve the urban design outcome and process?

We used a visual preference survey to investigate people's gaze experience using mobile eye-tracking technology. Accordingly, an observational study was conducted introducing two architectural conditions, namely: sectioned areas and walking lines. Eye-tracking recorded participants' eye-movement metrics: number of fixations (number of times an object was observed), duration of fixation (the amount of time the object was observed), and sequence of fixation (the order in which the observer looked at the objects around him). These objective statistics, with minimum interference by the conductors, are anticipated to capture participants' positive and negative experiences of the city. The data collection phase was completed within one week, while data processing and the elaboration of the visual output required two weeks.

After consenting to the use of their personal data, ten students from Shenzhen University were involved in the feasibility study. All participants were of the same age to guarantee the collection of comparable data. Among the participants, half were male and half were female and half were local and half non-local to prevent the possibility of a biocultural influence.

Sectioned Areas

'Living Shenzhen' was conducted in five out of more than three hundred villages still present in Shenzhen. The proposed feasibility study was first conducted in Futian, one of the main districts of Shenzhen and one of the city's fastest-growing areas. The selected areas were all chosen for their unique characteristics within the formal city. Given their sharp contrast in terms of scale and urban environment, Shenzhen's urban villages seemed particularly suitable for this feasibility study.

By sectioning the areas of the district, the aim is to explore how participants' visual perceptions of the city change when walking the edge between two morphologically different parts of the metropolis: the spontaneous urban villages and the formal fabric of the planned city. Shangsha village offers a snapshot of the widespread phenomenon of the demolition and reconstruction of the urban fabric. The original villagers have cooperated with emerging Chinese real estate developers to replace old buildings with better-quality apartment complexes. An ongoing debate on the transformation process involves the opposing hypotheses of public administrations, who support destruction-reconstruction processes, and researchers and enlightened communities, who promote conservation and regeneration attempts.

The topic of public space for social outdoor aggregation is important for Chinese culture. For property speculation reasons, mature villages are usually made up of 'pencil' buildings, which stand six to eight floors high with a rectangular plan of 100 square meters, separated by one or two meter-large streets, and lacking common spaces to bring people together (Urbano, 2015). Despite being a 'pencil building', Shixia presents squares, sports facilities, a river walk, and an ancient temple, all widely used by local people. This can be viewed as one of the first institutional attempts to offer the villages an alternative to demolition. The area has experienced gentrification and is now well-known for its international nightlife and iconic colored rooftops, where white-collar workers live in rental apartments.

The difference between Shuiwei and its neighboring village, now under an ongoing demolition, is stunning. Another important element involved is its nearby park, one of the biggest in Shenzhen. The neighborhood is now one of the most important city centers in the country because of the dynamism of new skyscrapers integrating with the existing small buildings.

Walking Lines

Though planning still remains car-oriented, over the last 70 years, growing attention has been paid toward the role of pedestrians in shaping the city. Since the post-modernist era, walkability has been identified as a crucial component of an efficient, equitable, sustainable, and livable community (Lo, 2009). Studies in this field address their investigation beyond mere 'walking distance' planning: great importance is given to understanding how urban design affects pedestrian perceptions, behaviors, and attitudes (Mehta, 2008). The current emphasis on walking as a health-related activity (Adkins et al., 2012) has brought an old interest in the sensorial qualities, such as those mentioned in Lynch (1960), Bacon (1967), Bosselmann (1998), and Isaacs (2000), back into vogue. This framework proposes a criterion to capture influences on pedestrians' walking behaviors by collecting data with eye-tracking technology. For example, walkability was operationalized in Moudon et al. (2006). In the present study, 'walking lines' are proposed separately from 'area' (considered in this research as a separate condition). Accordingly, participants were provided with origin (A) and destination (B) and allowed to explore the route freely. Participants with complementary characteristics walked in pairs to their assigned origin and destination route. They were asked to walk

Figure 2. Sectioned areas of the Futian District. Frame took from the Video presented at the exhibition 'Living Shenzhen' Bi-City Biennale of Urbanism/Architecture (UABB) of Shenzhen-Hong Kong 2019-2020 curated by Carlo Ratti.

freely for one hour (according to the battery duration) within a square area (1 km for 1 km). The starting point (A) and endpoint (B) provided transition areas between urban villages and the rest of the city. A and B were inverted for each of the two volunteers. While participants walked the lines of the transition areas, a drone camera filmed the walking lines by flying above the starting and arrival point.

Technology

While walking through the city, participants wore a pair of eye-tracking glasses produced by Tobii and supplied by Psytech, a local tech supplier based in Shanghai, and recruited from Shenzhen University. The glasses recorded simultaneously with a traditional video camera placed over the nose and a special device that captures the pupil's movement while a table instantly registered all of the collected data. The collected data was then converted back into the original video (see Figure, 4 a, b) along with a heat map with transparent background, a visual output elaborated by software specifically programmed for this experiment by Shenzhen University and the Senseable City Lab at MIT.

Results

The overall results from this study show that the distribution of the gaze point appeared with significantly more frequency and for the longest duration in the top zone in the middle and the middle zone. Also, significant but with less frequency and duration, fixation points appeared in the top-right and bottom-middle zone. Ultimately, the gaze points appear least at the bottom-left zone and bottom-right zone. However, the distribution of total fixation duration and fixation count was non-signif-

icantInterestingly, these results appear in contrast with people's normal gaze patterns, as people usually first gaze straight and above and then gaze below and top right; moreover, lower left and lower right are rarer gaze points. The results show that the urban conditions in which this study was conducted did have an influence on participants' gaze experience. However, one limitation of this design was that we were unable to assess the actual experience of participants.

Discussion

The feasibility study presented in this paper adopted an eye-tracking method within two architectural conditions to explore participants' responses with minimum interference by the researchers. The aim was to capture how moving across the varying urban fabric (formal to spontaneous urban villages) affected participants' attention. However, several critical issues that were encountered in conducting the study are important to emphasize for the consideration of future studies. In particular, the hardware used to support the eye-tracking data collection risks producing noise in the data when exposed to direct sunlight. Therefore, there is considerable room for improvement with regard to the reliability of outdoor eye reading. Moreover, it is difficult to perform comparisons with similar research given the nature of the observational design of the conducted study,

Figure 3. Visual of walking lines of Futian District. Frame taken from the Video Presented at the exhibition 'Living Shenzhen' Bi-City Biennale of. Urbanism/Architecture (UABB) of Shenzhen-Hong Kong 2019-2020 curated by Carlo Ratti.

Figure 4a. Visual output of the gaze/fixation line and target. Frame taken from the Video presented at the 'Living Shenzhen' presented in occasion of the Bi-City Biennale of Urbanism/Architecture (UABB) of Shenzhen-Hong Kong 2019-2020 curated by Carlo Ratti.

Figure 4b. Visual output of the overlapped heatmap. Frame taken from the Video presented at the 'Living Shenzhen' presented in occasion of the Bi-City Biennale of Urbanism/Architecture (UABB) of Shenzhen-Hong Kong 2019-2020 curated by Carlo Ratti.

as in future research several parameters may change. A further critical issue is the time required for data collection, which may vary depending on the characteristics of the area selected and the operationalization of the framework (e.g. dimension of the area, walking distance) and on the quality and specification of the hardware used (e.g. battery duration).

In conclusion, the choice to utilize mobile eye-tracking technology is appropriate for investigating gaze experience by recording people's eye movements in natural settings, as shown from the early literature on this method (Hollander et al., 2019; Junker et al., 2018; Junker & Nollen, 2018; Uttley et al., 2018). Future research should also address the potential ethical challenges of this methodology.

Conclusion

This research project intended to propose a framework with two main outcomes: a method and a map. A dual-faced methodology was used to represent the critical areas of the city of Shenzhen, which is the first city to be analyzed in this way. In this parallel map, the urban reality and the individual perceptive experience dwell in parataxis as in the disjointed dual vision of Aldo Rossi's La città analoga (1976). With further testing in the future, this methodology could act as a template to apply in different urban locations. Moreover, the method proposed in this framework is intended to benefit professionals as an innovative tool for urbanscape planning. For example, via local observation forming an overlay of multiple personal perspectives on the planning process ensuring a fitted, well-thought urban environment for urban planners and stakeholders in the city such as businesses and citizens.

The main component of the described framework is the experimental use of eye-tracking glasses. Eye-tracking recordings were translated into numeric data and then into visual outcomes that can provide a different view of the built environment and might facilitate better communication between daily local life and city planners, who currently have limited mechanisms for urban analysis.

The research assumes the usage of data collection methods for the city and its architecture. The use of smart glasses in a

natural urban environment should be further investigated to simultaneously capture the user's vision combined with geolocation and other physiological information (e.g. heartbeat, skin conductance response). A further possible future development is the design of a platform that brings direct and indirect benefit to all those involved in the process, both as a public instrument to oversee territorial transformations and as an informative open source about city users' experiences.

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Report from Durrës after Earthquake Non-Normative Buildings

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Abstract
Durrës is a city of historical and economic importance. With an important geographical position, the city has a harmonious development in terms of culture, economy, and history, with an important port where the past lives with the present and develops the future.The city of Durrës has great architectural and urban values, consisting of a combination of squares of coastal space, monuments, galleries, museums, and buildings of architectural importance. This historical-cultural city was hit by a powerful earthquake recently, on November 26, 2019, which caused both physical and psychological hardships to all the residents. This article shows the emotional effect caused by the earthquake, and the consequences of the latter on the cultural heritage and contemporary built form of the city. Some buildings were destroyed, and others were deformed on the facades but not in the structure. This paper shows how Durrës, a historical city, is affected by and loses its original image because of a very harmful earthquake. The paper also proposes to rebuild it again and keep its identity.

Keywords
Durrës, Earthquake, Cultural Heritage, Buildings, Architecture

Introduction

Durres is a coastal city that borders the Adriatic Sea. It is located in the plains and some hills surrounding the city. Light earthquake vibrations are often felt, until they reached their peak on November 26 with the 6.4 magnitude earthquake. Albania due to its location has always had strong earthquakes since historical times, where Durres has been most affected since the earthquake of 1267, after which nothing remained.

Durrës is one of the oldest cities with thousands of stories hidden inside, turning it into a very important city. With its strategic position and trade routes, it became one of the most desired places since the old times. A country that hides enigmas, tragedies, and confrontations for power, which made Durrës one of the largest cities in the Mediterranean in ancient times. While more and more excavations are being carried out, traces of the past are being found, where the roots of this city emerge, as the old one was sunk during natural disasters. Durrës has always continued to repeat and recover after every tragedy. Raising everything on the foundations of its embedded buildings. The city enjoys a strategic position where it is a crossroads of the sea and land routes.

Geologically, Durrës is located between the seismic plate of Africa and the Euro-Asian plate, a position that makes Durrës prone to earthquakes. Topologically and naturally hills, swamps, plains, or sea have undergone numerous transformative actions, due to unstable clay geologies and numerous earthquakes.

Typology of constructions

The strategic position oriented the city towards trade and handicrafts and turned it into a highly coveted place for politics and power. Many rulers from other civilizations have left their mark on the city of Durrës and influenced the image of the city. Archeological excavations in Durrës have discovered a hipodamic organization that was inherited from the Greek cities. In addition to the geometric plan, irregularly shaped residential blocks have been discovered that fit the hilly terrain on which they were built. These characteristics can be easily read in the city.

The building materials were mainly bricks, semi-bricks, stone blocks, river stones, and mortar. All are built with the Roman technique opus quadratum (figure 1,2). The foundation stone blocks were taken from the earliest Hellenistic buildings in the city and were reused in Roman times.The ancient houses were mostly built on two floors. The first floors are thought to have been inhabited by aristocratic strata because the first floors were built with more durable and resistant building materials. The doors and windows enabled the introduction of fresh air and light into the interior. Their roofs were built of wooden beams and baked clay tiles.Due to the high number of inhabitants, there was a need to build public spaces where various activities took place. Most importantly, the amphitheater, best displays the Roman technique.

Historic Earthquake

The first historical evidence of earthquakes in Durrës was from

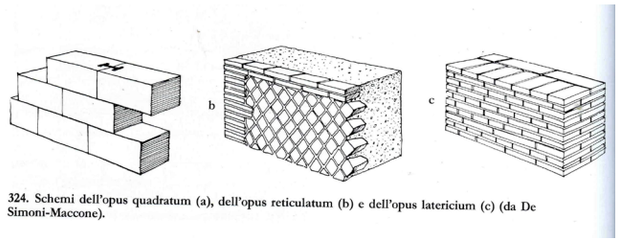

Figure 1. Construction techniques using bricks in the ancient Rome/ source romabella.com/

Figure 2. Durres Amphitheater, Roman Brick technique/ source wikipedia

Figure 3. Building Construction after Earthquake/ source.bbc

the visit of the Roman philosopher and orator, Marcus Tullius Cicero. According to the description, Cicero had not yet stepped ashore when "an earthquake started accompanied by a strong sea turbulence". According to historical sources, this was the first earthquake in the middle of the first century BC. Centuries later, in 345 BCE, another earthquake struck. Earthquakes in that era were thought of as acts caused by the gods, who punished the inhabitants. This appears from an anonymous work, belonging to the middle of the fourth century, which is the only notice of this earthquake.

*"Dyrrahu because of the bad habits of its inhabitants was destroyed by the angry god, sank and did not appear anymore", writes the anonymous treatise called "*Description of *the whole world and peoples" (Descriptio totius Mundi et Gentium). According to the scholar Moikom Zeqo, the destruction of the Illyrian city is explained as "a curse of the biblical type, of the*

new worldview of the proto-Christians".

A strong earthquake was that of in 1267, recounted by the historian George Pachymeres:

After some time, a pitiful and tearful event took place in Durrës. In July, unusual noises caused the earth to tremble continuously, noises which we would normally call a groaning. They portended that something dreadful was about to occur. One day, the din echoed more continuously and more forcefully than it had done previously. The fear which took hold of some people caused them to go and find shelter outside the city, as they were afraid that things would get worse. The houses and tall buildings, resisting not for a second, gave way and tumbled, burying their inhabitants within them. For there was nowhere for the people to escape because the buildings were constructed one beside the other.[1]

This earthquake destroyed almost everything built in the city. The buildings that resisted were the amphitheater and the walls of the Castle, which were built by Emperor Anastasios and completed by Justinian I. Their construction was well thought out from an engineering point of view to withstand seismic shocks. These occasional blows have also brought about a change in the structure and image of the city. A new panoramic layer of the city was designed at the beginning of the 20th century, after the Independence of Albania in 1912. This layer respected the rules and historical layers. Durrës has been rebuilt with buildings of no more than two floors. They stood in line with the coastline and gave the city an identifying image with medium-sized buildings, roofs, and shores.

What is evident is that despite the strong earthquakes, Durrës has recovered again and is being built with different styles and standards. We need to learn from buildings that have withstood natural causes and time, and not because of fate, but from well-thought-out and detailed plans of their construction to be resilient despite everything. The constructions had the philosophy to serve the city and to create an identity in it, and not for benefit.

Figure 4. Seafront from the Old Town of Durrës/ source flickr

21th century earthquake

An earthquake is a phenomenon that occurs due to the discharge of accumulated energy, and it happens in seismic areas. Albania is a seismic country, but after the earthquake of the XIII century, there had not been another strong one in Durrës, until November 26th. This earthquake caused loss of human life, emotional and psychological hardships, and severe destruction of the built fabric. Since the city is built in different periods, its identity consists of multiple architectural styles. Time is what determines the events, time creates the image of a city and gives an identity.

In the event of the earthquake in the city of Durrës, time stopped for a moment, mercilessly destroying the traces accumulated over the years. Many buildings failed to resist, while some others struggled with the vibrations, which shows that they were powerful because they were built with love and care by people. These buildings had withstood every period by thus being an example to all the young architects and engineers that they must love their city and preserve its image by building with love. If we love our country and want to work to resist generation after generation and resist disasters, we must be careful. We should not think only aesthetically, but use materials suitable for a city with soft soil, be within the allowed standards and follow the rules for seismic areas.

Figure 5. The Castle Tower of Durrës after earthquake/ source by the author

21th century earthquake/Geological Aspects

The earthquake that occurred in Durres on November 26, 2019, was a powerful earthquake that caused a lot of damage. The earthquake occurred on the surface and for this reason, the damage was greater. This event triggered the development of many studies in architecture, engineering, etc. Durres is in an alluvial plain between tectonic plates belonging to the Ionian geotectonic unit. The central and western parts of the Ionian unit are composed of clays, conglomerates, and sandstones. Figures 6 and 7 below show data and statistics from *"Observations from the 26th November 2019 Albania earthquake: the earthquake engineering field investigation team (EEFIT) mission".*

Ghost city

The city of Durrës already has a different look, after the earthquake. The atmosphere of the buildings was like a "halo" where at one point you see nothing and suddenly the city appears in another dimension, ruined and without hope. Frightened residents can no longer adapt to the present, and dream of the past.

The facades of buildings have broken up, and the apartment interiors and furniture are visible to everyone. There are not only

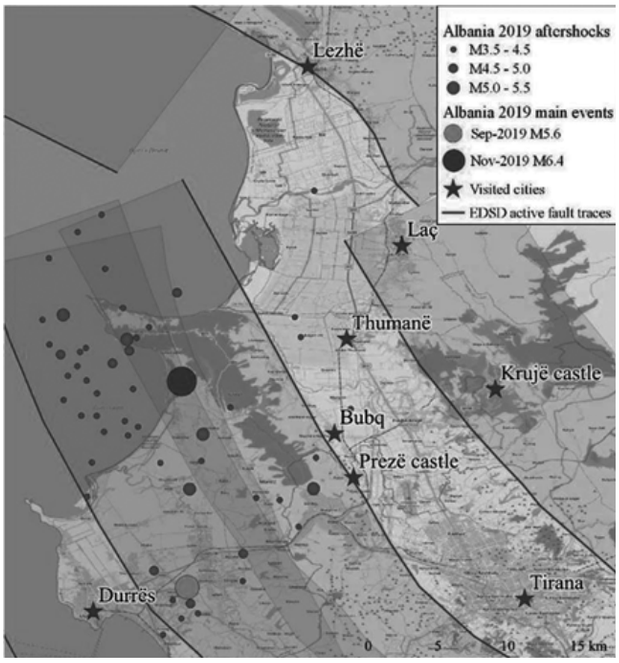

Figure 6. Albanian earthquake sequence of 2019 and visited locations during the EEFIT mission/ source springer.

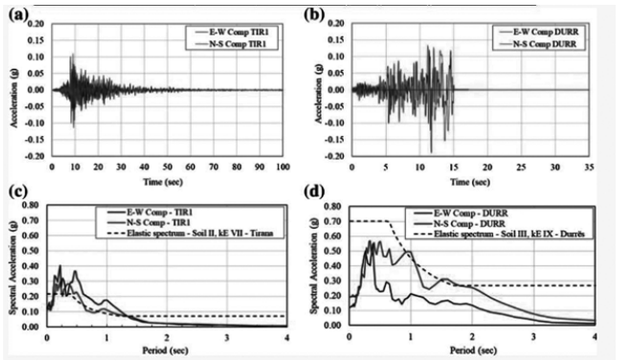

Figure 7. Earthquakes were recorded in a Tirana (TIR1 Station) and b Durrës/ source springer

facade cracks but also psychological ones, felt by the whole population of the city. In the central part of the city where history has left its roots, the earthquake did not even spare certain parts of the Durrës castle.

After the earthquake, most of the inhabitants had left the city, and at that moment it seemed as if the city's identity had disappeared. The city looked like a ghost, and this would not have happened had we been more responsible for where and how we build it. It was a strong earthquake, but if the constructions were built according to standards, then no one would have been harmed, neither the city nor its inhabitants.

Conclusion

The purpose of this paper was to reveal the persistence of the city, which over the years has created its cultural and historical stratification where everyone has left their mark. Starting from the invasions which brought different urbanization and continuing further, with the constructions of different periods, as well as natural disasters at different times, they all gave a new image to the city. Durrës will always remain a city with overlapping periods, as well as one of the most notable cities of antiquity, the center of Byzantine rule. Everywhere you dig today, you'll find the old roots of the city.

This earthquake made us realize that we must build carefully to preserve the identity of the city which was affected deeply by the earthquake, and how important it is to be humane and preserve the city by building well and conscientiously. Despite the blows of nature and the invaders, this city will always remain a great and powerful crossroads that carry high cultural values in history.

Figure 8. The New Town of Durrës/source stock.adobe

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Autonomous, Real-time, and Dynamic Configuration of Public Space in Smart Cities
Challenges and Opportunities for Urban Planners

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Abstract
Although there is not yet a worldwide accepted formal definition of what a Smart City is, the concept is already very used in architecture, engineering, and human sciences and is one of the most important research and development areas of the near future. The article focuses on the observation that smart cities are near to being ready to have the capability to temporarily reconfigure the use of their public spaces, either autonomously or in a human supervised way. A smart city can rearrange the way a portion of its public space (e.g.: squares, accessible streets, stations, parks, ...) is used, directly communicating with people, vehicles, drones, road signs and other elements that use and manage the public space. This can be done autonomously by "the city" (e.g. traffic jam detection, statistical prediction, ...) or under human-driven requests (e.g. large meetings or crowded events, emergencies, road works, ...). Such capability is mostly made possible by technology (ICT, robotics, nanotechnologies, ...) but can be improved and governed through careful urban planning and design. Ruling and leveraging such features is a very new field in urban planning and design and is very important to effectively take advantage of the smart city paradigm regardless of the size of the smart city. In smart cities, the public space has also gained a virtual expansion through cyberspace, leading to a new concept where virtual and real spaces intersect, meet, and, often, melt together. The paper analyses the public space definition in a smart city, its arrangement in different classes, and the ways of reconfiguring it. Then the challenges that urban planning first, and urban design second, must face to leverage in the best way such opportunities are explored, and a first set of guidelines to develop a methodology for this scope is described. The paper considers both normal conditions and emergency conditions (including epidemics) and describes the principles of a new methodology to enhance urban planning, leveraging this smart city's ability to dynamically reconfigure the public space.

Keywords
Smart City, Public Space, Urban Planning, Urban Design, Change Management

Introduction

In the 60s an avant-garde architectural group inside the London Architectural Association, known as "Archigram", developed many different ideas that tried to implement Le Corbusier's thought "Une maison est une machine à habiter" (a house is a machine for living in). Members of this group, also influenced by Futurism, proposed many projects that had, as a common frame, the creation of cities or buildings using an approach based on the ability to change the space (public or private does not matter) using elements that were machines. Peter Cook's "Plug-in City", Ron Herron's "Walking City", the "Instant City" initiative, and other utopian projects, all aimed to use machinery to change the way of building a city. At the same time, Cedric Price conceived the "Generator" project. In this idea, starting from a set of orthogonal foundations, standard building blocks, all of the same measures, could be moved by automated cranes and used to continuously change the city space to adapt to changing requirements. Price's idea was conceived not only in using traditional drawings or sketches: he also involved two computer experts, John and Julia Frazer, to work as his consultants to develop a software that was able to organise city layout to respond to changing requirements from "The City" or from the citizens. It also suggested that each building component should have inside a single-chip microprocessor to allow it to become the controlling processor. The Generator, conceived in the second half of the '70s (1976-1979), was influenced by the so-called Artificial Intelligence Golden Age. At the Dartmouth Conference in 1956, organised by Martin Minsky and John McCarty (young computer scientists) and by Claude Shannon and Nathan Rochester (both senior scientists), the term "Artificial Intelligence" (abbreviated as AI) was formally accepted and was distinguished from cybernetics, also defining for it a specific mission. After this conference, there was an explosion of enthusiasm among computer scientists and computer professionals that propagated it even outside their circle.

After 1974, while computer scientists started understanding that AI was not as easy as expected, the excitement about its opportunities had spread out of their control and this was the environment that allowed Archigram and Price to speculate about their architectural projects that, almost always, digressed towards something more like to science-fiction than to architecture. Times were not ready for such visionary thinkers.

Today, when talking about smart cities, the Internet of Things, autonomous vehicles, cooperative robotics, and other technologies it is inevitable to think about Archigram and Price. The Generator in particular, while not the only one, contains these concepts in an embryonal form. But today's times are not those of forty years ago: the technologies are real, often well established or near to being mature.

What is missing today is not the technology, which is evolving very fast, but the ability to introduce formal or empirical methodologies that can help architects and engineers to build the smart city, whatever this term could mean. As practically demonstrated by the Generator, the cooperation between the architectural side and engineering side (meaning ICT and robotics engineers) is important and can be even stated as necessary today. But methodologies to implement this cooperation are still late. The reasons for this delay will be investigated at the end of this paper but, before, it is mandatory to understand how it can be realised today and which are the issues.

Definitions

Although a common, formal, and complete definition of what a Smart City is has not yet been provided, the existing ones all have a common ground that can be used to define a framework of what could be and what could not be a Smart City. This common background is based on the use of artificial intelligence, robotics, the Internet of Things and other technologies related to information processing, communication and automation. The list of these technologies is continuously growing and changing. Changes are in both capabilities and cost reduction. According to this analysis, smart cities are today mostly considered both from an engineering (ICT and robotics) point of view and an architectural point of view (i.e. aesthetics, space usage, sociological impact, …). Smart cities are then considered as entities able to optimise some processes, like energy consumption or traffic flow and they are designed following this approach. In this optimization perspective, at least two important items are missing in current approaches to smart city planning and are:

- The ambition is to leverage the capability of smart cities to dynamically rearrange space (public and private)
- A methodology that connects the architectural world with the ICT & Robotics engineering world, to let the two worlds cooperate effectively and efficiently, to provide the best results from many different points of view which will be discussed later

These items are based on the fact that, excluding Archigram's ideas and few others, nobody has evidenced the capability of the Smart City to reconfigure spaces, opening new opportunities for architects and new challenges for engineers. Many definitions can be found in the literature but, in this paper, a new one will be given, starting from the one provided by the European Commission (Russo, Rindone, Panuccio, 2010) which can be considered a good summary of most of them, and completing it with the ability to reconfigure space usage:

"A smart city is a place where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and business. A smart city goes beyond the use of information and communication technologies (ICT) for better resource use and less emissions. It means smarter urban transport networks, upgraded water supply and waste disposal facilities and more efficient ways to light and heat buildings. It also means a more interactive and responsive city administration, safer public spaces and meeting the needs of an ageing population. ***It also can temporarily reconfigure the use of its public spaces, either autonomously or in a supervised way.".***

This new version, proposed by the author, contains evidence of the above-described capability of space reconfiguration.

According to this definition of a Smart City, it is clear that the tendency to rely on data, to render the urban environment making it more rational and efficient, most directly aligns with the logic of modernization. Digital applications first appeared to be bound to the cyberspace, a virtual public space, but this space has spread becoming a new "public space of interactions" – practically an "electronic agora" that "subverts, displaces and radically redefines our notions of gathering place, community and urban life" (Mitchell W. J., 1995). The diffusion of computers in a quick and pervasive way has altered the nature of our interaction with (or inside) our environment. Monitors and screens are the new windows through which to observe the world (Koolhaas, 2002). Today, the assets of digitalization have overcome the boundaries of the virtual space because, with recent developments in digital technologies, smart applications are appearing everywhere to optimize urban life (i.e.: urban services and urban spaces/environments). The smartphone is now the "megacity survival kit, a digital Swiss Army" (Townsend, 2015). Smartphones, but not only them, have spread everywhere and disrupted social interactions and urban services, thanks to the technological miniaturization that is allowing anything to be "smart" (e.g.: Internet of Things).

This virtualisation of relationships and interactions has led to the understanding that these small and even smaller devices are a sort of "black boxes" that are "richer in functions but poorer in transparency" (Anceschi, 1996). The same pattern is present and should be considered when designing Smart Cities.

Urban public space has always been the core of the urban (human) activity and has political, socio-economic and historical connections (e.g.: Ancient Greeks Agorà, Medieval Square, Ancient Roman Forum, …). Sennett (2017) defines this space as "a place where strangers meet". Dovey (2016) expands this definition as the "primary site where a sense of the 'common' becomes embodied in everyday life before it becomes 'community'". The term "public space" means a space reserved for the public itself. Other definitions emphasize this stating that public spaces are "the triumph of the public over the market" (Iveson 2007), asserting that they are 'ceremonial spaces' for both celebration and protestation and are used by people to be "included in the public represented through the space". According to such a vision, the uses and the design of the public spaces are essentially political as well as subconscious (Benjamin, 1935-1999). But this vision has been abandoned in time due to the reduction of conflicts: Sorkin (1999) summarizes modern city planning as a 'conflict avoidance' activity where enemies of public space are privatization, identity politics, and [urban] sprawl. These concepts have led to the 'anti-urban character' that is a main feature of the large-scale suburbanization, of the closed communities, or of high buildings, where the interaction of the street level is diminishing (Dovey, 2008).

Public spaces are now facing a huge transformation led by the fourth industrial revolution (Schwab 2019) and this draws attention to the new dimensions of the proliferation of digital goods and services. As much as the dominant modes of production and politics formed everyday life throughout history, the fourth industrial revolution would, or even already begin to, challenge the ways we collaborate, produce, consume, communicate, and make sense of the world. Smart City technologies that are being used today are extremely pervasive and diffused everywhere, often as invisible presences, permeating and filling the entire ecosystem of existing urban infrastructure and services, and are therefore very hard to detect and concretize. Despite this, daily urban life is getting more and more dependent on these smart technologies provided through the various layers of digital infrastructure. In this way, the digital has begun to deeply influence public life not only on a small but also large scale. The recent COVID-19 emergency has dramatically demonstrated that we can be actively present at a set of activities at once without changing the location (as forecasted by Amin and Thrift in 2002). According to Amin and Thrift, the city, born as "a vast narrative structure that constantly re-presents itself", is changing, becoming "something that is beginning to read us" (Amin and Thrift, 2002). The places in Smart Cities "code/spaces" where "software and the spatiality of everyday life become mutually constituted" (2011) and, as Graham (2005) asserts, "coded worlds" or "computerized spaces" operate beyond the virtual, exerting "their power over the geographies and life-worlds of capitalism". According to Graham, aiming for a more secure, computer-based society that is theoretically freed from risk, crime, or congestion, entails the risk to avoid contact with the "failed consumers". Whereas, to meet the 'other' is the essence of public space.

In this vision, we get a heterogony of intents, a real unintended consequence that causes the loss of connection while building a hyperconnected world. At the same time, the new virtualisation of public spaces, if used to enforce crime suppression, security, efficiency and more, will lead to a reduction of natural behaviours that protect individuals and communities from such risks. What will happen if, suddenly, such a system loses its capability to prevent undesired events in a context when no one is ready to manage dangerous circumstances?

As a trendy concept, Smart City became a label that many urban actors are willing to say they have attached to their public spaces. Anyway, currently, there is no real place that we may consider a Smart City as a whole yet (Townsend, 2013). Nevertheless, academic circles (but not only them) indicate two distinct examples of Smart Cities: Songdo in South Korea and Masdar in UAE (Sennett, 2012); (Hollands, 2015); (Albino, Berardi, & Dangelico, 2015); (Kitchin, 2015).

Both examples are not exempt from criticism. For example, Sennett describes Masdar as follows: "There's no stimulation through trial and error; people learn their city passively. User-friendly in Masdar means choosing menu options rather than creating the menu." About Sondo, Calvillo et al. (2015) describe it as follows; "a system that theoretically continues to produce wealth-without-end through the construction of huge conduits for bandwidth and of vast quantities of environmental sensors, all focused on the monitoring and indexing of its inhabitants' online and offline behaviours."

There is, anyway, an important relationship between Smart City and the public space. The medium and experience of the public space have been expanded by digitalization and now many "smart" applications are shaping the urban space, aiming at an optimized urban life thanks to the pervasive application of ICT, in most cases using smartphones. Even though the concrete physical space is being transformed (and augmented) by digital technologies, there is also a growing awareness coupled with the threats of digitalization. This awareness is exploiting its risks and changing the purpose of these technologies to comply with citizens' needs like privacy or freedom.

Being smart or digital citizens requires action rather than just "following the script as smart citizens". Then, for smart citizens, cyberspace is a "relational space in which digital citizens come into being through digital acts" (Işın & Ruppert, 2015). Cyberspace is not separated from the real world nor is it an independent space of freedom. Cyberspace is governed by the code. But there is a dilemma, which is potentially relevant to the 'code/space' of smart cities as asserted by Işın and Ruppert; "one obeys the laws as code not because one should; one obeys…because one can do nothing else". Thus, the afore-mentioned quantitative communities become extremely vulnerable to algorithmic biases or discrimination by design. This kind of influence on people is hard to be detected and harder to be demonstrated but it is a real risk. In this sense, the new digital public space suffers from the risk of hidden manipulation "by design",

Digital technologies are an immense, exponential and promising sea that opens new horizons, in the sense of augmented spaces, to perceive the new definitions of citizenship, participation and democracy in many creative ways. Such an approach spatially holds "a real possibility to approach a dynamic re-composition of spaces, places and territories articulated and influenced by information technologies at many different scales." (Duarte & Firmino, 2009).

Today it is not clear which will be the direction in which the future Smart Cities and their public spaces will evolve but they will change and be re-defined. Greenfield (2017) emphasizes the urgent need to develop an understanding of how those technologies work and to ask rightful, critical questions whenever we come across new uses of such technology. Greenfield's call for a new understanding is crucially and fundamentally applicable to the practice of architecture and urban planning since the cities of the future are the most contingent areas of technological interventions.

The influence of the city on smart spaces is not only at the reality augmentation level but also in their function adaptation in time. As already stated before, even the physical public space can be rearranged to provide different functions in time. And this can be done autonomously by the Smart City itself, according to an automated decision algorithm that will change the use of the space with "Smart City needs". This concept will be further investigated later.

According to Sennet (in the Latham interpretation 2017) "the design and architecture of cities, along with the rituals of their use play a central role in the formation of society's social and political culture". In his book "Building and dwelling: Ethics for the City", Sennett addressed the Smart City concept as a dual-frame. This framework favours the "open city" against the "closed city" due to the "over-determined form". In his essay, "The Public Realm", Sennett asserts that "the closed system has paralyzed urbanism, while the open system might free it". For Sennett "open" is not a measure of aesthetics but rather a quality, a feature, of the urban form. Sennett (2018) has then associated the closed form with the so-called "prescriptive Smart Cities" that "does mental harm; it dumbs down its citizens", in contrast with the open form of the so-called "coordinating Smart Cities" that "stimulates people mentally by engaging them in complex problems and human difference". Sennett defines the aim of the "sheer efficiency" as an unbalanced attribute of Smart City effects, where "the prescriptive city becomes unbalanced in divorcing functioning from questioning". In his opinion, the technology must be used to coordinate rather than control, where the produced data is "limited and un-purposed" while "comprehensive participation and decision-making are truly enabled". In a coordinating Smart City model, the digital processes are transparent, and people are encouraged to get involved with the data processes by interpreting and acting on them. Thus, this is a "performative citizenship" model.

In "Building and dwelling: Ethics for the City", Sennet defines five open forms for coordinating Smart City. 1) "synchronic space", where several activities are happening at the same time as it is at an agora or a bazaar. He makes an "invitation to mix rather than impose mixing", offering a "spatial experience both stimulating and disorientating" – that requires orientation. 2) In the "punctuated space", he uses (allegorically) the punctuation marks to conceive the urban space as a meaningful language with orientation points. 3) the "porous space" comparing the built environment with organic forms that have a metabolism. He continues to define porosity as follows; "there is an open flow between the inside and outside, yet the structure retains the shape of its functions and form". 4) the "incomplete space". An incomplete form is not a 'shell' even though shells would provide unexhausted possibilities and porosity but rather a 'type form'; "a piece of urban DNA which takes on different shapes in different circumstances". Within its constraints, variations and improvisations are possible - a loose fit. 5) "seed planning" where the shifting complexities are coordinated. Sennett criticized all master planning approaches that "divides a city up into a closed system where each place function relates logically to other places". In contrast, he suggests "farmed cities" which are conceptually functioning as "an initially unrealized, incomplete form – a seed" that is provided with "the time to grow into its surroundings." Thus seed-planning is dynamic and does relate to the form of an urban project with the function at a minimum level.

In this paper, a methodology is defined as made by two fundamental elements: a descriptive language and a creative process. Descriptive language has the scope to describe what people are talking about. The language should be mainly

graphical because drawings are concise and expressive. It should also have the ability to define something to be measured because we cannot improve what we don't measure. Just to cite Edward W. Deming, an engineer who was one of the founders of the Quality concept, "You can't manage what you don't measure". A creative process has the scope to define the steps to reach the desired goals starting from some initial state. The creative process describes how things must be done to achieve success.

Types of public spaces in smart cities

A smart city can manage the flow of information, people, vehicles, goods, and services. And this can be done autonomously or be humanly supervised. Before smart cities, urban planners and urban designers could already design by conceiving multiple uses for public space (consider the medieval square, which had many uses ranging from meeting areas for business, for public decisions, for executions, for markets and more). In smart cities, public space usage can be "instantly" changed "simply" by reorganising how the smart city manages itself. For example, a road can be used as parking during normal traffic hours and as an arterial during peak hours, and this will be done automatically: smart vehicles simply will leave the road free when "The City" will ask and will park there when "The City" will allow. And this can be done better if vehicles are shared, re-allocating sharing requests on vehicles parked on such roads to move them without wasting energy and time, for example. In a few words, urban planners and designers can have a stronger degree of freedom in planning public space usage.

A challenge in city planning is the alignment in time between the planning process and social and economic dynamics that influence planning or are produced by planning itself. One approach could be to design the city as a system that can adapt (or be adapted) to changing contexts. The Generator by Cedric Price not only could be reconfigured by its human inhabitants to support their different activities, but it also could rearrange itself in the case it had been left in the same configuration for too long. The "too" should deserve a more formal definition and this could be done assuming that the project of the city can be interpreted as a transposition of Pask's conversation theory (Pask 1975). In his theory, Pask considered social systems (which are dynamic by nature) as symbolic and language-oriented systems where the responses depend on the interpretation that a person does about another person's behaviour. So, this conversation theory describes the interaction between two or more cognitive systems, and how they engage in a dialogue over a given concept and identify differences in how they understand it. Pask's studies originated from his cybernetic research when he attempted to explain the learning mechanisms of both living organisms and machines. To better explain the last sentences, a Smart City can temporarily reconfigure its public spaces to respond to inhabitants' explicit requests (e.g.: made by law enforcement agents or by the city major) or react to citizen's behaviour, learning from them through a conversation in the Pask's sense (e.g.: reconfiguring space in some way that leads to an improvement of some behavioural parameters of citizens in the space or its neighbouring). This last decisional process has not been configured by the city nor derived from simple statistical analysis or optimisation algorithms but has been learned by the City itself "conversing" with citizens. In this sense we can consider having two different processes of decision making: an explicit decisional mode where requests from some "privileged" citizens or organisations will be satisfied rearranging public space and a second one, the self-learning mode, where the City learns by itself how to reconfigure public space, conversating with citizens.

The second mode, the self-learning one, where a Smart City can decide autonomously to change after a learning process will not be considered in this paper and only the explicit mode will be discussed. The self-learning mode will be detailed in future work.

In this section, the main different types of public spaces will be enumerated and defined. Their extension into cyberspace will also be analysed in this and the next section.

Although the definition and the discussion of what is a Public Space and the differences between it and an Open Space is a very wide topic, this paper will make a simple classification of typical Smart City types of public spaces starting from the taxonomy provided by Carmona (2010) in his "Contemporary Public Space, Part Two: Classification" paper and shaping them according to Smart City capabilities, including their extension into cyberspace. The extension into cyberspace can be made by both digital twins and the provision of additional services
The classification proposed by Carmona is summarized in the following table: In the table above are described the classes of possible public spaces that can be found in a city and that can be rearranged by the smart city. But this list, in the case of a smart city, is not complete because the extensions of these "real" public spaces into cyberspace are missing.

Extension of real public spaces into cyberspace

All public spaces depicted above can have extensions into cyberspace. This extension can lead to a sort of "augmented reality" that is the mixing of the real public space with its cyberspace extension and that will be called, to avoid misunderstandings, "augmented public space".

Augmenting the public space can be done in many ways, in the following table some of them will be described. The table aims to provide enough examples of how the augmentation of public space can be done. It is focused on the possibility to augment public spaces and will not consider most of the aspects of the smart city that are related to sustainability or security, although these concepts will remain valid. The use of these augmentations will be cleared in the next section.Mixing the above augmentations can lead to very interesting results that go beyond the scope of this paper.

In the next section, thanks to the use of these augmentations, various ways of public space reconfiguration will be shown.

Space type	Distinguishing characteristics	Examples
Natural/semi-natural urban space	Natural and semi-natural features within urban areas, typically under state ownership	Rivers, natural features, seafronts, canals
Civic space	The traditional forms of urban space, are open and available to all and cater to a wide variety of functions	Streets, squares, promenades, pavements
Public open space	Managed open space, typically green and available and open to all, even if temporally controlled	Parks, gardens, commons, urban forests, cemeteries
Movement space	Space is dominated by movement needs, largely for motorised transportation	Main roads, motorways, railways, underpasses
Service space	Space dominated by modern servicing requirements needs	Car parks, service yards
Leftover space	Space left over after development, often designed without function	'SLOAP' (space left over after planning), Modernist open space
Undefined space	Undeveloped space, either abandoned or awaiting redevelopment	Redevelopment space, abandoned space, transient space
Interchange space	Transport stops and interchanges, whether internal or external	Metros, bus interchanges, railway stations, bus/tram stops
Public 'private' space	Seemingly public external space, in fact, privately owned and to greater or lesser degrees controlled	Privately-owned 'civic' space, business parks, church grounds
Conspicuous spaces	Public spaces designed to make strangers feel conspicuous and, potentially, unwelcome	Cul-de-sacs, dummy gated enclaves
Internalised 'public' space	Formally public and external uses, internalised and, often, privatised	Shopping/leisure malls, introspective mega- structures
Retail space	Privately owned but publicly accessible exchange spaces	Shops, covered markets, petrol stations
Third place spaces	Semi-public meeting and social places, public and private	Cafes, restaurants, libraries, town halls, religious buildings
Private 'public' space	Publicly owned, but functionally and user determined spaces	Institutional grounds, housing estates, university campuses
Visible private space	Physically private, but visually public Space	Front gardens, allotments, gated squares
Interface spaces	Physically demarked but publicly accessible interfaces between public and private space	Street cafes, private pavement space
User selecting spaces	Spaces for selected groups, determined (and sometimes controlled) by age or activity	Skateparks, playgrounds, sports fields/grounds/ courses
Private open space	Physically private open space	Urban agricultural remnants, private woodlands
External private space	Physically private spaces, grounds and gardens	Gated streets/enclaves, private gardens, private sports clubs, parking courts
Internal private space	Private or business space	Offices, houses, etc.

Table 1. Public Spaces Classification

Reconfiguration mechanisms

The reconfiguration mechanism of the public space in a smart city will follow a general common process that starts from a trigger event that requires the reconfiguration. This event can be a periodic event (e.g.: every Saturday the square becomes a market), which means that the event happens depending on the time, a human-forced event (e.g.: due to an emergency, these streets must be closed to some kind of traffic), which means that some human has given the order to the City to act, or a business rule event (e.g.: the traffic is jamming the main roads and part of it must be deviated to secondary roads to optimise vehicles flow), that means that some algorithmic rule (this is the real sense of "business" in this case) has been met and so proper action must be taken. After the arrival of the trigger event, the City will react by checking if the request can be satisfied or should be denied due to some constraints (e.g.: conflicting high priority requests). If the request can be satisfied, the City will start defining the boundaries of its action, and if needed developing different scenarios and choosing the best among them, then it will start applying the action(s) to overcome the request. Until the request will be satisfied, the City will monitor the evolution of the involved parameters and check that things are going in the right way, otherwise it will try to compensate for deviations or raise an alarm, if needed. When the request is satisfied, The City will return to the space default configuration. Although the term "The City" has been used up to now, it must not be considered as a central system that steers everything but as a distributed system of systems, mostly based on edge computing, that reacts to the request. The structure of this system will not be analysed in this paper, which focuses on the public space reconfiguration capability. The following sub-sections will present four different examples of potential space reconfiguration in a smart city. Other cases will not be considered in this paper for the sake of simplicity. These examples will not consider in detail why the change has been triggered but will only describe how this change can happen. Any reference to real places is a mere coincidence. The cases have been structured considering different types of spaces and implementing current and near-future technology to reconfigure them.

Augmentation type	Description	Examples
Augmented reality	When virtual reality is superimposed over reality (e.g.: by impressing the virtual images over a real-time capture through the camera of a tablet or smart glasses).	Get tracing, dietetic and performance information about goods in a shop.
Autonomous things	Autonomous things include drones, robots, ships, and appliances, that lead AI to perform tasks usually done by humans. They operate ranging from semiautonomous to fully autonomous.	Vehicles can drive autonomously and be shared when needed. They will also swarm to improve the city's quality of life (e. g. reducing traffic).
Democratization (of technology)	The capability of technology to become easier to be used by citizens.	Citizens could develop their own data analytics starting from available open data
Distributed ledgers	The use of technologies like blockchain will allow the creation of distributed ledgers where transactions of any kind are recorded and will allow a better data management	Vehicles can book parking places in an extremely easy way, even with large advance, and rearrange the booking with no human intervention and in a very quick way.
Edge computing	Edge computing means processing huge quantities of data near to their sources, reducing latency time and improving response/reaction time. This is a typical layer in the Internet of Things systems.	Cars can directly dialogue with parking places and find the nearest free.
Geolocation	Geo-referencing any object means identifying its position in the space. This can be done for items or humans and in many ways (e. g. GPS, cameras triangulation).	Instantly knowing the position of any element of the city, including citizens, and, if possible, their destination, if moving.
Hyper-automation	Through this advanced form of automation, which mixes AI and robotics, humans can remotely control shared robots to act for them. Hyper-automation also includes the capability to remotely measure many parameters.	Shopping can be done remotely even for non-standardized goods like fresh goods, dresses and more that, currently, are bought by the customer directly trying them.
Multi-experience	Multi-experience replaces technology-literate people with people-literate technology. In this perspective, the traditional idea of a computer evolves from a single point of interaction to include multisensory and multi-touchpoint interfaces like wearables and advanced computer sensors.	A weekly food shopping can be easily done at home using an App to order what is needed, cooperative robotics to prepare and package it and autonomous vehicles to deliver it.
Virtual reality	2D or 3D virtual reality allows the creation of a virtual representation of any object (e.g.: park, street, touristic place) or concept (e.g.: traffic flow, available parking map) that can be displayed to a human being and with which the human can virtually interact.	Virtual tour of a touristic place or a restaurant. Virtual tour of shelves in a supermarket.

Table 2. Some types of augmentations for public space

Example 1: parking, street, main traffic arteria
Scenario

The City, at 8:00, orders all vehicles to not park in Baker Street and to those that are already parking there, to move to different places in the neighbourhood, already assigned them by The City. This is because, up to 9:00, Baker Street must become the main artery in inbound traffic flow. Small streets that merge into Baker Street are assigned as a temporary stop to let passengers leave their vehicles and go to work in the building near them, without hampering the main traffic flow. All vehicles are autonomous, so they obey this order with no human intervention. At 9:00, The City checks that the traffic has reduced its intensity and that Baker Street is not yet needed as the main artery, so the Street Becomes a pedestrian-only road where shops are open, and people can move around to get some coffee or buy something. Many mobile shops made by autonomous vehicles can park in the zone. The pavement in the middle of the road automatically reverts and opens, showing a medium-size children's playground allowing the neighbouring kindergarten to take children there to play. Around noon, the City decides that the mobile shops must move away (and they autonomously do this) and allows local restaurants to fill the road with tables and chairs. The weather report forecasts rain, so a covering is placed by an automated system all over the street and wind barriers are automatically put at the beginning and the ends of the street to repair from the windchill that has also been forecasted. At 14:30 the restaurant service closes and the road returns to being a normal street where low-intensity traffic is allowed, closing coverage, lowering the wind barrier and asking shops to remove tables and chairs, also hiding the children's playground. Now Baker Street is mainly used to gather people leaving their work. At 16:30 traffic in the city is increasing and The City requires Baker Street again as the main artery, as in the morning, asking autonomous vehicles to leave it free of parking and diverting a portion of the traffic through it. When traffic flow reduces, around 20:00, Baker Street returns to

be a normal, low traffic street and it becomes a one-way street, with a central portion used for two-lane traffic, and both sides as an area to deposit and pick up people that move to go to local pubs, bars, clubs and more. Then it cycles again from 8:00.

Comments about the scenario

In this simple example, the space that The City reallocates is an urban street. It has been made possible by the existence of autonomous vehicles (cars, mobile shops) that can easily respond to City requests. It is also based on the possibility of the children's playground being hidden below the road floor. Also, the anti-rain covering, and wind barriers have their role in this space reallocation. The use of the street as a normal road, pedestrian-only, high traffic arteria, one-way two-lanes street is made possible by changing road signs, most of which are virtual, i.e.: visible only through virtual or augmented reality but readable by autonomous vehicles. The scenario is quite easy and, for some aspects, naïve, but it is near to be practically realizable: only level 5 autonomous vehicles are missing from it.

Example 2: Mall by day, entertainment city by night
Scenario

The Magic Wand Mall (or MWM) is a shopping mall where there are 208 "shops". It has been designed to allow a set of mobile walls that can be controlled by The City. These mobile walls can be used to partition the shops into different subspaces. These walls can move (moved by someone or by themselves is not important). Each shop has a "default" area ranging from 60 square meters to 3,000 square meters. To access each shop there are two ways: the first one is through main halls and corridors, beautifully decorated that will be called "human access connections". The second one is a normal set of corridors of standard width of 4 meters, with white walls, and connected to the mall warehouse. These corridors will be called "restock corridors". The mall, as usual, will have two different access types: the main entrances, that face toward the human access connections, and the goods entrance, which faces toward the restock corridors. At 19:00 The City analyses the inventory of all malls and shops that are in it and the forecasts for goods requests for the next day. This process ends around 23:00 and requests are sent by The City to all suppliers to provide differences concerning what is already planned and not yet under shipment. In this way, The City has planned the entire logistic supply chain from peripheral logistic areas, just outside the city, that have been refilled during the day, up to a single shop in a single mall. At the same time, the MWM spaces are returned to their default configuration of pubs, clubs, and other entertainment places by robotic teams. Warehouse spaces (will be explained later) used as shops during the day are now hidden by mobile walls. Everything has been cleaned before 20:00.

Starting from 20:00, the shops in the MWM open to the real public (i.e.: humans) as restaurants, pubs, clubs, cinemas and other aggregational and entertainment places. This configuration is the default configuration of the public space. Up to 2:00 of the next day, people live in the MWM as an entertainment and meeting area. After the last human has left the area, the cleanings are done by automated systems (i.e.: cleaning robots). At 3:00, The Mall reorganizes its space to receive goods to be sold by remotely accessed shops: mobile walls are removed to use all the available space as storage. So, until 5:30, the MWM will be filled with robots that are refilling the warehouses which were hidden by mobile walls and also the space used by people as pubs or restaurants just a few hours ago.

In this case, customers, from their homes or using mobile apps from anywhere, virtually visit the shops in the mall and choose goods to be bought. In some cases, shopping-AIs (i.e.: Artificial Intelligences programmed to buy daily products basing their choice on their tastes) will make the order. In both cases, humans and AI, using hyper-automation and multi-experience, can virtually try dresses, smell scents of food, try fruit consistency and do other sensorial activities remotely. For all day, until 19:00, the MWM is closed to the public (or only a portion of it can be open), while most of it is used as storage space for virtual shops. At 19:00 the loop begins again.

Comments about the scenario

In this scenario, the same space, which has been designed as an entertainment or meeting place, is used for half of the day as storage from where buy goods acting from remote. Using citizens' behaviour prediction and other kinds of statistics, The City can rearrange this space to both support the need for meetings and the need for shopping. This scenario requires a bit more technology than what is currently available, but the trend ensures that in a few years it will be possible to be realized. Using a mall in this way will improve sustainability: the supply chain will use spaces that, after being freed by customers that buy goods, will be reused during the night for different purposes. This scenario can be evolved into the next one.

Example 3: The Mini-Generator without cranes
Scenario

In this scenario, space is a building with many floors but no walls (or only a few walls). Provided that it has various goods hoists that can move large loads from one floor to another, it is possible to reconfigure the space dynamically (as dreamed in The Generator). The only issue is about the interior design. And this is the main issue that will be faced in this sub-section. Changing the space configuration is not difficult: even today's automation level, using already existing forms of cooperative robotics, can provide mobile walls that can be put practically anywhere. Also, electrical connections should not be a problem: connecting from the ceiling and distributing through mobile walls specialised connections. Hydraulic connections can be provided through the floor or ceiling, directly to furniture, even in the case of gas furniture (for cooking). Climatization can be provided, again, by hiding pipelines in floors or ceilings. The problem is that spaces that must be used by humans need specific furniture to be provided and decorations and designs that must be changed in the blink of an eye. So, we will assume

that the mobile walls are not a problem and we will focus on furniture change. There are at least three different ways we can arrange different furniture. The first one is using furniture which moves autonomously, i.e.: that are mobile devices that know where to go and how to connect. It's easy and the only issue is where to put them when they are not used. The second one is to use furniture moved by someone else (e.g.: a robot that carries them and robots which position and connect them). Also, in this case, there is again the problem of where to put them when not used. In both cases, there is also the issue of damages during transportation. The third one is using furniture that is assembled starting from a common set of reusable components (e.g.: panels, small doors, glass windows, taps, sinks, …). In this case, the needed storage space will be lower but there is the problem of decoration: all elements are raw and need specific decoration to be used. The solution to the decoration issue, and probably, but with the need to further develop the technology, for the elements or furniture storage, is the use of nanotechnologies. Using nanotechnologies will soon be possible to paint surfaces creating changing patterns (remotely controlled) and also create sensorial and interactive walls. In this way it will be possible to change the aspect of raw elements, giving them the desired aesthetics and also specific surface performance (e.g.: waterproof, smooth, cold, hot, lighting, …). Such nanotechnologies promise that using nanorobots, simple structures can even be built. Structures interesting in this scenario range from intelligent seals for gas or hydraulic connections (for safety reasons but not only), passing through the creation of simple small elements like glasses, lamps and more, up to complex elements like furniture and even walls. For these last two, the technology is rather far to be ready, but for small scale applications, it is promising.

If we assume that nanotechnologies or even swarms of small robotics components can be used to realize and decorate furniture, in cooperation with the assembly of standard elements, we can entirely reshape a building by acting on all non-structural elements. What is assumed in the last statement, is that the City will be able to reconfigure public space for periods longer than one day or a few hours through mobile walls, modular furniture, and smart decoration. So, the building considered in the scenario will be able to be reconfigured by The City according to its needs. For example, it could start as a business building where there are offices and food services and then, after a few months, when the request for apartments near it has grown, be partially readapted by The City as residential. When a convention is needed, part of the offices will be arranged like a conference room. With the arrival of inhabitants in the building apartments, also some schools will be needed and, for nine-month each year, some space will be used for educational purposes.

Comments about the scenario

Although based on technologies that have to be further developed, this scenario gives reality to Price's Generator project and considers space (not public only but also private, like an office or an apartment) as something that can be shaped by The City (autonomously or under human control) to fill specific needs. In this perspective, the (public) space becomes a place where people meet other people to socialise and maintain the human contact that has been revealed to be important during the COVID-19 lockdowns: people have discovered how good is working at home but also the need to meet colleagues and other people. In a few words, people have discovered that they need a balance between smart working (or studying) and physical contact at the office (or school). This scenario is remarkably interesting because it allows us to find these balance points even considering change drivers like the growth of the average age of people. A city should support social changes by reshaping its space and this can be done if the technologies depicted above are used. Last, but not least, with the above approach, extended to any existing building, The City will be able to plan its whole reshaping to improve the overall quality of life, compensating for some urban planning/design errors or requirements changes.

Example 4: Public Space and 3D printers

Scenario

Large scale 3D printers are today able to build an A-class house from scratch in a few hours. Anti-seismic, cheaper, sustainable houses can be quickly created directly on-site with this technology.

Soon, even large buildings could be created using the same technology. In this way we can imagine that The City will be able to rule an army of such 3D printers, equipped with AI and with an adequate degree of autonomy and will be capable of expanding itself, creating new buildings, new roads, and even new districts.

In this way, The City can permanently change its (public) space. But the scope of this paper was a temporary reconfiguration and 3D printing does not allow this. Mixing 3D printing with nanotechnologies can lead to an interesting result: buildings will have very special features thanks to the nanotechnologies and can be demolished with up to 100% recycle due to the capability of nanomaterials to be easily separated and reused. Although this technology must be further developed, the trend is clear and remarkably interesting opportunities are on the horizon. Using this kind of approach, The City will be able not only to change its space (public or private can be considered the same) but also do this "temporarily", which does not mean hours or days but surely can be done for periods of many months or years. In this way, The City will support urban planners and designers to realize their ideas, giving both the data analytics to make decisions and the manpower to physically realize them.

Comments about the scenario

This last scenario requires a lot of technology that is not yet available and puts some questions about the energy efficiency of a process of creation and destruction, but the answer depends on a deep analysis of advantages and disadvantages. In this case, the Urban Planner and the Urban Designer will find in data analytics gathered from The City an important source of

information to support the decision and can create not only simple renderings of the future urban forms but also very detailed simulations that will increase the effectiveness of their work.

Challenges for urban planners and urban designers

Considering all the above considerations, the Urban Planner and the Urban Designer have to take into account the capability of the smart city to reconfigure public space. The Generator, in the end, has arrived, to use a metaphor, and it is time, as in Generator, to put together Architects (i.e.: Urban Planners/ Designers) and engineers (i.e.: ICT and Robotic engineers) to work together. This is the first challenge that has to be faced. But Price and his consultants did it in the past, so it should be possible now. But there is a fundamental difference: the level. The Generator was a utopian project, never realized, and did not have to face reality (i.e.: time, maintenance, errors, failures, …) while a Smart City is something that must live for a very long time and adapt to very quickly changing technologies and less-quickly changing social needs. What is needed is something that can be improved in time and that will allow us to reproduce successes and learn from failures to avoid repeating them. This is a methodology, according to the definition given in section 2. Putting together the language and the process, it will be possible to create these interdisciplinary teams and get the maximum from them. This interdisciplinarity is physiological in computing and has already been developed in other contexts: bio-informatics (for ICT application to medicine and healthcare), info-logistics (for ICT application to logistics) and more are, by now, well-established disciplines, where interdisciplinary teams work in a very efficient and effective way. But in these fields the solution was affordable: medicine, healthcare, logistics, chemistry and more are disciplines where there are already very rigorous procedures and, except for advanced and theoretical research, creativity is not the first quality people should have. In Urban Planning and Urban Design (and, in general, in Architecture) we have a very creative, soft-skilled, emotional, human-sciences oriented approach that must be met with the aseptic, cold and schematic mind thinking of ICT and Robotics engineers. In this case, the lack of a common methodology that preserves both approaches leaves the two parts of the team to work separately. To use a metaphor, the architectural portion is the left hemisphere of a brain while the engineering one is the right hemisphere. If we want our brain to work, we have to let them strictly cooperate while preserving the identity and peculiarities of each one. Today such bridging is missing, and architects and engineers work separately on these topics. And no methodology is yet available and no research in such a sense is reported. And this is a serious issue that should be deeper analysed and, if found a real issue, solved.

A set of methodology definition requirements

The above-cited methodology should comply with the following requirements that can be considered an initial set of guidelines for its implementation. In the table below, UP and UD refers to Urban Planners and Urban Designers while ICT refers to ICT & Robotics Engineers:

Final considerations and further development

The capability of a Smart City to rearrange its space is an opportunity to develop new strategies of urban planning and, at the same time, manage risks contained in smart city development. This capability is a topic that needs further analysis and could represent a new, important, degree of freedom. The methodology will be further developed in research about risk analysis and management in a Smart City. Such research will also investigate the application of Pask's Conversation Theory to Smart City self-organisation as a driver for a Smart City Intelligence.

Title	Description
Methodology goal	The scope of the methodology is to transfer requirements and specifications from UP/UD to ICT
Expressive capability	The methodology will be able to describe requirements and specifications for both UP/UD and ICT
Initial state	The methodology will start from UP/UD requirements and/or specifications
Final state	The methodology will end with ICT requirements
Bottom-up change management	The methodology will be able to transfer changes on the ICT side (in technologies or requirements) towards the UP/UD side, tracing up to impacted UP/UD requirements and specifications
Top-down change management	The methodology will be able to transfer changes on UP/UD side requirements and/or specifications towards the ICT side, tracing up to impacted ICT requirements
Risk analysis support	The methodology will be able to define all elements needed for a risk assessment or a risk analysis.
Measurability of kernel entities	The methodology will define some core entities that will have applicable measures and that can be used to evaluate in a quantitative where the methodology is arrived, from where it has started and where it has to go
Expandability	The methodology will define a mechanism to extend it and adapt it when needed without the need to alter its kernel
Structure	The methodology will be composed of both a descriptive language and a creative process

Table 3. Methodology requirements

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The Robots Are Leaving the Cage Imagining the Future of Construction

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Abstract
Architecture today is challenged by technology advancements and the spread of new tools such as robots, which are mediators between digital and physical. This paper aims to outline future trends that will introduce substantial changes in the construction sector and architecture technology. In support of the topic, representative examples of ongoing experimentations are provided. They are relevant to understand the potentials of tools and foreseeable applications to update the building culture. The introduction of new instruments and procedures might affect building methodologies and the relationship between upstream and downstream design workflows. This relationship is an important aspect because upstream strategies inform downstream processes and vice versa. Also, advanced construction tools enrich the creative phase by providing an opportunity for innovative data integration. The use of computational design, digital fabrication, robotics, and cobotics allows for innovating the building sector by promoting a method based on the customization of forms to be operated on-site. In this scenario, robots play the role of compressing the distance between design and production. Current trends open hypothetical potential for the future of construction: there is a chance for the perfect storm to overwhelm the industry shortly, in compliance with The Fourth Industrial Revolution and the Digital Transformation. Digital Transformation will result in the automation of every task that can be automated, accepting that robots want to "leave the cage," to be embedded in material workflows within hybrid human-machine workspaces. It is expected that architecture, which usually absorbs innovation from other sectors through technological transfer, will become an early adopter of new systems and technologies, always focusing on the design quality at all scales.

Keywords
Digital Transformation, Fourth Industrial Revolution, Construction Robotics, Cobotics, Design Workflows

Cultural background: Digital Transformation and new challenges

In contemporary practice, architectural projects must confront digital infrastructure at different scales of application. The impact of the digital environment on design and construction is led by the Digital Transformation or D(x). It is a technological shift that is changing social balances, work structures, and traditional decision- making phases in favor of iterative data-informed and data-driven approaches. According to the definition adopted by *Educause*,[1] the term Digital Transformation summarizes technical-scientific advancements that result in a modification of the work culture in multiple sectors. These advancements are made possible by the current development of Artificial Intelligence, cloud, computing, big data, social networks, and data storage capabilities. D(x) is a driver of change that profoundly affects the manufacturing industry - and as a consequence building construction - by taking advantage of technology and data to respond efficiently to market demand. D(x) brings together the innovations dictated by the Fourth Industrial Revolution, Industry 4.0, and Industrial Renaissance, a set of technological paradigms that come from the field of economics and have slightly different meanings.

The concept of the Industrial Renaissance recently spread through academic research. The concept refers to the production sector and is based on the economic theory formulated in 1983 by William Abernathy, professor at the Harvard Business School. Abernathy advocated for the American industry's modernization through the competitive advantage gained from the integration of - at the time, emerging computer-aided design (CAD) and computer-aided manufacturing (CAM) systems (Abernathy, 1983, 12-13). The integration consists of the possibility of bringing design and production closer together in a single digital workflow based on the data transfer to inform upstream decisions iteratively.

Similarly, the term Industry 4.0 refers to industrial production and describes the current state of manufacturing. In addition to Abernathy's vision, it focuses on evolving assets such as smart manufacturing, smart factories, and advanced logistics. It relies on interconnected tools driven by the industrial Internet of Things[2]. Industry 4.0 can be considered a subset of the Fourth Industrial Revolution (Schwab, 2017), which encompasses areas that are not necessarily related to production. It is currently building on the Third Industrial Revolution, and "it is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres"[3]. The term was coined by Klaus Schwab, founder of the World Economic Forum. It indicates a palimpsest of underway transformations including IoT, AI, automation, and robotics - that are taking place faster than any other revolution of the past. Among the innovations led by this complex ecosystem, robots are increasingly getting the attention of a wide audience, mostly due to their growing economic accessibility and therefore wide commercialization. The manufacturing sector is tied to the production of architecture, which can benefit from the use of innovative resources and equipment to update design processes and overcome standardized architectural prefabrication. In this instance, robots in architecture have the potential of breaking the limits imposed by traditional production methods toward mass customization (Davis, 1987, 168-173), a notion outlined for the first time by Stanley Davis in 1987.

The digital culture entered architecture in the early 1990's with the Digital Revolution that marked the transition from mechanical to digital technologies. This cultural shift in design is known as Digital Turn (Carpo, 2013). This new paradigm happened when architecture criticism was still busy formalizing deconstructionism, in the works of Zaha Hadid, Frank Gehry, and Peter Eisenman. At the time, the architectural design sector started to absorb digital workflows from the naval and aeronautic industries. Indeed, the production of ships has always been to the architects' attention: naval architecture is one of the oldest in construction. This relationship depends on the fact that both ships and buildings are complex systems: "interconnected spaces inhabited by people" (Kolarevic, 2004, 12) with the difference that, in addition to gravity, ships must withstand hydrostatic pressure. The Encyclopédie Méthodique Marine of 1783[4], as an example, reports a definition of naval architecture as "the art of building" or "the basis of the building science" that requires rigorous skills of drawing "vertical, horizontal, and oblique planes of smooth surfaces" (Blondeau, E. N., & Du Clairbois, 1793, 10). Today, as with aerospace engineers, shipbuilders no longer use drawings for the construction of high-tech products with the utmost precision, but perform design processes with a "comprehensive three-dimensional digital model from design to production" (Kolarevic, 2004, 14). In the shipbuilding sector, professionals use digitally-driven technolo-

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[1]According to the definition adopted by the journal Educause, Digital transformation (Dx) "describes a cultural, workforce, and technological shift, enabled by advances in technology that include analytics, artificial intelligence, cloud, mobile, social networks, and storage capabilities". D(x) calls for a rethinking of higher education (higher ed), to prepare future professionals to face the global changes dictated by the ongoing digital transformations. For further details, see: https://library.educause.edu/topics/information-technology-management-and-leadership/digital-transformation-dx (online: March 1st 2020).

[2] The Gartner Glossary describes the Industrial IoT as a set of integrated software capabilities. These capabilities "span efforts to improve asset management decision making, as well as operational visibility and control for plants, depots, infrastructure and equipment within asset-intensive industries". Moreover, the industrial IoT "is engineered to support the requirements of safety, security and mission criticality associated with industrial assets and their operating environments". For further information, see: https://www.gartner.com/en/information- technology/glossary/industrial-iot-platforms (online: May 18th 2020).

[3] "The Fourth Industrial Revolution: What it Means, How to Respond", in World Economic Forum. Available at: https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/ (online: May 20th, 2020).

[4] The Encyclopédie collects the knowledge of the time on shipbuilding. Along with the definitions of wood types and naval technical terms, it contains a set of detailed drawing boards. They illustrate how to exploit the natural shape of trees to make timber element for the construction of ships, boats, and vessels.

gies to generate the drawings needed to automate the manufacture of the components adopting a file-to-factory strategy, which is synonymous with process modernization.

In architecture, the Digital Turn introduced a new design culture contributing to the spread of computational thinking and digital tectonics. It enabled architects to interface with a common language, reduce uncertainties, and ensure greater awareness in decision-making phases. Moreover, the Digital Turn allowed for the integration in the discipline of computational workflows that "has emerged in an attempt to leverage the potential of digital tools to link existing sectors of the industry and bring in new sectors in response to the growing demand for intelligent processes and intelligent buildings" (Marble, 2012, 150). The spread of digitization favored the creation of new formal languages: "the new digital style of smoothy and curvy, spliny lines and surfaces [..] now called parametricism" (Carpo, 2017, 131). However, the Digital Revolution had a major limitation; it gave way to the production of digital drawings and two-dimensional simulations that resulted in a secondary role for material culture in architectural production (Picon, 2014). The rise of digital fabrication helped filling this gap. Therefore, the decade that followed 2010 witnessed a push toward a renewed design complexity, characterized by experimenting with robotics and reprogrammable tools to materialize the digital space with great flexibility. This approach expresses the opportunity of "turning data into things" (Gershenfeld, 2012, 44) to find new digital-material possibilities. The convergence of the digital environment with the material world allowed for a subsequent academic theorizing: the Second Digital Turn (Carpo, 2017).

The Second Digital Turn describes an ongoing cultural breakthrough – within the current framework of the Fourth Industrial Revolution - that aims at making the digital space tangible and perceivable (Gramazio and Kohler 2008). It refers to the diffusion, in design, of programmable tools, such as robotic arms, 3D printers, smart-assembly or combined tools, which are the mediators between design and production. These tools make it possible to compress the distance between digital and physical, in a hybrid cyber-physical workspace that expands the design options and elevates the impact of material culture. Therefore, design is not separated from construction and the translation between one and the other becomes nearly instantaneous.

The resulting "digital continuum" (Kolarevic, 2004, 91) can lead to pioneering conceptual results and renewed aesthetic paradigms pointing towards the possibility of transforming roles and disciplines of professionals working together within the digital environment. Given the trajectory of Digital. Transformation as an evolving ecosystem (Figure 1), a new conception of the master-builder – a professional figure that comes from the Middle Age - might represent a balanced point between the advancing technological level in building construction methods and the artisanal approach that characterizes the making of architecture (Figure 2). The new master-builder could constitute a group of figures between the various actors operating in the complex building process and the expression of digital complexity and dexterity. The present-day master-builder could also be the promoter of a renewed project culture and the supervisor of all the design - construction - management activities that take place in the design process. Consequently, design output links between the conceptual phase and the built result, as in the past with craft traditions. Digital manufacturing technologies occupy a fundamental role in this scenario. They are the foundations for mass-customization and performative architecture.

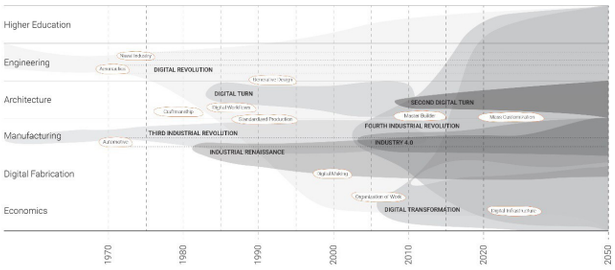

Figure 1. Graphic representation of the development of the digital infrastructure that connects intertwined sectors such as Architecture,

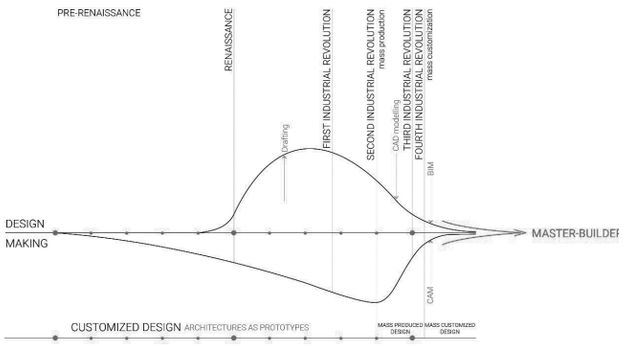

Figure 2. Contraction and deviation of design and making in architecture through industrial revolutions. The current convergence is synthesized by the figure of the master-builder. (Diagram by the author).

Addressing robotics in architecture: approach and methodology

This paper aims to outline future trends that will introduce substantial changes in the construction sector and architecture technology. These changes affect not only the building methodologies but also the relationship between upstream and downstream design workflows. The latter is an important aspect because upstream strategies inform downstream processes and vice versa. The upstream process is the early-stage phase, where the morphological decisions are made, and the design language is defined. On the other hand, the downstream design process concerns production. Advanced construction tools enrich the creative stage by providing an opportunity for innovative data integration. By speculating on the future of construction, the international scientific community shares the idea that the next decades will be characterized by research focused on the development of:

- Cobotics, or human-machine collaboration in a shared physical workspace;

- On-site robotics, which means the use of automation for the customized production on-site of construction compo nents;
- Automated monitoring of building processes for the real-time validation of BIM-based projects.

In the paper "Cobots: Robots for Collaboration with Human Operators", published in 1996, the Northwestern University professors Edward Colgate and Michael Peshkin described for the first time their prototype of cobot. They defined it as "a robotic device that manipulates objects in collaboration with a human operator" (Colgate et al., 1996). Cobots, or collaborative robots, are machines designed to communicate with people and share a physical workspace[5]. To enable safe collaboration, they operate at low speeds and are equipped with sensors that allow them to detect and avoid obstacles. Cobots were developed to overcome the idea of a robot that, according to Isaac Asimov's[6] vision, operates as a mere "autonomous, automatic, and reprogrammable on three or more axes for use in industrial automation applications"[7]. These applications are possible through the installation of a fixed or mobile multipurpose actuator. Cobots, instead, are interactive and responsive devices that can be coordinated with human operations. The integration of AI in the operating systems could open possibilities for enhanced flexibility and problem-solving tasks. As brought up by Paul Daugherty and James Wilson in the publication Human + Machine: Reimagining Work in the Age of AI, unlike robots, cobots are designed "to work closely with people" literally "expanding worker's physical capabilities" (Daugherty and Wilson, 2018, 140, 148). Cobots are useful in a scenario in which "manufacturers are able to reimagine previously static processes" and "workers take on new roles when they collaborate with these smart machines". As a consequence, "business can make more various, adaptable choices about the kinds of products they offer their customers" (Daugherty and Wilson, 2018, 140). This approach is aligned with the Digital Transformation logics. Moreover, it represents an operable methodology to address the progressive loss of labor and skills that is occurring in the construction sector, resulting from the financial crisis that damaged global markets in 2007[8].

In addition to advanced tools, the development of on-site robotics for building site automation is a key factor in academic and industrial research. The traditional building process consists of a sequence of complex operations performed to transform a system and to obtain a superior unity for each phase of transformation. In other words, a sequence of discrete steps, where every operation happens after the previous one is completed, with a clear threshold marking the termination of each stage and the commencement of the next (Zaffagnini, 1981, 9-11). These operations are structured to organize and bring together "a set of inputs into a specified building output or product, in a given period of time, on a specified site" (Groak, 2002, 121). The decision-making phases have a relevant impact on the organization of work, as well as "you cannot have 40 people showing up on-site and figure out the materials to be used by the end of the day. We need processes, logistics. We need to know which progress is supposed to be made after a certain amount of time"[9]. As Pierluigi Spadolini states in the book Designing in the Building Process, building production sequences come from artisan production, where "the designer's knowledge was related to that of the highly specialized manufacturer with direct control of resources and technologies to provision" (Spadolini, 1981, 15). The technological influence in production processes varies in historical periods according to the tools used. The connection between design and construction has weakened with the beginning of industrialization, which has delocalized production and deskilled the technological elements for their repetitive production. Industrialization "has determined a flattening of the artisan interpretation" and has brought constraints to the design determined by the downstream production technologies (Spadolini, 1981, 16-17). This has inevitably led to restrictions in the work of the architect forced to limit formal and constructive choices based on industrial production. The 1980's, at the threshold of the Digital Turn, allowed designers to visualize a socio-cultural transition between hand, mechanical, and digital making. The theme of digital making has opened to philosophy, with the Theory of Objectile by Bernard Cache (Cache, 1998) and the theme of multiple variations (Deleuze, 1993) introduced by Deleuze. As a consequence, digital making is seen as a possibility to generate calculus-based forms, creating variations that can be produced using digital manufacturing technologies through the language of the algorithm (Carpo, 2011).

The use of computational design, digital fabrication, robotics and cobotics is an opportunity to innovate the construction sector and architecture by promoting a method based on the

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[5] "You've Heard of Robots; What are Cobots", in Forbes. Available at: https://www.forbes.com/sites/co gnitiveworld/2019/12/15/youve-heard-of-robots-what-are-cobots/ (online: May 20th, 2020).

[6] Isaac Asimov is the author of the sci-fi short story "Runaround", published in 1942 in the Astounding Science- Fiction magazine. By describing positronic robots, the author expresses the Three Laws of Robotics. In 1985, with the novel Robots and Empire, Asimov introduces a fourth law, called the Zeroth Law, according to which "a robot may not harm humanity, or, by inaction, allow humanity to come to harm". From this axiom derives the reformulation of the cited Three Laws. First Law: a robot may not injure a human being or, through inaction, allow a human being to come to harm by inaction, as long as such orders do not conflict with the Zeroth Law. Second Law: a robot must obey the orders given it by human beings except where such orders would conflict with the Zeroth and the First Law. Third Law: a robot must protect its own existence as long as such protection does not conflict with the Zeroth, First, or Second Laws.

[7] Definition provided by the IFR, International Federation of Robotics, which adopts the guidelines provided by the International Organization for Standardization. The ISO 8373:2012 - "Robots and Robotic Devices" states that "an industrial robot is an automatically controlled, reprogrammable, multipurpose manipulator, programmable in three or more axes, which can be either fixed in place or mobile for use in industrial automation applications". Available at: https://www.iso.org/obp/ui/#iso:std:iso:8373:ed-2:v1:en:term:3.11 (online: May 20th, 2020).

[8] Faced with the lack of response to concrete needs in the construction sector, the Robotic Industries Association estimates that by 2022 the construction robot market will reach a value of 321 million dollars. It could grow at a constant annual rate of 8,7%. For further information, see: https://www.robotics.org/service-robots/construction- robots (online: May 20th, 2020).

[9] From a lecture given by Karl Daubmann for the kick off of the course Critical Practice – Fall 2019 at Lawrence Technological University – College of Architecture and Design – MI, USA.

customization of forms to be ideally operated on-site. Indeed, we still construct in the same way that Gothic cathedrals were erected

- with the only difference that the tools are more sophisti cated
- with the same philosophy: "manual control, human opera torvisual feedback, and big positioning error" (Balaguer, 2000).

As mentioned, current trends lead to the conclusion that in the near future there is a chance for the "perfect storm" to overwhelm the construction sector, in compliance with The Fourth Industrial Revolution and the Digital Transformation. In architecture, some of these trends - which will be described in detail in the following paragraphs - include: the spread of CAD/CAM tools and skills globally; the increasing investments in digitization in multiple sectors; the democratization of automation and the decreasing cost of robots; the enhancement of digital interfaces for algorithmic design and robo-scripting; and the definition of new high-engineered materials compatible with 3D printing and robotic production. Today there are numerous limitations which make it difficult to scale-up the digital manufacturing approach from the Fab Lab to the construction site. However, there are some aspects to be considered in the advancement of First World economies. On the one hand, construction jobs are perceived as "Four Ds" working environments, which means dull, dumb, dirty, and dangerous. Even on the verge of a forthcoming global economic meltdown that could be worse than the collapse of 2007, building site labor is rarely the first choice for the unemployed. On the other hand, the upheaval of post-pandemic working conditions may hasten the research to find solutions and economic advantage from the use of machines within a cutting-edge digital infrastructure.

Cobots and on-site robotics: a brief overview of case studies

In this section, representative examples of cobotics and on-site robotics are provided. They are relevant to introduce the tools and foreseeable applications in the building sector. These technologies have been used mostly in industries that revolve around architecture. For instance, as it happens for robotics, the manufacturing industry is a testing ground for cobotics. In parallel, construction robots, including monitoring devices and autonomous vehicles, are experimented mainly in the research sector, to push the Technology Readiness Level[10]. The analysis of case studies provides an opportunity to clarify limitations and potentials of existing best practices, in the formulation of future scenarios.

In 2012, the start-up company Rethink Robotics[11] created Baxter, a collaborative robot intended to perform repetitive tasks alongside humans. Baxter is provided with multiple sensors that allow it to detect the presence of static or dynamic objects nearby, and circumvent them at a low speed to avoid causing harm to anyone. User-friendly cobot programming is easily done by unskilled workers, reducing overspending in coding. Based on variable inputs, Baxter is able to adapt accordingly. Its geometry includes two arms, defined by three nodes each (shoulder, elbow, and wrist), ending with the actuators, or hands. The hands could be customized, and often they were grippers equipped with extra sensors for picking and placing objects. The most innovative feature is the flat screen on its face. It displays various expressions that helps collaborators to understand its current status. By moving the eyes, Baxter foretells its next positioning in the working area. Compared to the technology available today, the project pioneered early-stage research on intelligent robots. An approach for a collaborative machine in construction is the Mule (Material Unit Lift Enhancer) project[12]. It is a programmable device that handles building materials to human workers, who are relieved of arduous and exhausting tasks.

Nowadays, examples of collaborative automation tools can be found in manufacturing plants. At BMW's factory, to name one, cobots "rub elbows" with humans[13]. They are installed by the company Universal Robots[14] that produces lightweight and low operating-speed robots to be adopted safely in shared workspaces. BMW business model is currently under study by researchers at MIT in response observations that maximized automation does not imply higher efficiency. According to their analysis, the human-robot collaboration in the car facility reduced by 85% the workers' idle time.[15] Moreover, the collaboration turns the assembly line into a flexible system that makes manufacturing labor less manual and more supervisory. This aspect is beneficial to workers, who become more appealing on the job market because of their renewed skills and greater awareness of production processes. Mercedes-Benz plant invested in cobots too, due to the increasing demand of customizable cars. As a consequence, "with so much variation in car manufacturing, the only way to assemble cars fast enough is to bring people back", instead of "dividing manufacturing plants into a heavy lifting robot section, usually fended off from people for safety reasons and another area for to perform more delicate tasks" (Daugherty and Wilson, 2018, 148). Customization is tied to architecture too, which could rely on hybrid human- machine completion of laborious tasks by keeping the craftspeople consciousness involved in making. This balance might be crucial to prevent construction sites from becoming standardized manufacturing sites, often theorized and never realized.

In the construction industry, the Hadrian X Robot[16], by Fastbrick Robotics (Perth, Australia), pioneered on-site automation. In 1994, the mechanical engineer Mark Pivac conceptualized a robotic arm for lifting, positioning, and installing building materials. Between 2005 and 2008, Pivac filed a patent for an "automatic bricklaying system" called Hadrian. It was used to successfully demonstrate the construction of a wall made of bricks and mortar. After this experiment, the Hadrian project was put on hold due to the financial crisis and rebooted in 2014 in combination with a global renewed interest in robotic construction. In 2016, the Hadrian Robot built, as a proof of concept, an architectural unit from a digital CAD model with no human intervention. The architects Gramazio and Kohler contributed to making the concept of automated bricklaying popular with the

parametric facade of the Winery Ganterbein project of 2006.

In the European framework, the project Hephaestus addresses autonomous systems like cable-robots with modular end-effectors to install curtain walls in new buildings. In particular, as specified by the researchers, the project "focuses on high-risk and critical construction tasks such as prefab wall installation"18 with the aim of innovating the building sector, where the presence of robots and automation is minor. A further example is the P2-Endure project. Instead of working on new constructions, it promotes "evidence-based innovative solutions for deep renovation based on prefabricated Plug-and-Play systems in combination with on-site robotic 3D-printing and Building Information Modeling"[19], opening new scenarios in the field of redevelopment and retrofitting. P2- Endure is based on an interpretation of European data assets. 70% of the residential real estate stock is composed of buildings originating prior to 1970 and needs to be adjusted to new levels of energy efficiency, seismic safety, inclusivity, and living comfort. On a larger scale, about 35% of the EU's buildings are over 50 years old[20]. 90% of the existing building stock in Europe was built before 1990[21]. In both projects there is a commitment to accelerate the access to advanced technology in architecture, from new construction to deep renovation.

By considering the possibility of opening the robotics market to restoration and deep renovation, Skanska is taking pioneering steps in robotics. The company is leading a research consortium to study robotic applications for mechanical, electrical, hydraulic, and carpentry tasks to produce or fix building components. A relevant outcome of this research is the creation of a prototype, called Camera, designed to contribute to the overall productivity of building construction cost-effectively. It is a semi-autonomous lightweight mobile platform capable of moving around the construction site assisted by visual sensing. Skanska's approach considers the lack of flexibility and reconfigurability of existing automation systems. These systems are still committed to intensive prefabrication. The Camera platform, instead, operates with small units that may require high-precision non-invasive repair or assessment.

A final example worth mentioning is the DFab house[22], the first full-scale architectural system built entirely with digital fabrication, additive manufacturing, and on-site robotics. The project was developed in 2018 at ETH Zurich. For the completion of the work, the robots were programmed to perform multiple tasks and collect data in real-time on the construction advancements. The DFab house included the construction of a double-curved reinforced concrete wall. The reinforcement grid was built by a six-axis robot that operated on a mobile platform to assemble and weld the technological components. Before erecting the structure, the wall footprint was determined on the floor by markers that served as reference points. A camera positioned on the robot's head measured the tags and geo-referenced it in space via a calculation system with no need to use external measuring devices. Two additional cameras monitored the accurate construction of the steel mesh. The surface of the wall was finished by spraying concrete. Computer vision and advanced feedback loop systems allowed for the realization of a complex output guided by a technological-driven and digital-informed design workflow. Overall, the use of robotic sensing has triggered experimentation and encouraged the diffusion of digital services[23] that supported the adoption of automation fueled by algorithms and AI. This technological combination allows for the robotic applications in site monitoring and evaluation of constructions as-built, displaying the potentials of the Fourth Industrial Revolution.

Trends in the construction industry and critical analysis of relevant data

Since the global economic crisis of 2007, the construction industry was forced to reduce most of the workforce. The dynamics of the market have prevented these workers from returning to the building sector. In the Italian framework, the European Construction Sector Observatory in 2018 reported that the number of workers in construction decreased by 26.5% between 2010 and 2016. As a consequence, this pattern led to the current inability to meet the demand for the labor force in building construction, particularly in the first world economies.

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[10] The Technology Readiness Level is a scale to evaluate applied research. It was elaborated by Nasa in the 1990's. Later, the classification was adopted by the Europan Commission within the Horizon2020 framework program for research and innovation. For further information, see: https://ec.europa. eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf (online: May 20th, 2020).

[11] Rethink Robotics: https://www.rethinkrobotics.com/ (online: May 20th, 2020).

[12] Mule project: https://www.construction-robotics.com/mule/ (online: May 20th, 2020).

[13] A Universal Robot at the BMW assembly line: https://vimeo.com/78283765 (online: May 20th, 2020).

[14] Universal Robots – Collaborative Robotic Automation: https://www.universal-robots.com/ (online: May 20th, 2020). The company provides also open source courses for the dissemination of the robotic culture in manufacturing.

[15] How Human-Robot Teamwork Will Upend Manufacturing in MIT Technology Review. Available at: https://www.technologyreview.com/2014/09/16/171369/how-human-robot-teamwork-will-upend-manufacturing/ (online: May 20th, 2020).

[16] Hadrian X Robot by Fastbrick Robotics: https://www.fbr.com.au/view/hadrian-x (online: May 20th, 2020).

[17] Winery Ganterbain project with the non-standardized brick wall by Gramazio and Kohler Research at ETH - Zurich: https://gramaziokohler.arch.ethz.ch/web/e/projekte/52.html (online: May 20th, 2020).

[18] The European project Hephaestus, developed with Horizon2020. For further information, see: https://cordis.europa.eu/project/rcn/206251/factsheet/en (online: May 20th, 2020).

[19] P2Endure project. For further information, see: https://www.p2endure-project.eu/en (online: May 20th, 2020).

[20] For further information, see: https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analy sis_in_support_en_0.pdf (online: May 20th, 2020).

[21] A European long-term strategic vision for a prosperous, modern, competitive, and climate neutral economy, study for the ITRE Committee: http://www.europarl.europa.eu/RegData/etudes/STUD/2016/587326/IPOL_STU (2016)587326_EN.pdf (online: May 20th, 2020).

[22] DFab house at ETH Zurich: https://dfabhouse.ch/ (online: May 20th, 2020).

[23] Today, there is an increase in consultant companies that combine AI, computer vision systems, and hardware for the construction industry. Among them: Voxel, https://www.doxel.ai/, and Scale Robotics, https://www.scaledrobotics.com/ (online: May 20th, 2020).

The value of skilled workers in the job market is continuously increasing, in parallel with the growing cost of construction materials. In parallel, the cost of robots is gradually decreasing, facilitating investments in automation. As confirmed in the article "The Construction Labor Shortage: Will Developers Deploy Robotics?" published in Forbes, "when the recession hit, 600,000 workers left construction jobs never to return. Today workers avoid construction jobs, perceiving them as dangerous, difficult, and dirty"[24].

Taking the Unites States context as a reference where – pre Covid19 pandemic, the new paradigm shifter – the construction crisis seemed to be over, in 2019 the US Bureau of Labor Statistics in 2019 reported 434,000 jobs offers[25] in the AEC sector: Architecture, Engineering, and Construction. The disparity between supply and demand is due by the lack of skilled workers[26], which means those able to manage firsthand complexity and building site unpredictability. The skilled workers are the professionals to rely on within the intricate relationship between owners, designers, contractors, and users for each project.

In 2013, Emilio Pizzi presented a comprehensive analysis on a foreseeable new scenario in the future of construction, with the publication "Toward the simplification of the design process chain aimed at optimizing the productive processes to improve innovation and competitiveness". In the text, he talks about new design tools and the progressive diffusion of BIM technologies that, together with the interconnection with robotic production techniques, "may lead to new premises for a new control over the project, over the different components, their assembly, life cycles and recycling after their [disassembly]". This statement is supported by the idea that "The construction industry will be enhanced by introducing robotic equipment - within the manufacturing plants - and adopting on-site automated construction systems" (Pizzi, 2013).

Construction companies that are investing in automation are convinced by the possibility of: reducing production and labor cost, responding to labor shortages, reorganizing work and redundant sequences, increasing productivity, improving quality, reinforcing safety by reducing tasks that are too dangerous for employees, and enabling higher flexibility in production[27]. Moreover, robots have expanded physical capabilities. They manage tolerances to a hundredth of a millimeter, and can take long, uninterrupted shifts without drawing a difference between day and night. The co-existence human-robots has the requisites to be the best choice. The tasks can be divided in order to optimize the result. By comparing the cost and time required by a human and a robot to complete a chore, as complexity increases, automation pays off. As mentioned before, all these instances are taking place at a time in which the economic accessibility of robots is challenging the increasing value of the workforce[28] (Figure 3). In Italy, data updated to 2016 show that to 10,000 workers in the manufacturing sector correspond 185 robots; 25 more than in 2015 and above the world average, which is 74. The pole position is occupied by South Korea (631), Singapore (488), and Germany (309). They are followed by Japan (303), Denmark (211), and United States (189)[29]. In parallel, the advancement of research in AI/ML, allows for programming devices to facilitate a safe collaboration between human and machines in a physical work- cell validated through digital simulations and predictivity of working conditions.

The translation of robotics from manufacturing to construction is not a disruptive new concept. The race for automation

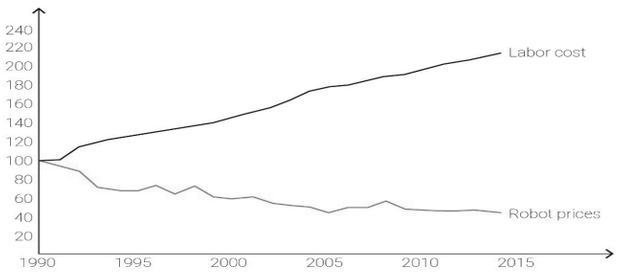

Figure 3. Cost of automation. Index of average robot prices and labor compensation in manufacturing in United States, 1990 = 100%. Source: graphic elaboration by the author, based on the analysis carried out by Economist Intelligence Unit, IMB, Institut fur Arbeitsmarkt und Berufsforschung, IRF, US Social Security data, and McKinsey&Company.

on the construction site happened between the 1960's and the 1980's in countries that invested the most in technological advancement. In the 1970s's there were opposing trends in the economies of Japan and the United States that are worthy of mention. In 1973, the oil embargo in the USA triggered recession. The awareness of limits on economic growth arose. Therefore, attempts to fully industrialize the building process declined or were abandoned in both Europe and the US. Simultaneously, in Japan the growing population led to an incremental demand of social housing. The lack of skilled labor in the building industry was a driving factor to lead the promotion of automation in prefabrication and construction. It was an alternative to traditional construction practices. As Thomas Bock and Thomas Linner explain in the publication Changing Building Sites: Industrialization and Automation of the Building Process, in the Japanese context a massive research was directed toward automated housing prefabrication, on-site single task construction robots, and integrated automated construction sites. The integrated automated construction sites were organized "as partly automated, vertically moving on-site factories providing a shelter for on-site assembly, which was controlled, structured and systemized, and unaffected by the weather, as well as for a disassembly process of prefabricated, modular low, medium and high-level detailed building components" (Bock and Linner, 2014). In the 1960's, Japan shifted from the building site to a structured and automated factory-based work environment. Where 85% of the work was executed off-site for the most part by human labor. The processes still relied on the assembly line, rather than real automation. In contrast with European approaches, where prefabrication was primarily optimized to achieve fast and cheap production of large numbers of identical elements, Japanese prefabrication was more oriented to customization and personalization. The assembly-line work, combined with the advantages of human labor in a factory, "al-

lowed for the individual adaptation of single parts meeting customer demand without disturbing the production chain. They could be taken out of the assembly line and replaced manually, to be reworked or finished, before being introduced back into the next stage of the production process, causing minimal disruption to the overall productivity" (Bock and Linner, 2014). This approach can be considered a precursor of today's promotion of robotics in architecture. The enhancing of research in this field during the following decade was based on the "robot boom" in the manufacturing industry. As a consequence, the adoption of robots was a logical approach for Japanese construction firms. Single task construction robots were subsequently developed. They could execute a single, specific task repetitively. They could be used on construction sites for demolition, surveying, excavation, paving, tunneling, concrete transportation and distribution, concrete slab casting and finishing, welding and positioning of structural steel members, fire-resistance and paint spraying, inspection, and maintenance. Sites would be structured and designed like factories. The final objective was the implementation of automated manufacturing and construction technologies, which is not a Fourth Industrial Revolution approach. That said, why aren't construction sites populated by robots? What's the missing link in the innovation chain? As per tradition, every building is a prototype and every architectural realization is the result of a "temporary coalition of people and organizations" (Groak, 1994, 128), probably working together for the first time. For this reason, despite a long history of collective building tradition, individual professionals have little opportunity for learning between one project and another. Technology has evolved substantially since the 1970's-1980's. The design industry has not. Some of the world's largest firms still do everything on paper from managing blueprints to keeping track of employee hours and pay. The past efforts of automating construction failed for several factors. For instance, robotic applications required high initial installation costs. For this reasons, the integrated automated building sites were used when contingent conditions required them, such as high labor cost, traffic, noise, and waste restrictions. Moreover, these efforts failed because computing power was still weak[30] (Figure 4). Finally, there was a lack of regulations (building codes specify "what", not "how"). The historical precursors show that the implementation of robotics in architecture at a large scale requires a substantial change in the early design stages as well as in the construction process that goes far beyond imitating existing building technologies. Instead of trying to copy and perform factory automation methods, new robotic tools require: appropriate conditions, design strategies, kinematics, programming, and control. Every innovation in construction technology needs at least one generation to establish itself. Advances in automated construction continue to be developed today. The use of flexible industrial robots in the prefabrication of building elements, as well as in architectural research institutions, is becoming widespread. Now the technological and economic accessibility foundations are being laid.

Consequences in the culture of making and conclusions

Robotic spread scares workers. However, the emergence of the economy of scale is a precedent that shows the tendency of the market to restore a balance, after a stressful transition. Yuval Noah Harari expresses this concept is the book 21 Lessons for the 21st Century in a chapter called sarcastically "When You Grow Up, You Might Not Have a Job". He states: "fears that automation will create massive unemployment go back to the nineteenth century, and so far, they have never materialized. Since the beginning of the Industrial Revolution, for every job lost to a machine at least one job was created, and the average standard of living has increased dramatically" (Harari, 2018, 19). Data collected from the US Bureau of Statistics show that in 165 years technology has created large sector shifts but also new jobs[31]. For instance, "agriculture's share of US employment was close to 60% in 1850, but today it represents just 3%

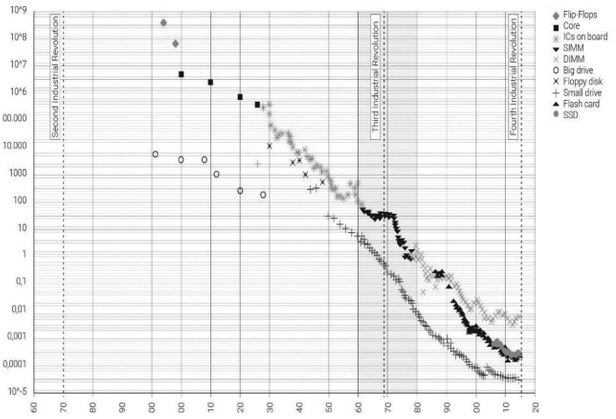

Figure 4. Historical cost of computer memory and storage. Between the 1960's and the 1980's, 1 MB used to cost around 50 dollars. A gigabyte was worth 50,000 dollars. Source: graphic elaboration by the author, based on Hblok data.

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[24]"The Construction Labor Shortage: Will Developers Deploy Robotics?" in Forbes. Available at: https://www.forbes.com/sites/columbiabusinessschool/2019/07/31/the-construction-labor-shortage-will-developers-deploy-robotics/ (online: May 20th, 2020).

[25] US Bureau of Labor Statistics available at: https://www.bls.gov/news.release/jolts.t01.htm (online: May 20th, 2020).

[26]"The Construction Industry Needs a Robot Revolution" in Wired. Available at: https://www.wired. com/ story/the-construction-industry-needs-a-robot-revolution/ (online: May 20th, 2020).

[27] The main drivers triggering investments in automation have been studied by McKinsey&Company. The report "Industrial Robotics. Insights into the sector's future growth dynamics" is available at: https://www.mckinsey.com/~/media/McKinsey/Industries/Advanced%20Electronics/Our%20Insights/Growth%20 dynamics%20in%20industrial%20robotics/Industrial-robotics-Insights-into-the-sectors-future-growth- dynamics.ashx (online: May 20th, 2020).

[28]"Automation, Robotics, and the Factory of the Future" in McKinsey&Company. Available at: https://www.mckinsey.com/business-functions/ operations/our-insights/automation-robotics-and-the-factory-of-the-future (online: May 20th, 2020).

[29]Source IFR - International Federation of Robotics. For further information on the diffusion of robotics in the market, see: https://www.therobotreport.com/10-automated-countries-in-the-world/ (online: May 20th, 2020).

[30] Historical Cost of Computers Memory and Storage, available at: https://hblok.net/blog/posts/2017/12/17/historical-cost-of-computer-memory-and-storage-4/ (online: May 20th, 2020).

of jobs"[32]. In parallel, new sectors emerged in entertainment, trade, professional services, and education. To mention a European example: in Italy, between 1910 and today, people employed in agriculture fell from 60% of the working population to 3,8%[33].

Agriculture has some similarities with the construction sector. In both working contexts, the "Four Ds" are applicable. With the advancement of technology, wherever labor conditions are repetitive, humble, or exhausting, there is a tendency for automation. The 2016 publication Farm Workers Futurism – Speculative Technologies of Resistance by Curtis Marez shows several examples of mechanized production systems for harvesting that were developed experimentally between the 1930's and 1960's. Among them, an experimental cotton picker (1942)[34], an automatic pump to milk cows (1933)[35], and a prototype of humanoid robot that could be controlled remotely (1938)[36]. The reason for these efforts to automate agriculture lay in the urgency of improving efficiency by taking the best advantage from machines[37] (Marez, 2016, 20). Anyway, the technological advancement of agriculture has reduced job opportunities that no one wants to take anymore.

In the future of construction, innovation is encouraged by market demand and work perspective. In the US, from 2007 to 2010, the building industry saw a massive decline due to the recession. In the decade 2010-2020, it rebounded with an expectation of a positive employment trend projected to 2026 (Figure 5). The study highlights that in July 2018 there were 7.2 million construction jobs, the "highest employment level for the construction industry in a decade. Leading into and through the Great Recession, the industry experienced declines in employment. In recent years, however, employment has trended upward" [38]. The previous paragraph shows trends that would have continued had it not been for the Covid19 global pandemic. As soon as the lockdown imposed in various countries of the world is over, the global community will confront an unknown and unexpected market reaction to Covid19 containment measures. The post-pandemic scenario is unknown: it does not follow a normal pattern. As Joshua Gans would argue, "this time is different" and soon we might face a "dark recession"[39]. Given the current building culture, construction workers can't do smart working because their activity takes place outdoor with the support of specialized machinery. However, the pandemic, the new normativity of social distancing, and the need to ensure safe work spaces could encourage Research & Development sectors to "rallying innovation" taking into account that "the innovation challenge is so potentially large that it is very important that we pursue as many different paths as possible"[40]. In this scenario, there is an opportunity for first world countries to undergo a transition to a knowledge economy, where the figure of the master-builder becomes the professional who has intellectual control of processes by instructing construction tools on how to operate. To add a note of disbelief in this discussion, the pandemic has highlighted that, in architecture, the flexibility afforded by knowledge work does precede the actual active construction. All stages prior to construction are manageable remotely and digitally, such as: design, estimates, and logistics. Conversely, the building phase still relies on the physical strength of workers moving things around the construction site, where knowledge and creativity are not deployed. As a result, the transition to a knowledge economy approach in construction is not likely to happen quickly. The current trends in construction are operationalizing robots as a real option to innovate the obsolete organizational structures that connect human labor, architectural production, and advanced making (Figure 6). There real-time interactions could take place in a digital continuum that ties closer together the decision- making phases and the management of human and economic resources for the translation from digital to material data. Technological development will allow for the use of integrated and interconnected tools directly on site, shortening the supply chain of building materials and improving the sustainability of construction processes. It is expected that architecture, which usually absorbs innovation from other sectors through technological transfer, will become early adopter of new systems and technologies. Digital Transformation will result in the automation of every task that can be automated, accepting that robots want to "leave the cage", to be embedded in material workflows within hybrid human-machine workspaces. As summarized in the 2017 document Re-Imagining Work 4.0 issued by the German Federal Ministry of Labor and Social Affairs, "a new generation of robots is emerging with progressive advances in AI. While in recent decades robots were primarily used to automate simple production steps, the latest industrial robots are now also capable, thanks to AI-based high-performance sensors, of taking on fine-motor tasks and interacting directly with their human

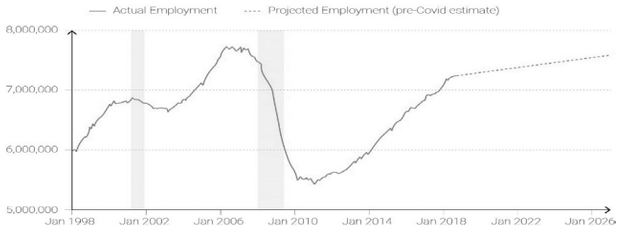

Figure 5. Construction industry employment, January 1988 – July 2018 and projection to 2026. Source: graphic elaboration by the author, based on US Bureau of Labor Statistics data.

Figure 6. Citizen Robotics, the nonprofit FabLab in Detroit that provides access to robots and training to upskill the construction workforce of the future for the built environment. Source: citizenrobotics.org.

co-workers. […] The previous spatial separation of people and robots is becoming irrelevant; the machines are leaving the "cage"4 and they are adventuring in our world. In addition, the integration of AI and machine learning might question the role of human experience, making traditional work obsolete and redundant. The technological advancement of physical-systems determined the First and Second Industrial Revolution. After that, the Third Industrial Revolution developed cyber-systems. Finally, the Fourth Industrial Revolution integrated the virtual and material worlds by introducing the cyber-physical- systems. In this circumstance, it is essential to understand and manage an increasing amount of data in multiple information spaces (Floridi, 2014). In the near future, professionals in the architecture production chain will operate in a cyber-physical infrastructure defined by AI, machine learning, and robotic automation. These professionals, referred to as master-builders, are teams of data-informed architects that will be able to manage the impact of technology within upstream design phases and the languages that rule them.

[31] "Jobs Lost, Jobs Gained: What the Future of Work Will Mean for Jobs, Skills, and Wages": IPUMS USA 2017, US Bureau of Labor Statistics, andMcKinsey&Company analysis. Available at: https://www.mckinsey.com/featured-insights/future-of-work/jobs-lost-jobs-gained-what-the-future-of-work-will- mean-for-jobs-skills-and-wages.For further information, see: https://www2.census.gov/library/publications/decennial/1900/occupations/occupations-part-3.pdf (online: May 20th, 2020).

[32] "Visualizing 150 years of US Employment History", in Visual Capitalist. Available at: https://www.visualcapitalist.com/visualizing-150-years-of-u-s-employment-history/ (online: May 20th, 2020).

[33] For further information, see: https://www.istat.it/it/agricoltura (online: May 20th, 2020).

[34] Mechanical cotton picker, available at: https://www.wisconsinhistory.org/Records/Image/IM23599 (online: May 20th, 2020).

[35] Vacuum Pump and Milker on Display at "A Century of Progress", available at: https://www.wisconsinhistory.org/Records/Image/IM49700 (online: May 20th, 2020).

[36] "Harvey the Harvester", available at: https://www.wisconsinhistory.org/Records/Article/CS3488 (online: May 20th, 2020).

[37] In the cited paragraph of the book Farm Workers Futurism – Speculative Technologies of Resistance, the author refers to a 1951 Harvester World article called "Way Out West in the Land of Cotton" that talks about the development of mechanical cotton pickers in the industry.

[38] "Careers in Construction: Building Opportunity" in US Bureau of Statistics. Available at: https://www.bls.gov/careeroutlook/2018/article/careers-in-construction.htm (online: May 20th, 2020).

[39] Economic in the Age of Covid19 by Joshua Gans, chapter 4. The open source text is available at: https://economics-in-the-age-of-covid-19.pubpub.org/pub/mh2yb73z/release/1 (online: May 20th, 2020).

[40] Economic in the Age of Covid19 by Joshua Gans, chapter 7. Available at: https://economics-in-the-age-of- covid-19.pubpub.org/pub/pyu3z6d4/release/1 (online: May 20th, 2020).

[41] The open source document is available online at: https://www.bmas.de/SharedDocs/Downloads/EN/PDF- Publikationen/a883-white-paper.pdf?blob=publicationFile&v=3 (online: May 20th, 2020).

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Global Architectural Fascism (GAF): The Extreme Case of MVRDV Projects in Tirana

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When I was asked to write an opinion on the Downtown One building in Tirana designed by MVRDV I hesitated to give it. I hesitated because I remembered a piece of advice from my mom when I was young that always told me "if you can not talk about something well, it is better not to talk". I do not know how much I have followed this advice in my life but but, at least, I try to remember it often. My mom's advice was valuable at the time and I believe it is probably still valid today.

Immediately after that, I started thinking about the reasons that lead a person to come out and give such advice. I found the answer to the fact that my mother was born immediately after the Second World War where in Albania the fascist and Nazi regimes had passed and then with a life spent in the communist dictatorship she could not build and could not have a critical spirit towards what surrounded her. This is because the critical spirit was suppressed and always denounced as agitation and propaganda. Immediately after this reasoning I set out to analyze the aspects of Fascism and Nazism that in a certain way formed the main ideologies of the first half of the 20th century and which, together with communism, must have influenced my mother's mentality and a major part of the society that was born in the second half of the last century. For all three of these ideologies, including communism manifested in Albania, the main aspect was that of nationalism translated into all possible forms. As Sotir Dhamo says, the slogan of that period in Albania about architecture was "National in form and Socialist in content" What is currently happening with the way MVRDV reads the Albanian context is precisely a sick nationalism that goes as far as architectural parody. Here I want to mention three main projects of this studio.

The first one is the decoration of a building in Tirana with the red and black flag of Albania. It consider Albanians like the indigenous tribes studied by Warburg in the "Serpent Ritual " who managed to understand only their archaic totems and had no kind of abstract culture. While in the beautiful Holland where Mr. Maas was born, I believe and I do not have any information that any international architect has proposed a building painted with the flag of the Netherlands. I also believe that even at Delft University of Technology, where Mr. Maas studied, they do not educate students to take archaic totems and carve them into architectural forms. Others do like this: Vasily Klyukin does in Russia but not Mr. Maas in the heart of Europe. Anyway, maybe Mr. Maas does not do it in Europe, or maybe someone, clever, do not allow him to do it in Europe, but he proposes it in the heart of Albania: in Tirana.

The second case of a misinterpretation is the Tirana Rocks case where organically developed "copa Tirane" are banally interpreted as a formless urban informality. A project that have nothing to do with the organic parts of Tirana and that through rhetorical metaphors sought to conquer that small part of the curated public greenery that is still one of the most beautiful

that Tirana has. While the first two proposals for Tirana had the good fortune to not be builded, the third case, Downtown One, is unfortunatly on its way to completion. I write "unfortunatly" because, contrary to my personal belief that a building should exist only for the fact that it comes to life (just like humans whose existence should not be questioned after birth), this building did not deserve to be built for the simple fact because it seems like a kind of nationalist mockery where the state map is taken and overlapped to the building. This action has all the colors of ridicule and parody, like we were an indigenous people who are not cultured with an abstract knowledge, as stated above, and who understands only material forms. From the formal point of view expressed by the rendered images but now also from what has been realized, the MVRDV building is reminiscent of the mysterious stone slab of Kubrick's 2001 Odyssey film. Without the map of Albania it would have looked like something mysterious that contains inside a magical secret, the bearer of an impenetrable mystery. The repetition of a rectangular module, typical of the serial architecture of Modern Movements, made this building have a kind of dignity of its own which is then desecrated by the presence of the pixelated map of Albania. Perhaps Mr. Maas' action is an attempt to give a sense of orientation to the inhabitants of this building: "I live in Kukes". At least that is the goal stated by the design studio. The problem of orientation was the main one from the architectures of modern movements but that can not be solved simply with a banal and naif action since people in the tower of Mr. Maas will not enter from the balconies of Tirana or Fier but from the corridors, stairs and elevators from the interior of the building. Also from the point of view of the urban scale, at least in the façade that appears on the side of the Lana River - the one where the map is pixelated - expresses a kind of Global Architectural Fascism (GAF) where the great dimension "Bigness" hegemons over everything that is contextual.

This hegemony of GAF is covered and sold as context-respecting architecture by proposing an architectural parody like the pixelated map that is similar to the other architectural mockery that crowns the towers with Skanderbeg's helmet. This project is from another design studio but it seems like something mysterious put them together in a certain way. Something that makes these works a "duck architecture": a banal and misunderstood postmodernism; an architecture made for people considerated stupid who understands only the forms manifested in images and not abstract concepts. A Fascist mockery.

"Out our home" tel quel: An Opinion on the Albanian Pavillion in the Venice Biennale 2021

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In this year's Venice Biennale, the Albanian pavilion named "In our home" proposed a notion of *neighbourliness* that presumably existed "less than 20 years ago," yet one that has now disappeared as a result of "diving deep in the waters of globalization" and moving "toward an isolated indifference and uncertainty."[1]By 'peeking sneakily' at such reality through clips of "In our home" *("Në shtëpinë tonë")* – a rather consummated cinematographic totem of our communist quotidian anthropology, the pavilion invites us "to cross [the walls of our globalist apartment] and rediscover the gift of this bond[2]." Such crossing is 'scripted' through a pinwheel axonometric composition, in which four neighboring apartments "share a "['secret'] space that can only come to life if the neighbors are willing to make the discovery."[3] Some inconsistencies notwithstanding, like the association of a communist era film with the wrong periodization of "20 years ago" (which should be like more than 30 years…), or the fact that the number of the 'neighboring apartments' in the brief is miscounted as three (when it should be four as an immanent result of the very pinwheel composition of the square), the pavilion explicitly proposes a return and recovery of a 'lost' time and its related 'neighborliness'.

The topicality of the Albanian pavilion has already been criticized for romanticizing and producing a sort of false memory of the communist era, a time in which the subject was robbed of everything, more importantly, of that very interiority necessary to individuate as a subject in the first place. This *telquel* opinion, however, is concerned not so much with the topicality of 'neighborliness' as such, than with the architectural language chosen to communicate and carry .out such topicality. This language is the very same one as that of Dogma's "The Room of One's Own," exhibited at the Chicago Biennale of 2017. This exhibition consists of "48 *[ligne Claire]* perspectives that depict the 'private' room from antiquity to the present day." The conceptual aim of the exhibit is to "study the private room as a specific architectural form."[4]

Yet what might the relationship between such concept and that of the Albanian pavilion be, beyond the obvious similarity of their titles? And how does the architectural language figure in such conceptual content? The concept of Dogma's exhibit is to draw the specific architectural interiority of the room, but not any kind of room… They are the rooms of Giorgio Morandi, Virginia Woolf and Marcel Proust, among others, characters whose real room is their very work, characters whose *oeuvre* is a kind of interior in the Bachelardian sense, in the same way that a mollusk secretes its interior, its shell… Dogma's drawings attempt to hit a resonance with the process of such *secreted interiority* through the rigor of the very act of drawing, which is metonymically similar to the precision and meticu-

lousness of the shell. In an existentialist sense, the work of the inhabitants of these rooms tends to undermine the very notion and boundaries of home, or the room as the most 'homey' of all other spaces. The final result of their work is not to find home but homelessness, the only state, according to Heidegger, in and through which one can find one's true home… The concept of the Albanian pavilion, on the other hand, is rather the opposite: it is to re-find the 'lost home'… It re-establishes 'home' through the the narrative of a neighborliness that never existed as depicted "In our home." What appears as neighborliness, was, indeed, nothing else than the negative result of a dreary everyday life.

If there is not any conceptual affinity between "The Room of One's Own" and "In our home," then what is the significance of the very act of choosing Dogma's architectural language? Choosing someone else's language in a biennale is kind of 'weird', since the very purpose of participating in a Biennale is to exhibit a new language, technique, or script, a new way of doing architecture. If choosing someone else's language (in this case Dogma's) signifies anything (in this particular case) is that we, Albanians, are not capable of inventing and practicing an architectural language by our own, and we have to import one. The very idea of going back to one's home…, to the 'secret room…', to the too familiar… signals a preemption of any desire to invent or speak a new language. Why would anyone bother to invent a new language if one were to only speak in one's home… *Homelessness is the real price of finding a new language*…, and conversely: *finding a new language is the only way to find one's true home*…

Of course, in this particular context, Dogma's partners being Italian is way more significant and operative than their being Marxists… Italy is Albania's modernist consciousness…; Italy has given us our boulevard, our *Champs Elysée,* even before we had Tirana…As Adrian Guma, the Albanian intellectual in Ismail Kadare's novel *The November of a Capital*, elegantly but *untruthfully* put it with regards to the urban interventions in Tirana during the 'Time of Italy': "I have seen cities without boulevards, but I have not seen boulevards without cities."[5] What is known as the 'Time of Italy'[6] is more than just an historical periodization: it is a concept *of branding* that mysteriously renders all the things produced in this period as 'Italian', as if 'Made in Italy', even if many were 'Made in Albania' by Albanian architects. Show a 30's modernist villa in Tirana, Korça or Gjirokastra to anyone in the street, an architectural student, or even an architect, and insofar as s/he will identify it as belonging to that historical period at all, such identification will almost always default as 'Italian', being accompanied with admiration for a sophistication and elegance that could only have come from 'beyond the sea', as it were… (The sea in question is the Adriatic…)

Recent scholarship shows, however, that there was already a *modern vernacular* in Albania, well before the 'Time of Italy'. Such vernacular formed the basis of the 20-s and 30-s modernism which was, no doubt, substantially shaped by the Italian architects, but also by Albanian architects who had studied in different European countries and the United States, as well as by Austrian, French, Greek and even American architects, such as in the case of the Albanian American 'Charles Telford Erickson' Agricultural School of Kavaja, designed by Howard Raymond Meyer of 'Thompson and Churchill' Architectural firm in New York, in 1925.[7] Both spatially and temporally, geographically and historically, modernism was never national but always already *inter-national,* well before the advent of International Style…; it was always already post-modern, well before the advent of postmodernism… Indeed, modernism is precisely that which transgresses and displaces the national, the home, the familiar, the autochthonous… This is modernism's true emancipating function. *To be modern means and has always meant to not be in one's own home…* This is not to say, however, that home is rejected or disavowed as an identity or specificity, but rather that it is reconfigured and re-invented anew in and through the very act of being displaced, de-&-re-territorialized, and dispositioned. *It is only from outside home that one can re-invent one's own home and language…* Perhaps the Albanian Pavilion in the next Venice Biennale should be called: *"Out our home…"*

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[1]https://www.labiennale.org/en/architecture/2021/albania, accessed accessed June 21st, 202

[2] Ibid

[3]Ibid

[4]https://drawingmatter.org/dogma-the-room-of-ones-own/accessed June 21st, 2021

[5]As cited in Ismail Kadare, Nëntori i një Kryeqyteti (The November of a Capital), (Tirana: "Naim Frashëri" Publishing House, printed by "8 Nentori" Press, 1975), 62, (translated by author).

[6]See for instance: Skënder Luzati, Qyteti i Shkodrës: Urbanistika dhe Arkitektura gjatë Rilindjes e Pavarësisë Kombëtare (The City of Shkodra: Urbanism and Architecture during the National Renaissance and Independence), (Tiranë: Botimet Kumi, 2012), and Pirro Thomo, Korça: Urbanistika dhe Arkitektura, (Tirana: Morava, 2012). In this book, Thomo recounts how the local specialists – the architects and builders of Korça changed the design of Florestano di Fausto, which was distinctly monumental and expressive of the official language of fascist Italy. The local architects changed the façades completely, as well as its proportions and decorations (p. 339).

[7] See Shpend Bengu's documentary film "Damnatio Memoriae: Albanian-American Institute of Kavaja, Near East Foundation, 1925-2020," shown in Tirana Express on September 20th 2020.

Understanding Emergent Urbanism
The Case of Tirana, Albania

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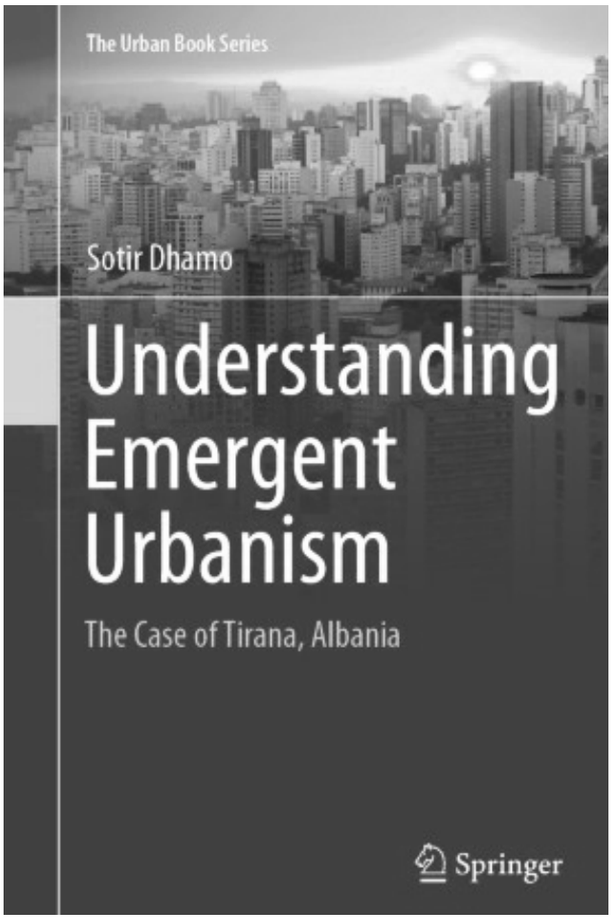

Author: Sotir Dhamo
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The canonical architectural studies have handed us the idea that city is the result of a series of top-down procedures - and related documentary materials - which depict a rigid and hardly contestable direction of development of our urban tissues. Looking at the different regulatory plans throughout which contemporary cities have been developed, it is quite difficult to perceive the human component of such spaces, leaving us to wander in a series of linear relations where the final form is predetermined by external judging eyes. But if we look at the city as a living being, characterized from the different complex entities that inhabit it and interact among each others, is it possible to bring the real city - or as the author underlines, the city of everyday life - close to conventional planning? Can we read its tissues not only from a quantitative/standard-oriented point of view but through an holistic approach? And, even more important, can we model this 'emergent' complexity and apply as a methodology to design better and more human-based cities? These are just some of the main questions addressed in the book Understanding Emergent Urbanism. The Case of Tirana, Albania authored by Sotir Dhamo, architect, urbanist and professor of Urban Design at POLIS University, Tirana.

The text is the result of a series of intense years of active research of the author in this field: firstly, through his involvement in the Albanian NGO Co-PLAN (Institute for Habitat Development), that after the fall of the Communist regime imported grassroots and bottom-up processes in Albania; and then through his pedagogy experience at POLIS University. His PhD thesis, of which this book is the natural prosecution, represented a first attempt to systematize and transmit a specific knowledge that was accumulated only thanks to almost 20 years of applied research and continuous clashes with that specific reality that the text urge the readers understand: the city of Tirana. The very city is not presented in a canonical way throughout the work: dimensions, toponymy, quantitative values, etc. are unimportant elements that leave space for an urban environment that discloses in front of our eyes as a com-

plex palimpsest amidst different layers, each of those can be interpreted using some specific categories proposed by Dhamo. According to the author, if we aim to correct the distortions and the rigidity of common top-procedures we need to find the courage to move on from this consolidated approach and lose ourself in the historical and anthropological nature of urban phenomena, through an original point of view: understanding reality through quantum physics ideas that can lead us to computational procedures. With such interesting premises, and in order to sustain this peculiar perspective, the book it is divided eight parts (plus 2 appendix) which in turn are composed of numerous subchapters. The overall feeling, while reading the book, is to be submerged in a dreamlike Fellini movie where first the reality it is first presented as it is and then fades in a continuous leap of scale and labyrinthine path just like the streets of the city of Tirana.

The opening section, "Introduction", has the fundamental role of opening Dhamo's digression and to explain precisely why the Albanian capital has been chosen a case study besides of biographical reasons. It represents the author's 'manifesto of intent', where the city is analyzed through the methods and approaches based on the conceptual tools of quantum, fractal, self-organization, and the theory of complexity. Some of the specific characters of Tirana are highlighted and discussed and, most important, the methodology used is presented and anticipated to that reader that will understand the importance of such a mixed quantitative/qualitative-based approach.

The second part, "The Natural City", presents the concept that gives the name to the whole chapter. Opposed to the "artificial" one, the natural city is described as a complex emergent phenomena which, created by the collective intelligence of its citizens, self-organizes from the bottom in a continuous exchange between formal/informal moments that guarantee its continuity and survival. The related ideas of 'organic', 'informal', 'sprawl', 'spontaneous', etc. are explained by means of their self-organized structure and their inner similarities with complex biological entities. In response to the bureaucratic planning that gripped Albania for more than half of a century, the chapter has the objective of raising a more in-formed and enhancing knowledge (both theoretical and practical) in the young generations of architects and planners that could start to critically reflect around the possibility of having new tools-at-hand to face problems such as social housing, urban sprawl, and informality issues. "Additional Theoretical Lens to Understand the City" is the third chapter and opens up the discussion regarding some fundamental theoretical concepts to understand the phenomena of the 'natural city' and its divergence from the previously perpretated 'top-down' model. To understand the emerging reality of a city we should first of all understand the interrelationships among such ideas and stand exactly in their intersection. The fractal city logic is the attempt to overcome the mechanistic and positivist paradigm and understand the recursivity of the internal dynamics of growth and development of specific cities through an holistic lens.

The fourth section, "Historical Notes on Tirana" it is an historical overviews of the many faces that Tirana have had during the last century: the capital of a Monarchy; of a Communist parade-oriented regime; to end up as the main city of a country in a never-ending transition towards a democratic system. Nevertheless, besides the historiographical interest of this part, its real purpose is to serve as trigger to introduce the following one "Tirana Patterns at a Glance". In the latter, three main generative patterns have been identified, extracted, and analyzed both from the point of view of time, of their characteristics and position in the urban tissue of Tirana. Historical Organic is presented as an urban maze of internal parts with a labyrinth and introvert structure. Such areas still maintains a peculiar capacity through influence the passage of time, preventing their replacement by the contemporary city. Recording over is the attempt of giving new meaning to the geometric frames of the residential blocks built during the Communist regime that became the symbol of the revenge against the public space in order to forget the painful past of the country. The last one, New Organic, is still active, it is the attempt of the emergent city to erase the city form through a self-organized spontaneous process that gave birth to a kaleidoscopic and non-defined forma urbis. Each of them is presented through maps, diagrams, and on-site documentation to let the readers directly understand what (and where) they refer too in the contemporary city. The penultimate chapter, "Holistic Approach to Tirana Pattern Analysis", stands as a deeper understanding of the above-mentioned patterns, and focus this time not on their physical characteristics, but on the web of interrelationships they weave as hierarchical structures of a more complex system behavior filtered through the lens of a quantum approach. The holistic analysis is composed by the application of the already explained concepts in the existing reality to underline the direct translation of human behavior in the built environment. Such holistic approach is then transferred into a proper methodology in the last section "Methodology for Holistic Understanding of the Urban Patterns". Three main steps composes it: the conception of reality as a larger whole (holistic reality); the need to unpack the overall qualities that are generated by the interrelationships of past and present event on a collapsed horizon of time; the transformation of the previous ones (holistic and relational) into an information system to be modeled for design purposes.

The "Conclusions" tries to re-tie the threads of the author's narrative and highlight the need of such complex analysis when it comes to emergent realities such in the case of Tirana and the need for pedagogy processes to prepare a new generation of architects and planners to a deeper understanding of the reality they live in.

At this point, even if the book might have come to an end, there are still two appendices that Dhamo shares with the readers. The first one (A), through charts and sheets, explains how the measurement process he has conducting for years, have made possible the understanding and the delineation of the patterns presented in the book. Those calculations are the sum of some solitary investigation campaigns and others with students and colleagues. The material presented is stands at the inter-

section between math and phenomenological interpretation of reality and confirms the holistic approach that permeated all the work.

The second one (B) is an interesting work conducted with a group of selected students and colleagues where the analysis and observation are transferred into a computational design model. After identifying some of the main emergent characteristics of a specific portion of a Tirana's neighborhood, the model is built through several iterations that guarantee its further development and evolution. In the end, a design project is presented has one of the possible crystallization of the multiple interrelationships amidst the different components of the diagrammatic model.

As a young researcher at POLIS University, I had the chance of being involved on several levels in the genesis of this text: starting from some brainstorming moments with the author to reflect on some his theoretical assumption, arriving to be part of the implementation team that produced the results showcased in the Appendix B. Apart from the interesting and valuable concepts and speculations contained in this book, one of its biggest value stands for me in the attempt of the author to reconnect theory and praxis and to show how a research can live of different moments, outputs and to engage different level of an academic and professional lives. Some of the students that were exposed to the contents throughout of the workshops today, while I am writing this review, have become our colleagues and most probably will apply for a PhD program. They understood clearly the value of ideas as a tool to disclose new perspectives on existing reality and to questions things that we are used to take for granted in our everyday activity. Some of them maybe will take the ideas and, together with the author, will do another step forward towards new discoveries and implementation of the methodology because, as he stated in a passage of the introduction that is likely to go unnoticed, "although the theory in this book is illustrating using the specific reality of Tirana, the logic is valid for cities in general". The text is a clear ideas of how the circularities of ideas can have a direct resonance of the multiple and interrelated levels: architectural, theoretical and, most of all, human.

L'attività Ludica Come Strategia Progettuale
Regole e Libertà per una Grammatica del Gioco in Architettura

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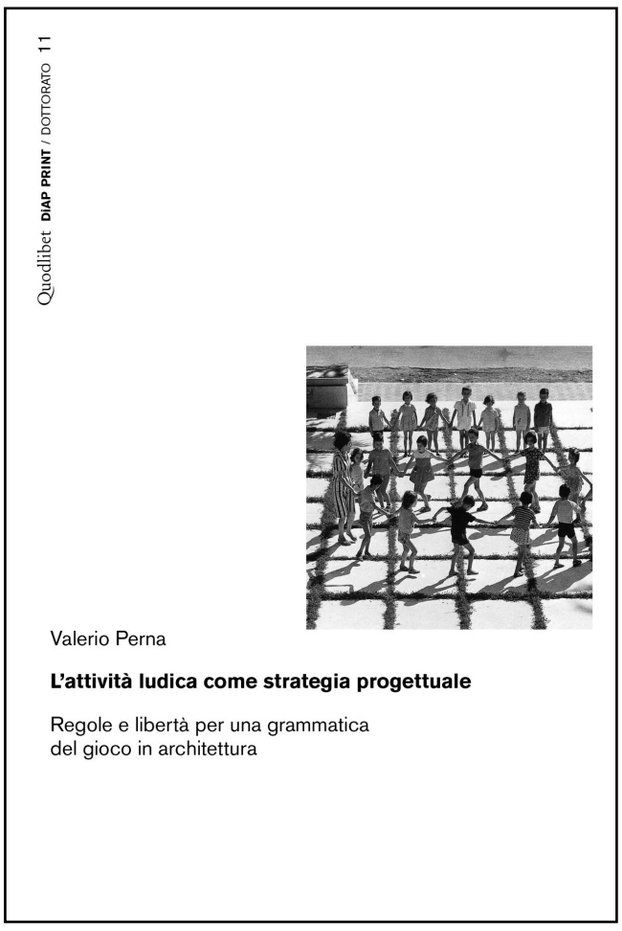

Author: Valerio Perna
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Creating is a mysterious activity, happening somewhere between the mind and the body. It is mysterious indeed but it is not an arbitrary act. At least this is the position of who needs to teach how to create.

The same challenge is faced when designing. One of the most difficult design tasks for an architect would be to generate a project without constraints. We are taught that one of the first decisions an architect should take is to position oneself relative to the boundary conditions. One can take inspiration from the context or choose to oppose it. Any position a creator takes, the *horror vacui* is a real challenge for the designer. The phobia of the blank space is confronted by some architects through the avoidance of the outer context. Instead, an inner disquisition on abstract formal speculations can be used to generate the design concept. In other cases, the spirit of the time is taken as the driving force for creating the new architecture. So did the modernist movement that turned the idea of the machine, born out of the industrial revolution, into a design paradigm. The architecture of the XX century and its city were born from the idea that they were machines for living.

Valerio Perna, in his "L'attivatà ludica come strategia progettuale" *Playful activities as design strategy,* makes the designers follow a different path. He explores the possibilities of creating architectural space starting from strategies borrowed from the games. The mechanically organized architecture of the first half of the XX century could not follow the pace of an evolving society. The forms that followed the functions were not able to host the explosion of activities needed to sustain the contemporary life so the need for new conceptual paradigms emerged. Perna describes how the idea of the game can help us understand some of the most important design strategies of the second half of the XX century and how architects can use strategies borrowed from other fields of knowledge for creating and negotiating new rules of designing.

It is on the idea of rules that the architectonic game can be played. As in a game, a set of rules define the constraints, and

it is in the ability of the designer to navigate these rules, create new strategies, have an open-ended mentality, and take into account the ever-changing environment. As in a chess game where there are no predefined sets of moves that lead you to victory, there are no recipes for designing the perfect architecture. But there can be strategies. The difference between a readymade recipe and a strategy is that the latter allows the other, the unpredictable, the life to be part of the game and by doing so allows the emergence of a new kind of architecture.

Perna organizes his book into three parts. The first analyses and describes the game and its rules. A review of the scientific research applied to the games is conducted. Through it, we can understand that historically there can be identified a number of branches in the study of games. Some study children's games in order to understand the development stages while others study the rules and strategies of the famous games. Only recently some new categories of studies have emerged that treat the game as a biological function of humankind, necessary for individual development and interconnected to complex social interactions.

The second part describes how the architect uses games as a generative method. Topics such as lateral thinking and the idea of error are explored on their potential for creating novelty in design. At the same time, it is analyzed how games played during childhood have influenced architects in their design methodologies. Famous examples such as the relation between Froebelian games and the organic architecture of F. L. Wright are explored in this section.

The conclusive part deals with methodological aspects of using games in bottom-up processes of urban regeneration. The regeneration project is one of the most complex endeavors an architect can undertake since it needs to mediate between the conflicting needs of different stakeholders. Games are very similar in nature, they are the playground of contradictory objectives of different players so, by borrowing methods from them, new strategies of design can be formulated. These strategies, as in the games, are evolving with the development of the game environment and can accommodate complex scenarios of interaction for non-zero-sum games.

The majority of the "games" we play in our everyday life are non-zero-sum games, meaning that the winning of one faction is not equal to the loss of the opposing group. We make friends, we negotiate, and we create long-term relations based on our ability to play long-term games. Valerio Perna opens this new horizon of methods, strategies, and actions to the architectural design practice. He opens up the possibility for a better architecture and for a playful city.

Wittgenstein Ruler

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Wittgenstein ruler: "Unless you have confidence in the ruler's reliability, if you use a ruler to measure a table you may also be using the table to measure the ruler." – Nassim Nicholas Taleb, *Fooled by Randomness*

The tools we use to understand our cities tell more about us than they tell about the cities. Modernism created opportunities for generations that couldn't get access to housing, education, culture, and health care. It shaped our lives and our cities more than any other period in the history of humankind. But at the same time created in the architects and planners the illusion that the more quantitative data we have the more we can determine the future through the project. An axonometric view of the built environment is the most scientifically accurate tool to represent a building, yet it misses to acknowledge complex phenomena happening in everyday life. This drawing represents the difficulties of understanding contemporary cities and the challenges of designing the future.

Drawing. Original artwork by Ledian Bregasi